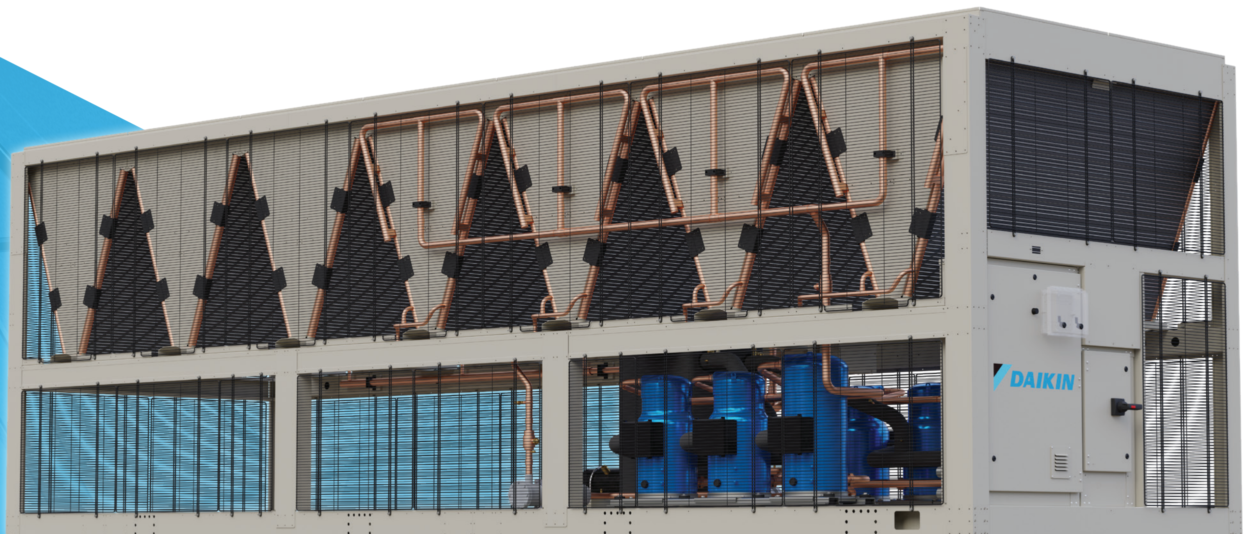
INSTALLATION, OPERATION & MAINTENANCE

IOM 1359-1

NOVEMBER 2024

TRAILBLAZER® AGZ-F

AIR-COOLED SCROLL CHILLERS



- MODEL AGZ, F VINTAGE
- 30 TO 230 TONS
- R-32 REFRIGERANT

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Safety Information

This manual provides installation, operation, and maintenance information for Daikin Applied Trailblazer® AGZ-F air-cooled scroll chillers with a MicroTech® unit controller.

NOTICE

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

⚠ WARNING

This unit contains R-32, a class A2L refrigerant that is flammable. This unit should only be installed, serviced, repaired, and disposed of by qualified personnel licensed or certified in their jurisdiction to work with R-32 refrigerant. Installation and maintenance must be done in accordance with this manual. Improper handling of this equipment can cause equipment damage or personal injury.

For installation only in locations not accessible to the general public.

Be aware that R-32 refrigerant may not contain an odor. Place in a well ventilated area to prevent accumulation of refrigerant.

Do not pierce or burn this unit.

Never use an open flame during service or repair. Never store in a room with continuously operating ignition sources (for example: open flames, an operating gas appliance, or an operating electric heater), where there is ignitable dust suspension in the air, or where volatile flammables such as thinner or gasoline are handled.

Only use pipes, nuts, and tools intended for exclusive use with R-32 refrigerant in compliance with national codes (ASHRAE15 or IRC).

Do not mix air or gas other than R-32 in the refrigerant system. If air enters the refrigerant system, an excessively high pressure results, which may cause equipment damage or injury.

Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.

For more information, consult “Refrigerant Guidelines” on page 95.

⚠ DANGER

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

⚠ WARNING

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

⚠ WARNING

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

⚠ CAUTION

Static sensitive components. A static discharge while handling electronic circuit boards can cause damage to the components. Discharge any static electrical charge by touching the bare metal inside the control panel before performing any service work. Never unplug any cables, circuit board terminal blocks, or power plugs while power is applied to the panel.

Hazard Identification Information

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

Notice indicates practices not related to physical injury.

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

UL Compliance Statements for Unit Work

- All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided.
- Work shall be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed.
- The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i. e. non-sparking, adequately sealed or intrinsically safe.
- If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO2 fire extinguisher adjacent to the charging area.
- No person carrying out work in relation to a REFRIGERATING SYSTEM which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space.
- Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards. Safety checks are necessary to ensure that the risk of ignition is minimized and “No Smoking” signs shall be displayed.
- Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.
- Equipment not to be used by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction.
- Children shall not be allowed to play on or with equipment.
- If unit is permanently connected to water main; hose sets are not to be used.
- Maximum water side operating pressure for unit is 435 psig.

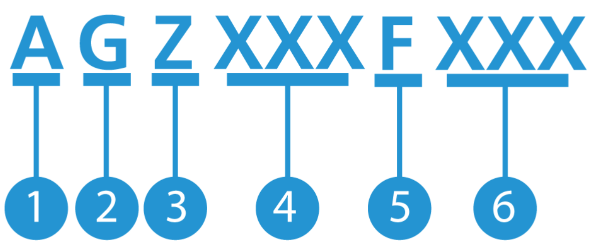
Introduction

General Description

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

The electrical control center includes all equipment protection and operating controls necessary for dependable automatic operation. Components housed in a centrally located, weather resistant control panel with hinged and tool-locked doors.

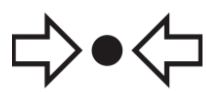
Nomenclature



No.	Description
1	A = Air-Cooled
2	G = Global
3	Z = Scroll Compressor
4	Number of Fans
5	Design Vintage
6	Compressor Code

Unit Labels

Pictogram warning and informational labels may be present on the unit. Consult the table below for reference.

Label	Description
	WARNING - flammable refrigerant present
	WARNING - flammable refrigerant present
	Read the technical manual for service instructions
	WARNING - A2L low-burning velocity refrigerant present
	Pressurized medium present
	Ultraviolet (UV) radiation present
	Read the technical manual for instructions

Installation

Operating Limits

Table 1: Operating/Standby Limits

Operating/Standby Limits	Temperature
Maximum standby ambient temperature	130°F (54°C)
Maximum operating ambient temperature	105°F (41°C)
Maximum operating ambient temperature 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)	-4°F (-20°C)
Leaving chilled water temperature	40°F to 65°F (4°C to 18°C)
Leaving chilled fluid temperatures (with glycol) - 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 20°F (3.3°C to 11.1°C)
Maximum evaporator operating inlet fluid temperature	81°F (27°C)
Maximum evaporator non-operating inlet fluid temperature	100°F (38°C)

Nameplates

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

⚠ **WARNING**

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

⚠ **CAUTION**

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

Inspection

NOTICE

All units should be carefully inspected for damage when received. Report all loss or shipping damage using a claim form supplied by Daikin Applied.

VISIBLE LOSS OR DAMAGE: Any external evidence of loss or damage must be noted on the freight bill or carrier's receipt, and signed by the carrier's agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier's refusal to honor a damage claim.

CONCEALED LOSS OR DAMAGE: Concealed loss or damage means loss or damage which does not become apparent until the unit has been unpacked or unwrapped. The contents may be damaged in transit due to rough handling even though the exterior may not show damages. When the damage is discovered, make a written request for inspection by the carrier's agent within **five (5) days** of the delivery date and file a claim with the form provided by Daikin Applied. Refer to the Daikin Applied Freight Policy for further information.

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

Lifting Guidance

Daikin Applied equipment is designed to withstand the loads of the lifting and rigging process resulting from ASME Standard P30.1 - Planning for Load Handling Activities or equivalent. Lifting guidance is intended for installations of newly delivered equipment. If moving previously installed equipment for relocation or disposal, consideration should be given to unit condition. Equipment should also be drained as unit weight and center of gravity values do not reflect the addition of water for lifting.

⚠ **DANGER**

Improper rigging, lifting, or moving of a unit can result in unit damage, property damage, severe personal injury, or death. See the as-designed, certified dimensioned drawings included in the job submittal for the weights and center of gravity of the unit. If the drawings are not available, consult the local Daikin Applied sales office for assistance.

Installation is to be performed only by qualified personnel who are familiar with local codes and regulations, and experienced with this type of equipment. Lifting equipment and mechanisms must be determined by the Lifting Director per the current version of ASME Standard P30.1 or equivalent and must be suited for the load capacity.

Daikin Applied is not a licensed nor certified rigging specialist. Therefore it is the customer's responsibility to consult a certified rigging contractor to rig, lift, and move components and subcomponents properly and safely as needed.

⚠ **CAUTION**

Forklifts may not be used to lift or move Trailblazer units as the method may result in unit damage.

⚠ CAUTION

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

Lifting Brackets

Lifting bracket designs vary from product to product. Rules of engagement with the lifting brackets are the same regardless of the bracket type. For Trailblazer units, a typical lifting bracket with 2" (51 mm) diameter holes found on the sides of the unit base are illustrated in Figure 1. See the as-designed certified drawings for specific lifting points on this product model.

Engagement with each bracket is to be as close to vertical as possible. The maximum allowable lift angle from the vertical is 30° as shown in Figure 2. If the lift angle shifts beyond 30 ° from vertical on any of the lift points, the lift shall not proceed until a corrective plan is formulated and rigging can be secured to correct the angle of the lift.

⚠ WARNING

The lifting angle must not go beyond 30 degrees from vertical or the unit can become unstable which may result in unit damage, property damage, severe personal injury, or death.

Figure 1: Illustration of Lifting Bracket and Allowed Angle for Lifting

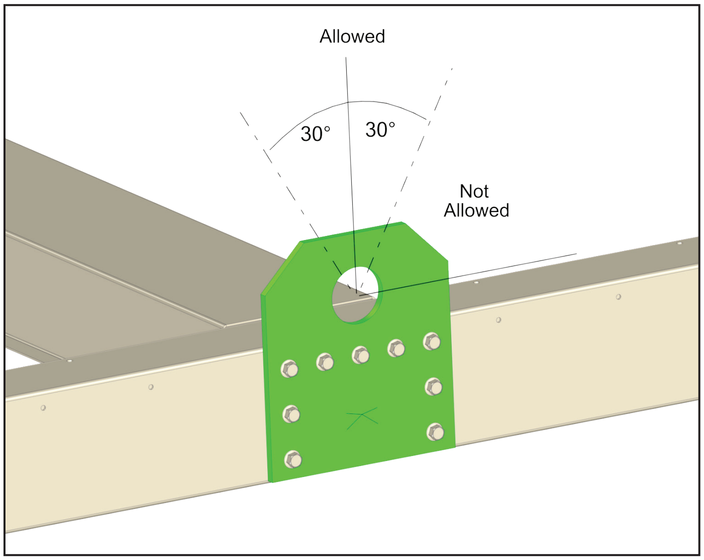
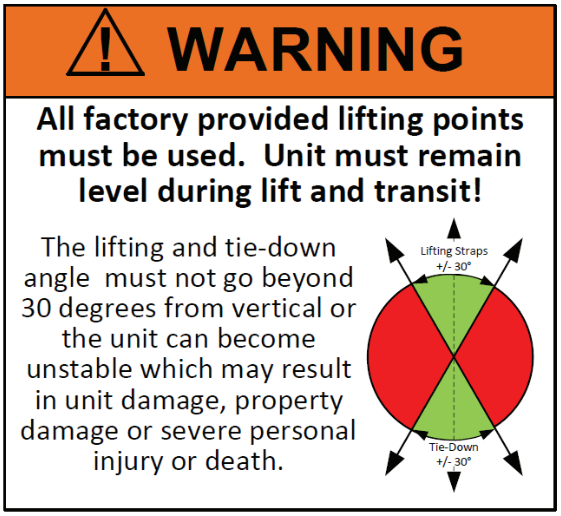


Figure 2: Illustration of Allowed Angle Label



Lifting Equipment

Lifting equipment is supplied by the user or their designate. This is typically selected around the unit certified information of the equipment to be lifted and the available lifting equipment planned to be at the site where the lift is to take place. It is the responsibility of the Lifting Director to follow a standard practice of lift planning and equipment selection, like that found in the ASME P30 series of standards. Lifting plan and equipment must ensure that the only contact with the unit is at the lifting brackets. Straps, chains or spreader bars that are likely to be used shall not come in contact with the unit.

⚠ CAUTION

Lifting mechanisms must not make contact with the unit beyond the lifting bracket. Extreme care must be used when rigging the unit to prevent damage to the control panels, unit handles, unit piping, and unit frame.

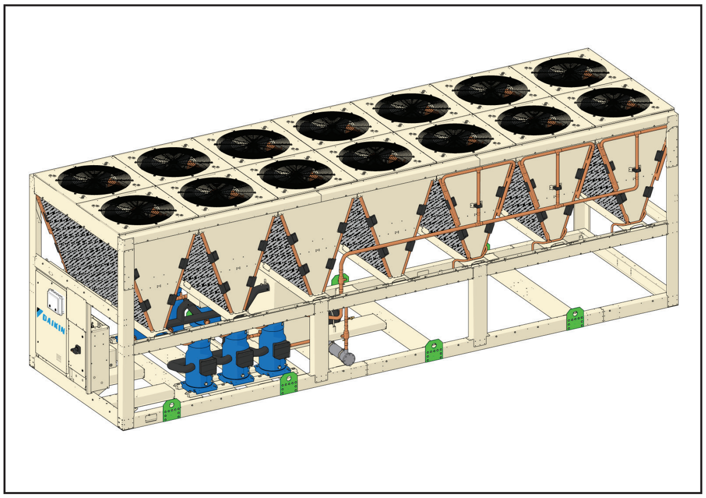
Lifting Points

Lifting points are predetermined by design. When lifting, all factory installed lifting brackets must be used. Figure 3 illustrates typical 8 point lifting configuration, with four lifting points on each side of the unit. The unit must remain level throughout the entire lifting event. Level is defined as one end being no more than 0.25” per foot of unit length to the opposite end.

⚠ WARNING

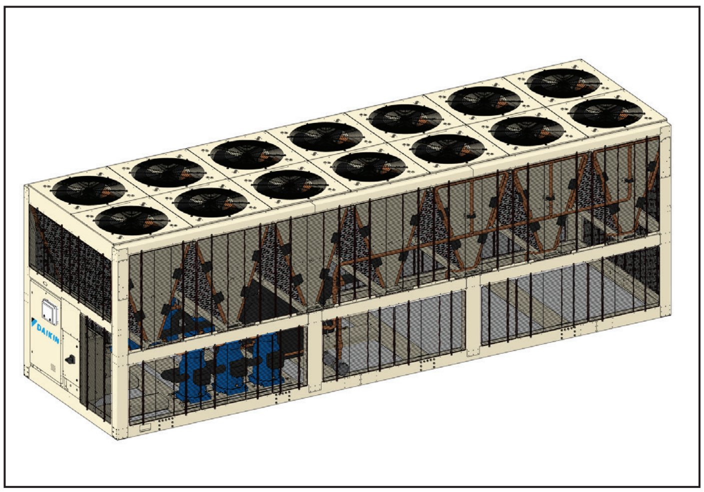
Be aware that the center of gravity may not necessarily be in the geometric center of the unit. No additional items can be added to a lift with the unit as it may affect the center of gravity and cause unit damage, property damage, severe personal injury, or death. Refer to as-designed, certified drawings for weight, center of gravity location and details specific to unit configuration.

Figure 3: Lifting Points Locations



> ⚠ **WARNING**
>
> After the unit is securely in place, remove the lifting brackets and install the wire guards. The guards must be in place prior to start up. Failure to do so can result in damage to the unit or personal injury.

Figure 4: Lifting Brackets Removed and Guards Installed



Transit and Temporary Storage

If the unit is stored for an intermediate period before installation or moved to a different location, take these additional precautions:

1. Support the unit well along the length of the base rail.
2. Level the unit (no twists or uneven ground surface).
3. Provide proper drainage around the unit to prevent flooding of the equipment.
4. Provide adequate protection from vandalism, mechanical contact, etc.
5. Securely close the doors and lock the handles.

When the unit is being tied down for transit, the maximum allowable attachment angle from the vertical is 30 degrees in the opposite direction of lifting. Shimming of the unit under the lifting brackets or tie-down points must be used to ensure even contact along the length of the base rail.

Long Term Storage

This information applies to new units being stored waiting for startup or existing units that may be inoperative or in storage for four months or more.

The chiller must be stored in a secure location and protected from any damage or sources of corrosion while in storage. It is recommended that a Daikin Applied service representative perform a leak test and visual inspection for any damage or unusual conditions affecting the unit on a minimum quarterly schedule, to be paid by the owner or contractor. Daikin Applied will not be responsible for any refrigerant loss during the storage time, for repairs to the unit during the storage period, or while moving the unit from the original location to a storage facility and back to any new installation location. If there is concern about the possibilities of damage and loss of charge during storage, the customer can have the charge removed and stored in recovery cylinders.

> ⚠ **CAUTION**
>
> If the temperature of where the chiller is located is expected to exceed 130°F (54.4°C), then the refrigerant must be removed.

It is necessary to observe some precautions during storage:

- Do not keep the machine near a heat source and/or open flame.
- Humid environments may cause condensate corrosion on steel surfaces. Consider adding a desiccant material to alleviate corrosion concerns.
- For units previously installed, ensure water has been drained from the unit or sufficient glycol has been added if ambient temperature may be lower than 40°F (4.4°C).

For additional tasks required, contact a Daikin Applied service representative.

Unit Placement

Trailblazer units are for outdoor applications only and can be mounted either on a roof or at ground level.

NOTICE
Outdoor installations are defined as open to the atmosphere with no permanent walls within the defined clearance distance and no roof is allowed above the unit.

For roof mounted applications, install the unit on a steel channel or I-beam frame to support the unit above the roof. Spring isolators for roof applications are recommended. For ground level applications, install the unit on a substantial base that will not settle. Use a one-piece concrete slab with footings extended below the frost line. Be sure the foundation is level within 0.5" (13 mm) over its length and width. The foundation must be strong enough to support the unit weight. Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

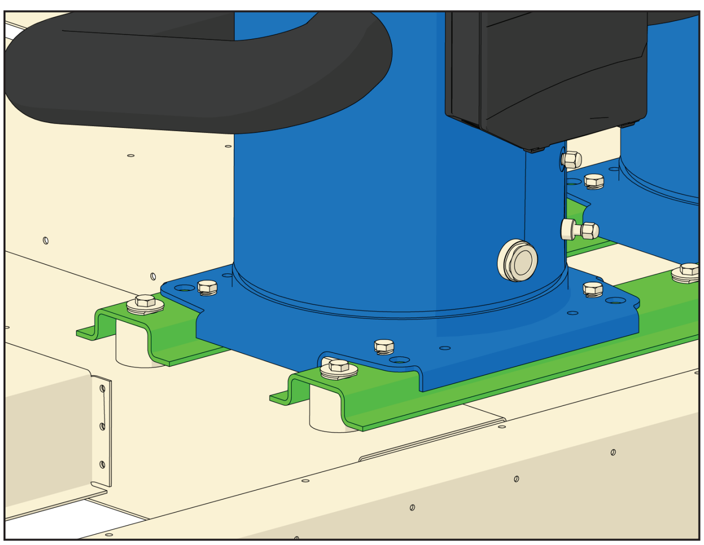
The addition of neoprene waffle pads (supplied by customer) under the unit may allow water to drain from inside the frame, which can act as a dam. Installation of optional spring or rubber-in-shear isolators can also assist with drainage.

Mounting

The inside of the base rail is open to allow access for securing mounting bolts, etc. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

All compressor bolts, rubber grommets, and fasteners should be left in place on the base plate as shown in Figure 5. None of these fasteners are considered to be 'temporary shipping bolts.

Figure 5: Compressor Base Plate Mounting



Service Clearance

Figure 6: Service Clearance

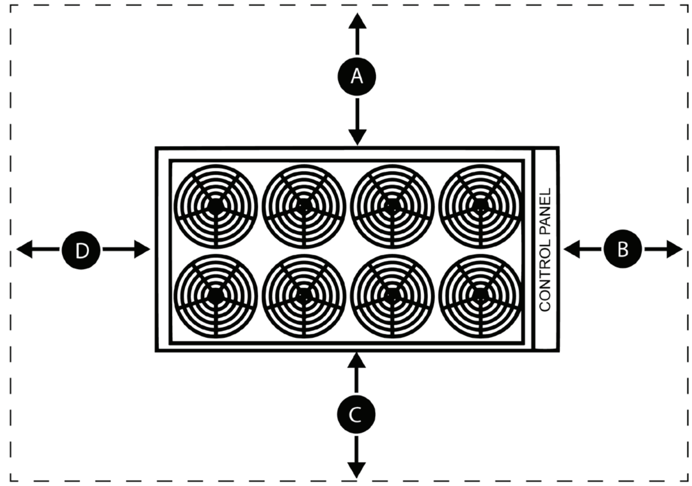


Table 2: Service Clearance

Side	Minimum Clearance	Notes
A	8 ft (2.4 m)	Sides: It is highly recommended to provide a minimum of 8 feet (2.4 meters) on one side to allow for coil replacement. A minimum of 4 feet (1.2 meters) of side clearance is required; however, the unit performance may be derated.
B	4 ft (1.2 m)	Control Panel Side: Minimum of 4 feet (1.2 meters)
C	4 ft (1.2 m) if all other requirements are met	Sides: It is highly recommended to provide a minimum of 8 feet (2.4 meters) on one side to allow for coil replacement. A minimum of 4 feet (1.2 meters) of side clearance is required; however, the unit performance may be derated.
D	4 ft (1.2 m)	Opposite Control Panel End: Minimum of 4 feet (1.2 meters)

Operational Spacing Requirements

Sufficient clearance must be maintained between the unit and adjacent walls or other units to allow the required unit air flow to reach the coils. Failure to do so will result in a capacity reduction and an increase in power consumption. No obstructions are allowed above the unit at any height. The clearance requirements shown are a general guideline and cannot account for all scenarios. Such factors as prevailing winds, additional equipment within the space, design outdoor air temperature, and numerous other factors may require more clearance than what is shown. Additional clearances may be required under certain circumstances.

⚠ CAUTION

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

Case 1: Wall on One Side

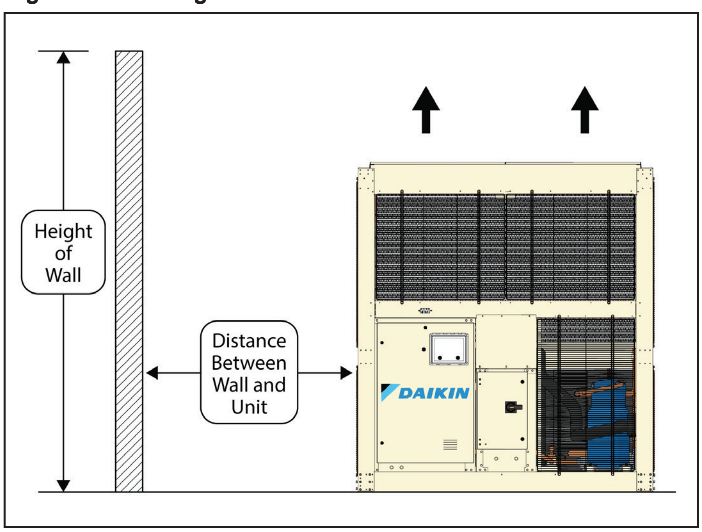
NOTICE

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

Table 3: Wall on One Side

No. of Fans	Clearance
4-6 Fans	4 ft minimum clearance from any solid height wall taller than unit
8 Fans	6 ft minimum clearance from any solid height wall taller than unit. Refer to Case 4 for partial open wall
10-14 fans	8 ft minimum clearance from any solid height wall taller than unit. Refer to Case 4 for partial open wall

Figure 7: Building or Wall on One Side of Unit



Case 2: Two Units, Side-by-Side

Percentage capacity reduction & percentage of power increase for different spacing between units.

Figure 8: Two Units, Side-by-Side

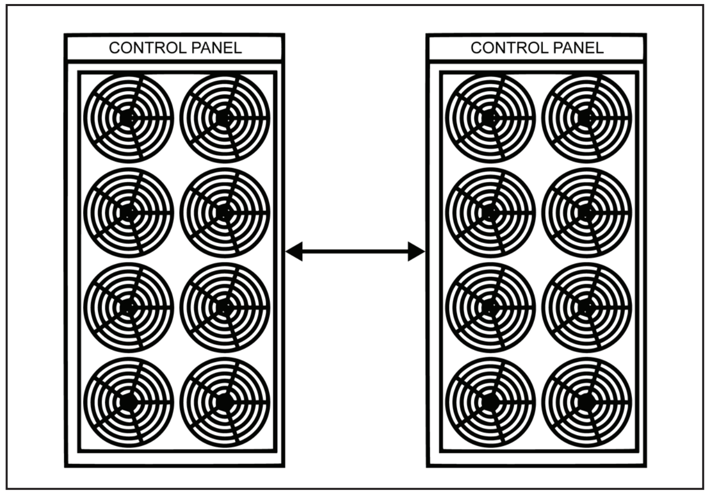


Table 4: Two Units, Side-by-Side

Distance Between Two Units		No. of Fans					
		4	6	8	10	12	14
4 ft	% Capacity Reduct. Unit	0.0	1.0	2.0	2.5	NR	NR
	% Power Increase Unit	0.0	1.5	3.0	3.6	NR	NR
5 ft	% Capacity Reduct. Unit	0.0	0.5	1.2	2.0	NR	NR
	% Power Increase Unit	0.0	0.7	1.7	3.0	NR	NR
6 ft	% Capacity Reduct. Unit	0.0	0.0	0.5	1.4	2.5	3.0
	% Power Increase Unit	0.0	0.0	0.7	2.0	3.5	4.0
8 ft	% Capacity Reduct. Unit	0.0	0.0	0.0	0.7	2.0	2.5
	% Power Increase Unit	0.0	0.0	0.0	1.0	3.0	3.5
NR = Not recommended due to air recirculation and elevated condenser pressure and elevated power input							

NOTICE

Distance between can only be reduced if the 8 ft (2.4 m) clearance is on the outside of the two units for coil removal.

Case 3: Three Units, Side by Side

For outside units on each side of the middle unit - see case 2 above. Percentage of capacity reduction & percentage of power increase for different spacing for the middle unit with a unit on each side.

Figure 9: Three Units, Side-by-Side

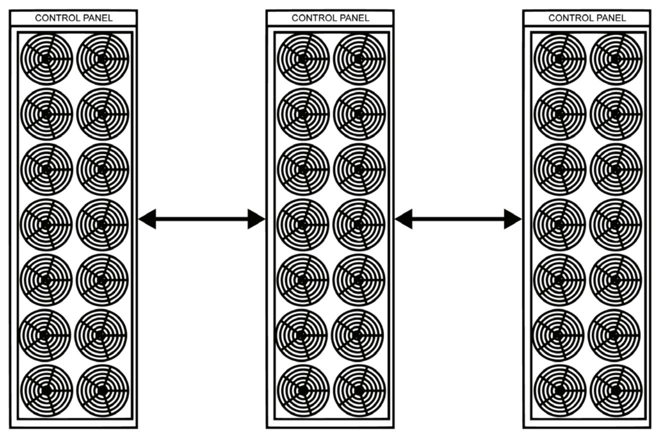


Table 5: Three Units, Side-by-Side

Distance Between Two Units		No. of Fans					
		4	6	8	10	12	14
4 ft	% Capacity Reduct. Unit	1.0	NR	NR	NR	NR	NR
	% Power Increase Unit	2.0	NR	NR	NR	NR	NR
5 ft	% Capacity Reduct. Unit	0.0	1.0	NR	NR	NR	NR
	% Power Increase Unit	0.0	2.0	NR	NR	NR	NR
6 ft	% Capacity Reduct. Unit	0.0	0.0	2.0	3.0	4.0	5.0
	% Power Increase Unit	0.0	0.0	3.0	4.5	6.0	7.5
8 ft	% Capacity Reduct. Unit	0.0	0.0	1.4	2.0	3.0	4.0
	% Power Increase Unit	0.0	0.0	2.1	3.0	4.5	6.0

NR = Not recommended due to air recirculation and elevated condenser pressure and elevated power input

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 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/Solid Wall Installation. 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 for most models. Values are based on walls on all four sides.

Figure 10: Allowable Wall Open Area

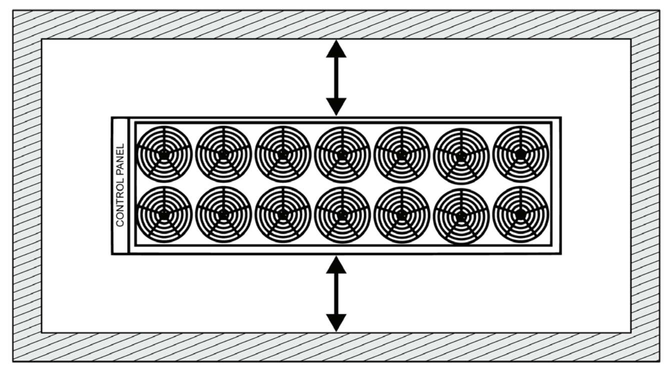


Table 6: Open Wall Area vs. Distance from Unit

% Open Wall Area	No. of Fans					
	4	6	8	10	12	14
0%	5.0 ft	6.0 ft	6.5 ft	7.0 ft	8.0 ft	8.0 ft
10%	4.4 ft	5.4 ft	5.9 ft	6.4 ft	7.4 ft	7.4 ft
20%	4.0 ft	4.8 ft	5.4 ft	5.8 ft	6.8 ft	6.8 ft
30%	4.0 ft	4.0 ft	4.5 ft	5.2 ft	6.2 ft	6.2 ft
40%	4.0 ft	4.0 ft	4.0 ft	4.6 ft	5.6 ft	5.6 ft
50%	4.0 ft	4.0 ft	4.0 ft	4.0 ft	5.0 ft	5.0 ft

NOTICE

One side of the unit must have 8 ft clearance for coil removal.

Case 5: Pit/Solid Wall Installation

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

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.

Figure 11: Pit/Solid Wall Installation

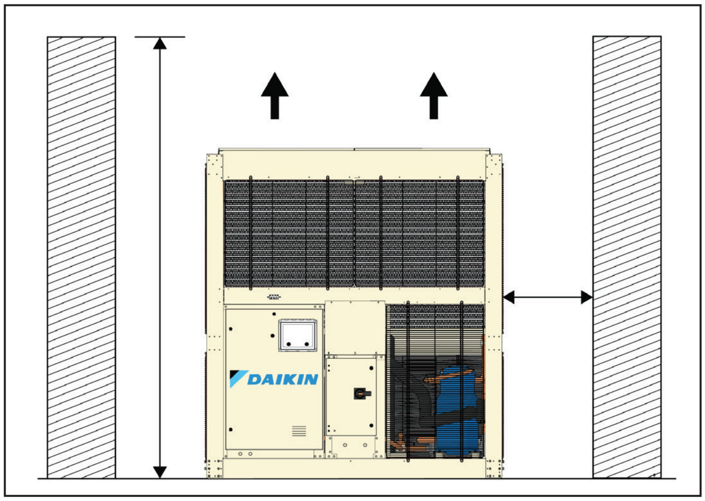


Table 7: Pit/Solid Wall Installation - % Full Load Capacity Reduction

No. of Fans	Distance from Wall	Height of Wall (ft)				
		Up to 8	10	12	13	14
4	4 ft	0.0%	1.4%	6.0%	NA	NA
	5 ft	0.0%	0.8%	3.2%	6.0%	NA
	6 ft	0.0%	0.0%	0.8%	1.6%	3.0%
6-8	< 5 ft	NA	NA	NA	NA	NA
	5 ft	0.5%	1.5%	6.0%	NA	NA
	6 ft	0.0%	0.8%	3.2%	6.0%	NA
	8 ft	0.0%	0.0%	0.9%	1.6%	3.0%
10	< 6 ft	NA	NA	NA	NA	NA
	6 ft	0.5%	1.5%	6.0%	NA	NA
	8 ft	0.0%	0.8%	3.3%	6.0%	NA
	10 ft	0.0%	0.0%	0.8%	1.6%	3.0%
12-14	6 ft	NA	NA	NA	NA	NA
	6 ft	0.8%	1.8%	7.2%	NA	NA
	8 ft	0.0%	1.0%	4.0%	7.2%	NA
	10 ft	0.0%	0.0%	1.0%	1.9%	3.6%
NA = Not Allowed						

Table 8: Pit/Solid Wall Installation - % Full Load Power Increase

No. of Fans	Distance from Wall	Height of Wall (ft)				
		Up to 8	10	12	13	14
4	4 ft	0.6%	2.0%	9.0%	NA	NA
	5 ft	0.3%	1.2%	4.8%	6.0%	NA
	6 ft	0.0%	0.0%	0.8%	1.6%	3.0%
6-8	< 5 ft	NA	NA	NA	NA	NA
	5 ft	0.5%	1.5%	6.0%	NA	NA
	6 ft	0.0%	0.8%	3.2%	6.0%	NA
	8 ft	0.0%	0.0%	0.9%	1.6%	3.0%
10	< 6 ft	NA	NA	NA	NA	NA
	6 ft	0.5%	1.5%	6.0%	NA	NA
	8 ft	0.0%	0.8%	3.3%	6.0%	NA
	10 ft	0.0%	0.0%	0.8%	1.6%	3.0%
12-14	6 ft	NA	NA	NA	NA	NA
	6 ft	0.8%	1.8%	7.2%	NA	NA
	8 ft	0.0%	1.0%	4.0%	7.2%	NA
	10 ft	0.0%	0.0%	1.0%	1.9%	3.6%
NA = Not Allowed						

Application Consideration

Chilled Water Piping

All evaporators and condensers have OGS-type grooved water connections (adhering to Standard AWWA C606). The installing contractor must provide matching mechanical connections. Be sure that water inlet and outlet connections match certified drawings and nozzle markings.

NOTICE

PVC piping should not be used.

⚠ WARNING

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

⚠ 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).
- Adequate piping support to eliminate weight and strain on the fittings and connections.
- A water flow switch must be installed in the horizontal piping of the supply (evaporator inlet) water line to avoid evaporator freeze-up under low or no flow conditions. The flow switch is supplied by the factory as an installed component or a field-installed kit shipped along with the unit. (See page 16 for more information.)

NOTICE

Units with the optional pump package include the strainer and flow switch.

- 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 12. These evaporators do not have drain or vent connections due to their construction.
- Water pressure gauge connection taps and gauges at the inlet and outlet connections of the evaporator for measuring water pressure drop.

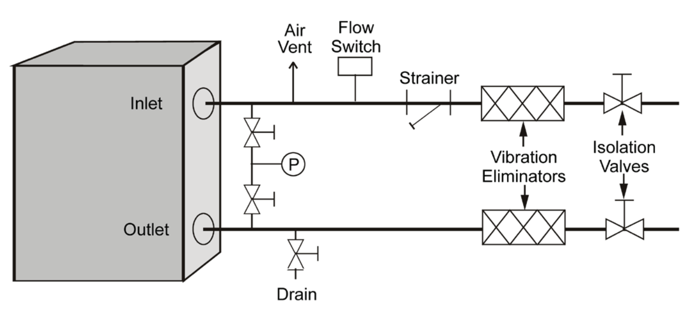
It is **recommended** that the field-installed water piping to the chiller include:

- Thermometers at the inlet and outlet connections of the evaporator.
- Vibration eliminators in both the supply and return water lines.
- Insulated chilled water piping to reduce heat loss and prevent condensation. For information on freeze protection, see "Evaporator Freeze Protection" on page 15.
- Isolation valves installed in the incoming and outgoing water piping to the evaporator.

NOTICE

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

Figure 12: Typical Piping, Brazed-Plate Evaporator



NOTICE

Welded pipe connections are not allowed between the strainer and evaporator due to the chance of slag entering the evaporator. Evaporator may be oriented with connections on a different side than shown.

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. A factory installed option.
2. A field-installed kit shipped-loose with the unit that consists of:

- Y-type area strainer with 304 stainless steel perforated basket, Victaulic pipe connections and strainer cap.
- 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.
- 0.5-inch blowdown valve
- Two grooved clamps

Both are sized and with the pressure drop shown on page 24.

3. A field-supplied strainer that meets specification and installation requirements of the current Installation, Operation and Maintenance Manual available at www.DaikinApplied.com.

Table 9: Strainer Data

Strainer Size	Maximum Perforation Size	Factory Installed Option	Field Installed Option
3.0 in	0.063	Y	Y
4.0 in	0.063	Y	Y
6.0 in	0.063	Y	Y

Figure 13: Strainer Pressure Drop

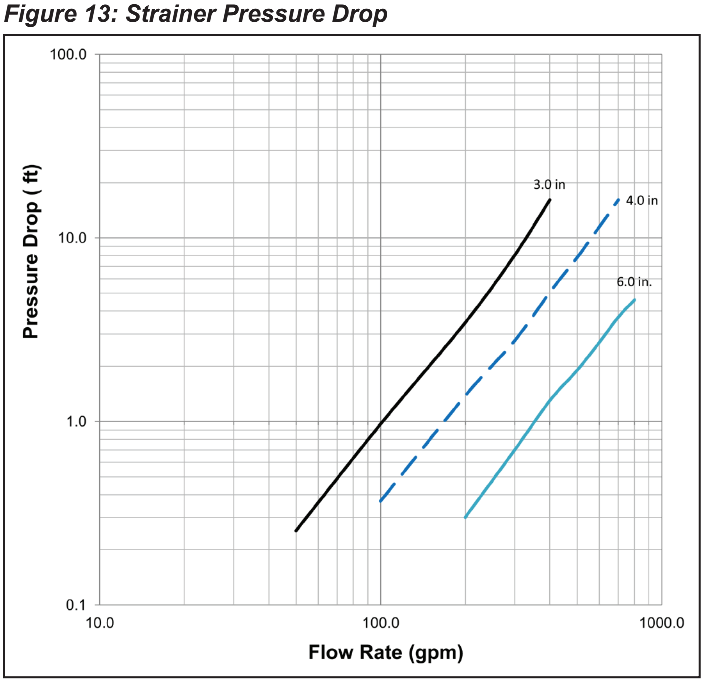
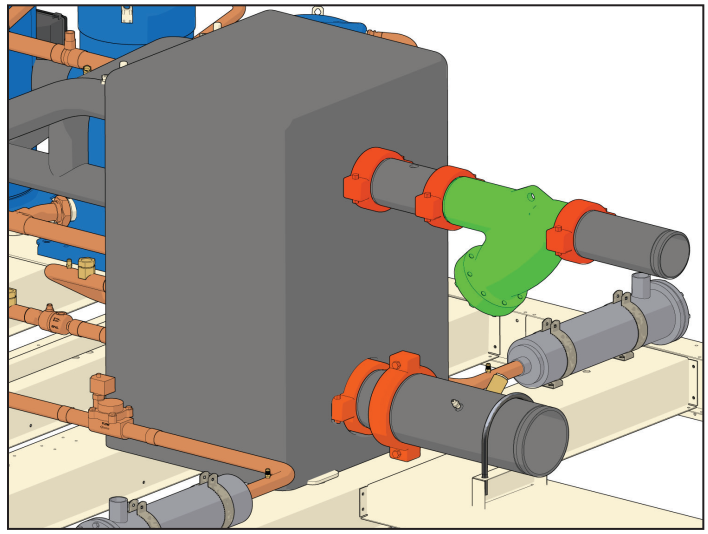


Figure 14: Factory Installed Strainer



Water Flow Limitations

Constant Evaporator Flow

The evaporator flow rates and pressure drops are shown on page 33 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 20°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. If flow drops below the minimum allowable, large reductions in heat transfer can occur. If the flow exceeds the maximum rate, excessive pressure drop and erosion can occur. See "Pressure Drop Data" on page 33 for allowable pressure drops and flow rates.

System Water Considerations

All chilled water systems need adequate time to recognize a load change, respond to the change and stabilize to avoid undesirable short cycling of the compressors or loss of temperature control. In air conditioning systems, the potential for short cycling usually exists when the building load falls below the minimum chiller plant capacity or on close-coupled systems with very small water volumes. Some of the things the designer should consider when looking at water volume are the minimum cooling load, the minimum chiller plant capacity during the low load period and the desired cycle time for the compressors. Assuming that there are no sudden load changes and that the chiller plant has reasonable turndown, a rule of thumb of “gallons of water volume equal to two to three times the chilled water gpm flow rate” is often used. A storage tank may have to be added to the system to reach the recommended system volume. Refer to AG 31-003 for method of calculating “Minimum Chilled Water Volume”.

The water quality provided by the owner/occupant/operator/user to a chiller system should minimize corrosion, scale buildup, erosion, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment. Strainers must be used to protect the chiller systems from water-borne debris. Daikin Applied will not be responsible for any water-borne debris damage or water side damage to the chiller heat exchangers due to improperly treated water.

Water systems should be cleaned and flushed prior to chiller installation. Water testing and treatment should be verified during initial chiller installation/commissioning and maintained on a continuous basis by water treatment professionals (see Limited Product Warranty).

⚠ CAUTION

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

Evaporator Freeze Protection

Evaporator freeze-up can be a concern in the application of air-cooled water chillers in areas experiencing below freezing temperatures. To protect against freeze-up, insulation and an electric heater are furnished with the evaporator. All models have an external plate heater and thermostat. These heaters help protect the evaporator down to -20°F (-29°C) ambient air temperature. The evaporator heater cable is factory wired to the 115 volt control circuit transformer in the control box. A 115V power source for the heater and controls may also be supplied from a separate power feed to maximize unit protection if desired. Refer to the field wiring diagram 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 glycol, 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.

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.

Chilled Water Pump

It is important that the chilled water pumps be wired to, and controlled by, the chiller’s microprocessor. When equipped with the optional dual pump output, the chiller controller has the ability to remotely send a signal to the pump relay to start pump A or B, or automatically alternate the pump selection, as well as enable standby operation. The controller will energize the pump whenever at least one circuit on the chiller is enabled to run, whether there is a call for cooling or not. This helps ensure proper unit start-up sequence. The pump will also be turned on when the water temperature goes below the Freeze Setpoint for longer than a specified time to help prevent evaporator freeze-up. See the Field Wiring Diagram for connection points.

⚠ CAUTION

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

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

1. If the chiller attempts to start without the building automation enabling the pump, the chiller will lock out on the No Flow alarm and require manual reset.
2. If the chiller evaporator water temperature drops below the “Freeze setpoint” the chiller will attempt to start the water pumps to avoid evaporator freeze. If the chiller does not have the ability to start the pumps, the chiller will alarm due to lack of water flow.
3. If the chiller does not have the ability to control the pumps and the water system is not to be drained in temperatures

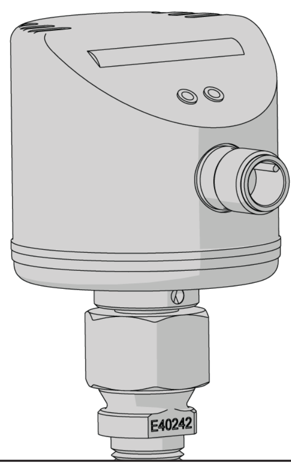
below freezing or contain glycol, the chiller may be subject to catastrophic evaporator failure due to freezing. The freeze rating of the evaporator is based on the evaporator heater and pump operation. The external brazed plate heater itself may not be able to properly protect the evaporator from freezing without circulation of water.

Flow Switch

All chillers require a chilled water flow switch to check that there is adequate water flow through the evaporator and to shut the unit down if necessary to avoid evaporator freeze-up under low or no flow conditions. A factory-included thermal dispersion flow switch will be installed on packaged models.

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. Flow switch installation and calibration is further discussed on page 82.

Figure 15: Flow Switch



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

Glycol Solutions

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

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

⚠ CAUTION

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

⚠ CAUTION

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

Low Ambient Operation

Compressor staging is adaptively determined by system load, ambient air temperature, and other inputs to the MicroTech unit control. The standard minimum ambient temperature is 32°F (0°C). A low ambient option allows operation down to -4°F (-20°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 low ambient fan control automatically include the high ambient option. Note that in cases of high ambient temperature, capacity could be reduced or the lowest leaving water temperature settings may be outside of the chiller operating envelope; consult with a Daikin Applied sales representative to ensure chiller is capable of the required lift.

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.

Epoxy coating is a water-based extremely flexible and durable polymer coating uniformly applied to all coil surfaces through a multi-step, submerged electrostatic coating process. Epoxy coated coils provide a 10,000+ hour salt spray resistance per ASTM B117-90, applied to both the coil and the coil headers. The epoxy coated coils also receive a UV-resistant urethane top-coat to provide superior resistance to degradation from direct sunlight. This coil coating option provides the best overall protection against corrosive marine, industrial or combined atmospheric contamination to provide extended longevity.

Table 10: Coil/Coating Selection Matrix

Coil Option	Non-Corrosive[1]	Unpolluted Marine[2]	Industrial[3]	Combined Marine-Industrial[4]
Standard Microchannel	+++	-	-	-
Epoxy Coated Coils	+++	+++	+++	++

NOTE: 1. Non-corrosive environments may be estimated by the appearance of existing equipment in the immediate area where the chiller is to be placed.

2. Marine environments should take into consideration proximity to the shore as well as prevailing wind direction.

3. Industrial contaminants may be general or localized, based on the immediate source of contamination (i.e. diesel fumes due to proximity to a loading dock).

4. Combined marine-industrial are influenced by proximity to shore, prevailing winds, general and local sources of contamination.

Pump Package

Figure 16: Pump Package Components

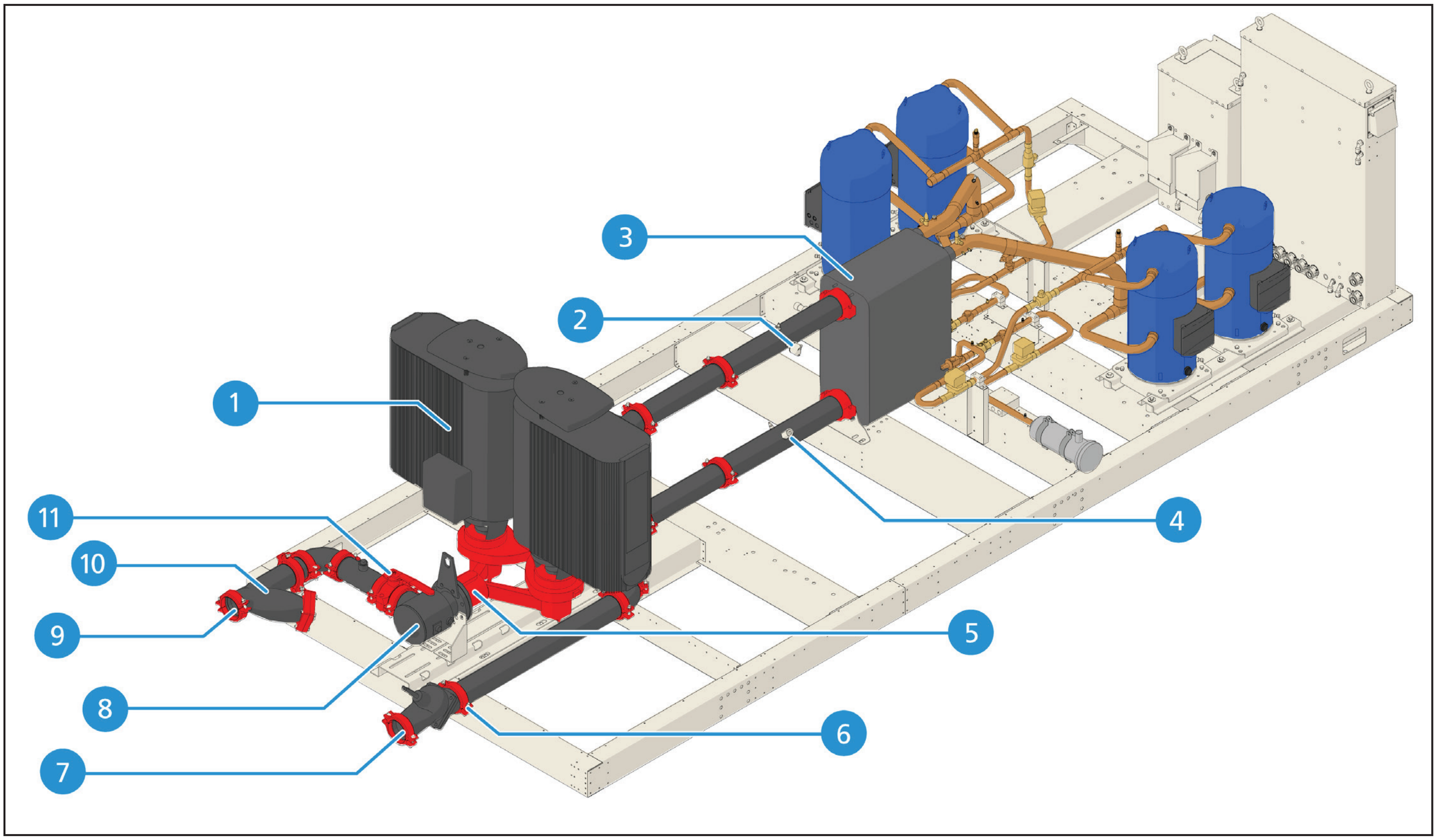


Table 11: AGZ-F Pump Package Component Locations

No.	Component Description	No.	Component Description
1	Vertical Pump(s) - Single or Dual	7	Chilled Water Outlet
2	Evaporator Flow Switch	8	Inlet Suction Guide
3	Brazed-Plate Evaporator	9	Chilled Water Inlet
4	Temperature Sensor	10	“Y” Type Inlet Strainer/Drain Port
5	Pump Pressure Gauges	11	Butterfly Valve
6	Triple Duty Outlet Valve		

Standard Components of Pump Packages

Factory-installed pump packages provide important benefits:

- Simplify the chilled water system design and installation
- Provide installation savings by reducing field piping, wiring, and control costs
- Save valuable floor space inside the building
- Reduce project engineering content
- Greatly reduce pump operating cost with the optional variable flow pump Variable Frequency Drive (VFD)

Pump Design Features

Pump packages may be single or dual pump arrangement. Each pump is a vertical, in-line, radially split-case pump with a single spring inside mechanical seal with carbon against silicon carbide faces. Each case is cast iron. Impellers are bronze, trimmed to design conditions and then balanced. The shaft sleeve is bronze, extending the full length of the seal area.

Dual pumps are mounted in a common casing with a common inlet connection and outlet connection. The pumps are designed for duty/standby, not parallel operation, and is capable of having one side running at one time. A flapper valve on the discharge side of the casing is flipped over to the side by the moving water to prevent recirculation when only one pump is operating.

The servicing of one side of the pump will require the following:

A. to stop running the pump

B. remove the one rotating head

C. install a gasket and blanking plate on one side of the pump casing

D. start the pump back up with the one rotating head and the defective one can be serviced

For all pump arrangements, each pump is serviceable without breaking pipe connections. The motor and pump rotating assembly can be serviced without removing the pump casing from the line.

Pump performance curves are generated by Daikin Tools for the specific criteria of the installation. Contact a Daikin Applied representative for this information.

Pumps and pump package components are not heat traced and may require additional freeze protection measures.

Additional Factory Provided Components

- “Y” type inlet strainer (shipped loose)
- Combination triple-duty outlet valve having a drip-tight discharge shutoff valve, non-slam check valve, and flow throttling valve (shipped loose)
- Combination suction guide with flow stabilizing outlet vanes and stainless steel strainer with a disposable fine-mesh strainer for start-up
- Factory power and control wiring from the AGZ-F chiller to the pump package control panel
- Flow switch mounted and wired
- Interconnecting piping with grooved couplings
- Insulation of all cold surfaces

Optional Components (Factory or Field Supplied)

- Water pressure gauges on pump suction and discharge
- Expansion tank with size increments from 4.4 to 90 gallons, field installed (some sizes can be factory mounted)
- Air separator with air vent, field installed
- Flex piping connections, field installed
- Storage tanks - vertical, insulated (150, 300, 600, 1000)

Pump Operating Control

Constant Flow

The pumps will run at constant speed and will start and stop automatically with the chiller unit. When the chiller is enabled to run by having its MicroTech unit controller in the Auto state or by a signal from a BAS (not necessarily with compressors running based on availability of a cooling load), the pump panel will receive a signal to start from the chiller controller when either the chilled water leaving or entering temperature reaches the chiller freeze point setting to help prevent freeze up. When there is sufficient flow to close the flow switch within a timed period (recirc timer), a proof-of-flow signal is sent to the chiller and the pump is in the Run state. If there is a call for cooling based on the chilled water temperature, the chiller will commence its compressor startup procedure. If there is no call for cooling, the chiller will be on stand-by waiting for load.

If the flow switch does not see flow, the pump remains in the Start state until flow is established, at which time the pump will be in the Run state. Flow is recognized when the flow switch indicates flow for longer than the recirc timer setpoint.

The Run state is a control condition established by satisfying certain conditions. The Start state means that a digital signal has been sent to the pump for it to start running.

When starting the chiller, it is prudent to be sure there is flow so the chiller compressors will be able to start based on a call for cooling due to high chilled water temperature. Observing water pressure gauges can confirm flow.

Flow interruption will open the flow switch, sending a signal to the chiller to shut down and also de-energize the pump. If the chiller is turned off, the pump will shut off after a timed period to allow water circulation during refrigerant pumpdown.

Variable Flow with Pump VFD

The operating cost savings resulting from using variable chilled water flow via a pump variable frequency drive (VFD) is well known. In the past, however, its usage has been somewhat limited by the cost and uncertainty of field installing the required system pressure differential sensors. Daikin Applied offers a variable chilled water flow system, completely self-contained within the pump package, by simply ordering the optional pump VFD and no external sensors are required when operating in Sensorless Pressure Control.

There are four pump operating modes available with the optional factory-installed variable flow VFD is selected on the pump package is equipped with the VFD option:

1. Sensorless Pressure Control (default setting)
2. BAS Control
3. Remote Sensor Control
4. Locally Selected Constant Speed Control

Sensorless Pressure Control

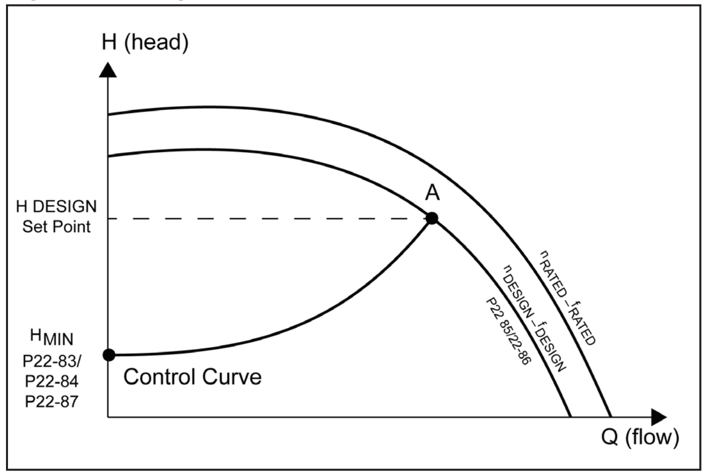
Onboard measurements allow control of the pump speed to optimize chilled water flow with respect to water system pressure. External pressure sensors are not required, eliminating design and installation effort. The unit is factory-configured for this mode.

NOTICE
Sensorless operation is only allowed for single chiller systems. Systems with parallel chiller operation must use one of the other control methods.

The default control mode for Sensorless pumps is 'Quadratic Pressure Control' where the controller is set to control the speed according to a 'control curve' between max and min flow. The control curve is designed to replicate sensor positions at varying distances from the pump based on power, frequency, pressure, and flow across the flow range of the pump. Speed and pressure are adjusted to match the system load without the need for a sensor located at the most remote load point.

The quadratic measurements enable the pump to continuously identify the head and flow at any point in time which gives accurate pressure control without the need for external feedback signals such as a remote sensor. Incorporating the pump's hydraulic data into the controller and removing sensors results in true integration of all components and removes the risk of remote sensor failure.

Figure 17: Pump Control Curve



Previously, a differential pressure sensor was placed at the most remote load, across the supply piping and return piping encompassing the valve and coil set, as common practice for system energy efficiency. Sensorless control can replicate this control without the need for that remote sensor. As the flow required by the system is reduced, the pump automatically reduces the head developed according to the pre-set control curve.

In systems with a remote sensor, it is often found that using a differential pressure sensor to sense the pressure across a remote load could theoretically result in loads close to the pump being under-pumped. The situation would be where the load at a loop extremity is satisfied and the control valve closes while a load close to the pump needs full flow. The probability of this occurring is remote but it is possible. One answer to this is to move the sensor closer to the pump (two-thirds of the way out into the system is a popular recommendation) although physically re-positioning the sensor at commissioning stage can be a costly exercise. With Sensorless pump control it is possible to replicate the moving of a sensor by adjusting the head setting 'Hmin'.

BAS Control

The pump speed will be controlled according to the voltage level from a BAS input signal. The pump control protocol is the same as ordered from the chiller unit. BAS inputs may be: BACnet MS/TP or Modbus.

NOTICE
BACnet Ethernet/IP is currently unavailable.

Remote Sensor Control

The VFD is wired to pressure differential switch(s) mounted in the chilled water piping system. This is the standard VFD control when a sensorless VFD is not used.

Locally Selected Constant Speed Control

This mode is selected by pressing the Hand On key. Operation of the pump at a constant speed as selected on the VFD control panel. This mode allows selecting a pump speed to match the system curve.

Isolator Information

Figure 18: Spring Isolator

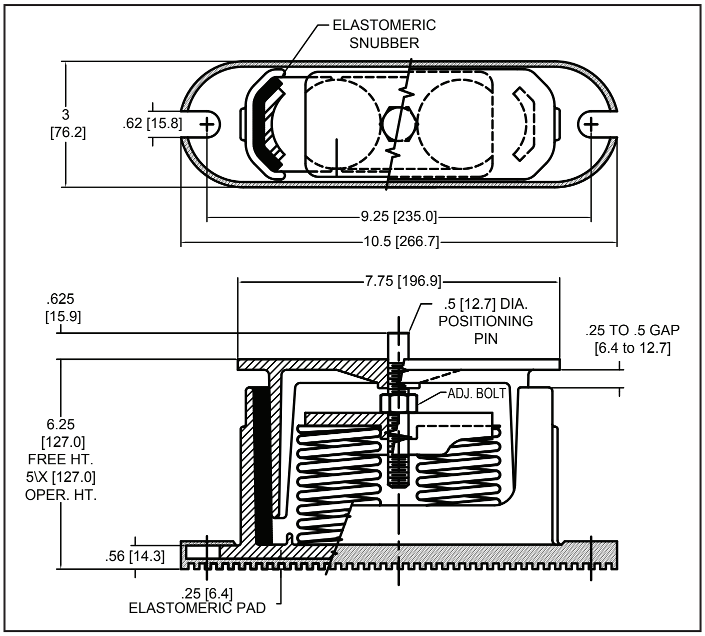
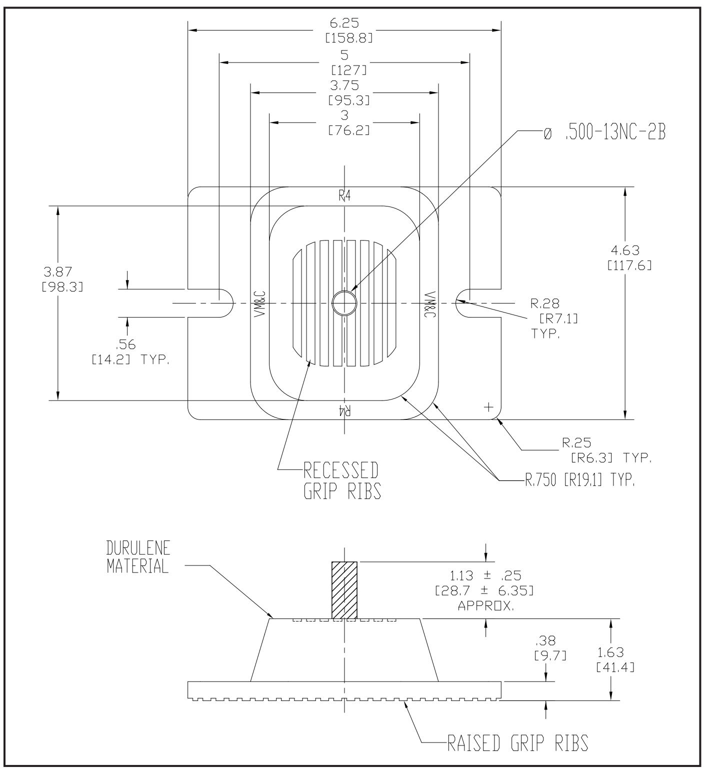


Figure 19: Rubber-in-Shear (RIS) Isolator



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

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

Installation of spring isolators requires flexible piping connections and at least three feet of flexible electrical conduit to avoid straining the piping and transmitting vibration and noise.

Neoprene waffle pads, supplied by customers, should be mounted at the defined mounting point locations along the full rail length.

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

Pump Controller

Pump Start Control

The standard arrangement is for the MicroTech unit controller pump output signal to automatically start and stop the pump(s). The methods and settings are discussed in “Evaporator Pump Control” on page 48.

Details on pump package installation and application considerations begin on page 18.

Pump VFD Operation

The VFD constantly monitors the chilled water system’s state.

When the building cooling load drops, air side controls will start to close in order to control the space temperature. At that instant in time, the pump power draw will start to drop. The drive will notice this and slow down the pump (Hz output will decrease) which then triggers a decrease in flow and head since the pump impeller rpm is dropping.

The reverse is true when the load increases (valves open). The power draw will increase and the drive will speed up (Hz goes up) and the flow and head increases.

Both flow and head will fluctuate and since they are being read instantaneously, as opposed to an averaged value, even the slightest change is registered on the screen.

A building’s cooling load tends to change slowly and it may be difficult to discern load changes by merely observing the VFD display. However, the pump rpm, Hz and kW can be noted over time and used for reference. A given building load will have a discrete reading.

Operating the VFD Controller

The VFD incorporates an integrated graphic local display and keypad to select mode, change parameters and view status and alarms.

The unit is shipped in the sensorless mode. If this mode is to be used, no programming is required.

BAS Integration of Pumps

The pump VFD can be integrated to a BAS via BACnet® MS/TP or Modbus network protocols. The appropriate MicroTech communication module must be selected as a factory-installed option on the AGZ-F chiller. The VFD pump controller ships from the factory with an attached communication card that matches the communication module selected with the chiller. The pump VFD controller is a native BACnet protocol device. The VFD controller comes with an additional communication card for Modbus. Note that while BACnet IP is offered as a factory-installed option on the AGZ-F chiller, BACnet IP is not offered on the VFD frequency converter. If a chiller unit is ordered with BACnet IP, the VFD will be provided with BACnet MS/TP.

Network parameters are set using the VFD controller graphical interface. The following sections describe the parameters that are required to enable communications from the VFD pump directly to the BAS via BACnet MS/TP or Modbus. Selecting a specific communication protocol changes various default parameter settings to match that protocol's specifications along with making additional protocol-specific parameters available from the BAS.

VFD Network Integration

Use the VFD controller's graphical interface to set unit parameters and factory defaults for unit setpoints. Network configuration involves: 1) selecting the Control Protocol for BACnet or Modbus, and 2) then setting the specific network parameters as required by each protocol.

The comprehensive set of network parameters available from the VFD pump to the BAS (i.e. point lists) are provided in separate AGZ-F VFD Pump Controller Operations Manuals for each protocol. These point lists can be found on www.DaikinApplied.com in MicroTech Unit Controls literature. For questions regarding the VFD pump operation and set up, please contact the chiller Technical Response Center (TRC).

NOTICE
AGZ-F chiller VFD controllers support only BACnet MS/TP and Modbus communications. Daikin Applied does not support other protocol options that may be offered by the VFD manufacturer.

Configuring the VFD Controller for BACnet MS/TP Communication

1. Set the basic BACnet MS/TP network parameters using the VFD graphical interface. The BACnet MS/TP Network Configuration Parameters for the Pump VFD are located below in Table 13. It is recommended that additional parameters available in menu 8-* should remain at factory defaults. See VFD installation manual for further details (available on www.DaikinApplied.com).
2. Cycle power to the VFD controller for changes to take effect.
3. The VFD controller is now ready for network configuration from the BAS. Refer to the BACnet Operations Manual for the AGZ-F VFD Controller, which is available on www.DaikinApplied.com, for a complete points list and additional configuration information.

Table 13: BACnet MS/TP Network Configuration Parameters

Parameter	Setting for BACnet; Note	Default Value
8-02 Control Source	Option A [3]; During initial power-up, the frequency converter automatically sets this parameter to Option A [3] if it detects a valid fieldbus option installed in slot A	FC Port [1] Note: This parameter cannot be adjusted while the motor is running.
8-30 Protocol	BACnet	Digital and control word
8-31 Address	0-127; This value must be unique throughout the MSTP trunk	FC RS485
8-32 Baud Rate	9600/19,200/38,400/76,800 baud; All devices on the MSTP trunk must be set to the same baud rate	9600 baud
8-70 BACnet Device Instance	0-4194304; This value must be unique throughout the entire BACnet network.	1
8-72 MS/TP Max Masters	1-127; Dependent on the Number of Masters in the system	127
8-73 MS/TP Max Info Frames	1-65534; Defines how many info/data frames the device is allowed to send while holding the token	1

Configuring the VFD Controller for Modbus Communication

The VFD controller (frequency controller) is a native Modbus device. In other words, it does not require any additional communication card or other hardware for integration into a building automation system (BAS) via the Modbus network. The configuration process is described in the following section. It is assumed that the user is familiar with Modbus technology and terminology.

Standard Modbus network rules apply. The network is a daisy-chain of unit controllers including the master (in this case, the BAS) and all slaves (VFD controller). The Modbus standard recommends that the network be terminated on each end with the characteristic impedance of the network (about 120 ohms). Follow the guidelines stated in the Modbus specifications.

Steps for Modbus Configuration

Table 14 defines the network parameters of the Modbus Communication Module that are available via the graphical interface. The Modbus network address and data transmission rate (Baud Rate) are available via the local control panel. At a minimum, you must set the network address and verify the correct baud rate before establishing network communication between the VFD controller and the BAS. Change remaining parameters as required for your network.

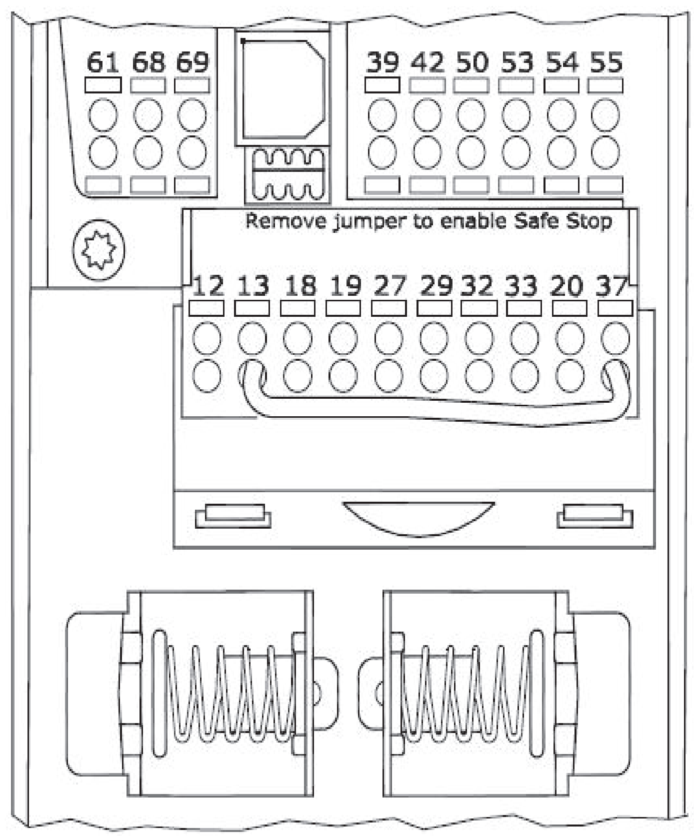
1. Set the Modbus network parameters as described in Table 14. It is recommended that remaining items in menus 8-* remain at factory defaults. See VFD installation manual, available on www.DaikinApplied.com for further details.
2. Cycle power to the VFD controller for changes to take effect.
3. Verify connection from BAS to VFD - terminals 68 (+) and 69 (-) on the main control board of the frequency converter.
4. The VFD controller is now ready for network configuration from the BAS. Refer to the Modbus Operations Manual for the AGZ-F VFD Controller, which is available on www.DaikinApplied.com, for a complete points list and additional configuration information.

Table 14: Modbus Network Parameters

Parameter	Value (Range)/Definition	Default Value
8-02 Control Source	FC Port [1]/ On-board RS-485 port	FC Port [1]
8-30 Protocol	Modbus RTU [2]/The protocol setting for the communication port	FC [0]
8-31 Address	1-247/The Modbus Address of VFD; this address must be unique throughout the entire Modbus network.	1
8-32 Baud Rate	2400 - 115200/This value should be set the same as all other devices on the trunk.	9600 baud [2]
8-33 Parity/ Stop Bits	Even parity, 1 stop bit [0]; Odd Parity, 1 Stop Bit [1]; No Parity, 1 Stop Bit [2]; No Parity, 2 Stop Bits [3]/Set to match the network settings	Even parity, 1 stop bit [0]

NOTE: Remaining items in menus 8-* should likely remain at factory defaults. See VFD installation manual for further details.

Figure 20: Modbus RTU Connection



Remote Evaporator

Refrigerant Piping and Application

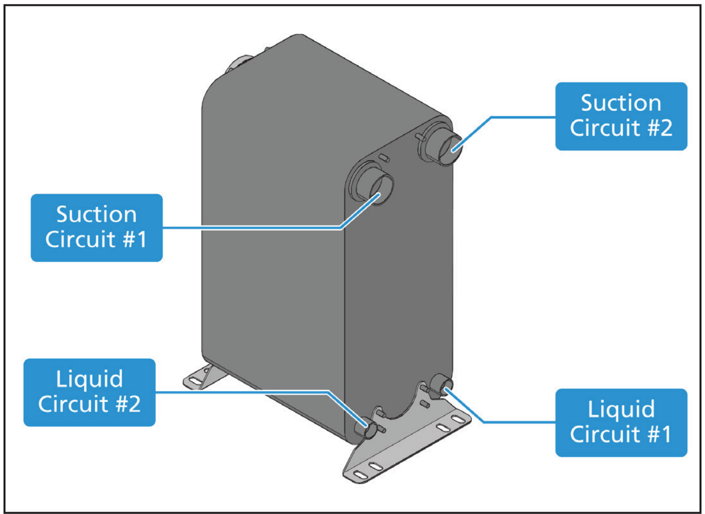
AGZ-F units have two circuits, each with either tandem or trio compressors. These circuits must be kept separate throughout the entire refrigerant piping system. Pipe all lines (suction, liquid, and hot gas bypass, if used) of each evaporator circuit to the corresponding circuit on the outdoor unit. Evaporator circuit #1 must be piped to the circuit #1 condensing unit. Evaporator circuit #2 must be piped to the circuit #2 condensing unit. Be careful not to cross-pipe any lines.

⚠ CAUTION

Refrigerant circuits must be kept isolated from each other throughout the entire system. Note that the connection locations vary by model size, see Figure 21.

Braze connections on evaporator are stainless steel so a minimum of 40% silver braze rod must be used.

Figure 21: Connection Locations



Performance Adjustments Due to Piping

Performance will be impacted by the equivalent feet of piping between the condensing unit and the evaporator. To determine the adjusted unit capacity, power, and efficiency, refer to DST Trailblazer selection software.

Piping Recommendations

NOTICE

Refrigerant piping information for this manual has changed to reflect only Microchannel coils.

New refrigerant piping must be used for all equipment installations. Refrigerant piping must be properly sized for the circuit capacity and unit refrigerant. Piping system must be brazed and have the proper lay out with all required components.

NOTICE

Service Form SF99006 (current version available from the local sales office) must be submitted to Daikin Applied Technical Response Center and reviewed at least two weeks prior to beginning piping installation.

Refrigerant piping design must be provided by a qualified HVAC Design Engineer familiar with piping design, as well as local codes and regulations. The manufacturer recommendations provided here are to be used as a general guide, and do not replace system design by a qualified professional. All field piping, wiring, and procedures must be performed in accordance with ASHRAE, EPA, local codes, and industry standards.

Proper refrigerant piping can make the difference between a reliable system and an inefficient, problematic system. See the recommended field pipe sizes shown in Table 19 and Table 20 on page 28. For additional information about refrigerant piping techniques and sizing, see the Daikin Applied Refrigerant Piping Design Guide, AG 31-011, which is found on www.DaikinApplied.com.

The primary concerns related to piping are refrigerant pressure drop, an adequately subcooled liquid feed to the expansion valves, continuous oil return, and properly sized refrigerant specialties. AGZ-F unit performance is negatively affected by suction line pressure drop losses. The distance between the AGZ-F condensing unit and the remote evaporator should be kept as short as possible to minimize the performance derate. Underground refrigerant piping is not permitted.

⚠ WARNING

Improper installation can cause refrigerant migration, flood back, oil loss, line corrosion, or mechanical failures.

⚠ CAUTION

Glycol is not allowed to be used in AGZ-F remote evaporator installations.

For installations where the evaporator is installed either above or below the unit - the following recommendations apply:

Evaporator installed below outdoor unit:

- 30 ft maximum measured vertical distance, 75 ft maximum vertical equivalent length
- Only single riser suction tubing is to be used - Double riser installations are not permitted
- A suction line trap must be installed at the bottom of the riser and a second trap at 20 ft height

Evaporator installed above outdoor unit:

- 30 ft maximum measured vertical distance, 75 ft maximum vertical equivalent length is required to prevent loss of liquid subcooling

Table 15: Remote Evaporator Piping Limitations

Piping Restriction	SE 002-004 HE 002-006	SE 006-014 HE 008-014
Maximum measured actual piping distance between the unit and the remote evaporator	90 ft	150 ft
Maximum total equivalent feet of distance between the unit and evaporator including friction losses of elbows and traps	150 ft	300 ft

NOTICE

Horizontal sections of the suction lines must be downward sloping toward the compressor with 1 inch slope per 10 foot of piping run to assist oil return.

Table 16: Fitting Losses Equivalent Feet of Pipe

Line Size In.OD	Angle Valve	Globe Valve	90° Std. Radius Elbow	90° Long Radius Elbow
7/8	9.0	22.0	2.0	1.4
1 1/8	12.0	29.0	2.6	1.7
1 3/8	15.0	38.0	3.3	2.3
1 5/8	18.0	43.0	4.0	2.6
2 1/8	24.0	55.0	5.0	3.3
2 5/8	29.0	69.0	6.0	4.1
3 1/8	35.0	84.0	7.5	5.0

SOURCE: ASHRAE 2014 Handbook Refrigeration

NOTICE

TEL values for the filter-drier and solenoid valve are already included and should not be added to the liquid line drop.

Additional Refrigerant and Oil Charge

Depending on the length of piping needed, additional refrigerant and oil charge will be needed. See Table 17 and Table 18 for specific requirements.

Table 17: Additional R-32 Line Charge

Suction Line Diameter	Suction Addition (oz/ft)	Liquid Line Diameter	Liquid Addition (oz/ft)
7/8	0.09	7/8	3.01
1 1/8	0.16	1 1/8	5.14
1 3/8	0.24	1 3/8	7.82
1 5/8	0.34	1 5/8	11.07
2 1/8	0.59	2 1/8	19.26
2 5/8	0.90	2 5/8	29.70
3 1/8	1.29	3 1/8	42.40

Table 18: Additional Oil Charge

Suction Line Diameter	Suction Addition (oz/ft)	Liquid Line Diameter	Liquid Addition (oz/ft)
7/8	0.002	7/8	0.060
1 1/8	0.003	1 1/8	0.103
1 3/8	0.005	1 3/8	0.156
1 5/8	0.007	1 5/8	0.221
2 1/8	0.012	2 1/8	0.385
2 5/8	0.018	2 5/8	0.594
3 1/8	0.026	3 1/8	0.848

Additional Piping Installation Guidelines

The brazed-plate evaporators have no charge and are not sealed. A holding charge of an inert gas, such as nitrogen, is provided for the outdoor condensing unit. Holding charges must be evacuated prior to the R-32 charging procedure. The interconnecting refrigerant piping and the total system refrigerant charge are field supplied and installed.

⚠ CAUTION

Ensure all isolation valves are shut and not leaking before performing a leak test. Failure to do so may result in unit damage and loss of unit warranty.

After evacuating piping system to 500 microns or below, the system cannot rise over 300 microns within an hour. Insulate the suction line to reduce excessive superheat build-up. Insulate the liquid line to prevent loss of subcooling and consequent liquid flashing.

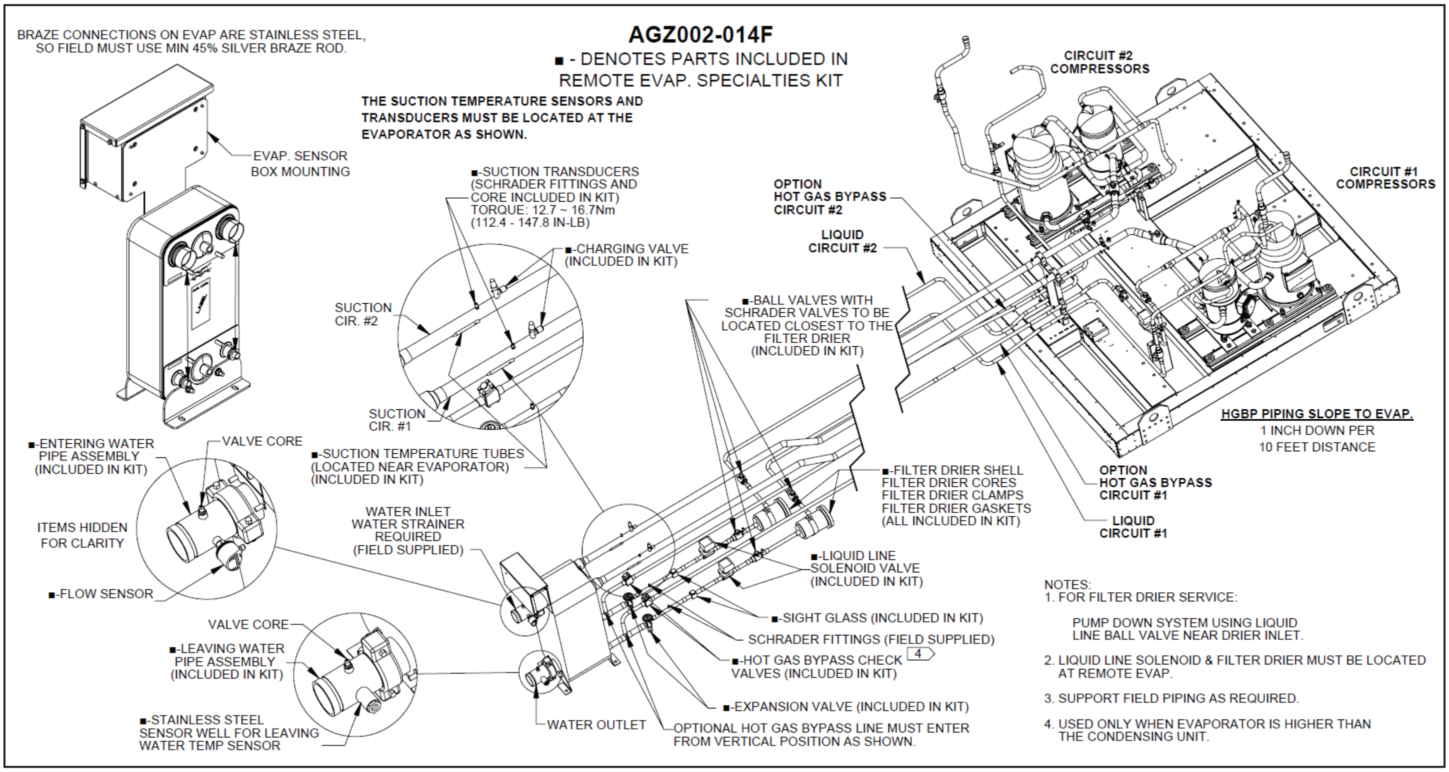
The use of double risers for vertical gas risers is not allowed. Size the single vertical riser per Table 19 and Table 20 on page 28. A small trap must be provided at the base of each major vertical gas riser to assist in the collection of oil. If vertical risers exceed more than 20 feet, install a second trap per guidelines above. Follow ASHRAE procedures and refrigerant piping guidelines. Exceeding these recommendations will decrease performance and could impact system reliability.

Use caution in sizing the liquid line in applications where the evaporator is above the outdoor section. The weight of the liquid refrigerant in the vertical column will decrease the pressure at the top of the riser (approximately 0.5 psi per foot of vertical rise) allowing some of the refrigerant to flash to a gas. Adequate refrigerant subcooling is needed at the outdoor section to prevent refrigerant gas at the expansion valve.

Care should be taken while designing piping system to avoid the draining of condensed refrigerant to the lower component when normal shut-down procedures do not occur (such as a power failure).

Refrigerant Specialties Kit

Figure 22: Specialties Kit Components



Remote evaporator units include a Refrigerant Specialties Kit which supplies the following field-installed components:

- Expansion Valves
- Liquid Line Solenoid Valve and DIN Connector
- Liquid Line Filter Drier with Filter Drier Core and Clamp
- Liquid Line Sight Glasses
- Liquid Line Ball Valves
- Charging Valve
- Suction Line Temperature Sensor Tube
- Schrader and Schrader Core for Suction Line Transducers
- Suction Pressure Transducer
- Check Valve for Hot Gas Bypass Line (specific installation requirements)

Field Installed Component Locations

The following components must be installed adjacent to the remote evaporator.

The expansion valves must be installed within 12 inches of the evaporator inlet connection and the outlet piping of the expansion valve must go directly into the evaporator with no bends in between.

The liquid line solenoid valves must be installed within 3 ft of the evaporator. The liquid line solenoid valve cable must be connected to the solenoid valve using a junction box to extend the wiring to the length required to reach the solenoid.

The liquid line filter drier must be installed at the remote evaporator, upstream of the liquid solenoid valve and expansion valve.

- Install a ball valve before and after the filter drier
- Only charging valve installed for remote evap. is on suction line
- Use schrader fitting on ball valves before and after filter drier to maeasure pressure drop

Hot Gas Bypass Applications

Provide condenser fan VFDs for applications when operation below 32°F ambient is expected and hot gas bypass is desired. This is necessary to maintain adequate condensing pressures and liquid refrigerant at the expansion valve when condenser capacities are at their minimum.

Referencing the refrigerant piping schematics, the solenoid valve and hot gas bypass valve need to be as close to the condensing unit as possible.

If at the same elevation or if evaporator is below the condensing unit, the hot gas bypass piping must be downward sloping toward the evaporator with a 1inch drop per 10 ft of piping run in the direction of flow.

If the evaporator is above the condensing unit, add a check valve in the hot gas bypass piping at the evaporator to prevent refrigerant condensing in the line, which results in loss of subcooling.

Table 19: Remote Evaporator Recommended Line Sizes - Standard Efficiency Models

Unit Model	Fans	Compressor	Liquid Size Recommendation		Suction Line Size Recommendation															
			All Equiv ft		Up to 50 Equiv. ft		Up to 75 Equiv. ft		Up to 100 Equiv. ft		Up to 125 Equiv. ft		Up to 150 Equiv. ft		Up to 200 Equiv. ft		Up to 250 Equiv. ft		Up to 300 Equiv. ft	
			Cir. 1	Cir. 2	Cir. 1	Cir. 2	Cir. 1	Cir. 2	Cir. 1	Cir. 2	Cir. 1	Cir. 2	Cir. 1	Cir. 2	Cir. 1	Cir. 2	Cir. 1	Cir. 2	Cir. 1	Cir. 2
AGZ002F	2	DDNNDDNN	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8						
AGZ002F	2	GGNNFFNN	7/8	7/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8						
AGZ002F	2	GGNNGGNN	7/8	7/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8						
AGZ004F	4	JJNNHHNN	7/8	7/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 5/8	1 3/8						
AGZ004F	4	JJNNJJNN	7/8	7/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8						
AGZ004F	4	LLNNJJNN	1 1/8	7/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8						
AGZ004F	4	LLNNLLNN	1 1/8	1 1/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8						
AGZ004F	4	LPNNLLNN	1 1/8	1 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8						
AGZ004F	4	LPNNLPNN	1 1/8	1 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8						
AGZ006F	6	SPNNLLNN	1 1/8	1 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
AGZ006F	6	SSNNLLNN	1 1/8	1 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
AGZ006F	6	SUNNLLNN	1 3/8	1 1/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8
AGZ006F	6	SVNNLPNN	1 3/8	1 1/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8
AGZ006F	6	UUNNLPNN	1 3/8	1 1/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8
AGZ008F	8	SUNNSUNN	1 3/8	1 3/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8
AGZ008F	8	UUNNSUNN	1 3/8	1 3/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8
AGZ008F	8	UUNNUUNN	1 3/8	1 3/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8
AGZ010F	10	VVNNUUNN	1 5/8	1 3/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8
AGZ010F	10	SVSNSSSN	1 5/8	1 3/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	3 1/8	2 5/8
AGZ010F	10	SVVNSSSN	1 5/8	1 3/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8
AGZ012F	12	SVVNSSVN	1 5/8	1 5/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8
AGZ012F	12	SVVNSVVN	1 5/8	1 5/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8
AGZ014F	14	VVVNUUUN	1 5/8	1 5/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8

Table 20: Remote Evaporator Recommended Line Sizes - High Efficiency Models

Unit Model	Fans	Compressor	Liquid Size Recommendation		Suction Line Size Recommendation															
			All Equiv ft		Up to 50 Equiv. ft		Up to 75 Equiv. ft		Up to 100 Equiv. ft		Up to 125 Equiv. ft		Up to 150 Equiv. ft		Up to 200 Equiv. ft		Up to 250 Equiv. ft		Up to 300 Equiv. ft	
			Cir. 1	Cir. 2	Cir. 1	Cir. 2	Cir. 1	Cir. 2	Cir. 1	Cir. 2	Cir. 1	Cir. 2	Cir. 1	Cir. 2	Cir. 1	Cir. 2	Cir. 1	Cir. 2	Cir. 1	Cir. 2
AGZ004F	4	DDNNDDNN	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8						
AGZ004F	4	GGNNFFNN	7/8	7/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8						
AGZ004F	4	GGNNGGNN	7/8	7/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8						
AGZ006F	6	JJNNHHNN	7/8	7/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 5/8	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8
AGZ006F	6	JJNNJJNN	7/8	7/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8
AGZ006F	6	LLNNJJNN	1 1/8	7/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8	1 5/8	2 1/8	1 5/8	2 1/8	1 5/8
AGZ006F	6	LPNNJJNN	1 1/8	7/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
AGZ006F	6	PPNNJJNN	1 1/8	7/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
AGZ006F	6	PPNNLLNN	1 1/8	1 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
AGZ008F	8	LPNNLPNN	1 1/8	1 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
AGZ008F	8	PPNNLPNN	1 1/8	1 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
AGZ008F	8	PSNNPSNN	1 1/8	1 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
AGZ008F	8	SSNNSSNN	1 1/8	1 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
AGZ010F	10	SUNNSSNN	1 3/8	1 1/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8
AGZ010F	10	UUNNSSNN	1 3/8	1 1/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8
AGZ010F	10	UUNNSUNN	1 3/8	1 3/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8
AGZ012F	12	UUNNUUNN	1 3/8	1 3/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8
AGZ012F	12	VVNNUUNN	1 5/8	1 3/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8
AGZ012F	12	VVNNVVNN	1 5/8	1 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8
AGZ014F	14	SSVNSSSN	1 5/8	1 3/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8	3 1/8	2 5/8
AGZ014F	14	UUUNSSSN	1 5/8	1 3/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8
AGZ014F	14	SVVNSSVN	1 5/8	1 5/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8

Wiring for Remote Evaporators

NOTICE
Condensing unit electrical information should be based on the packaged chiller and can be found beginning on page 35.

Figure 23: Remote Evaporator Sensor Box Wiring

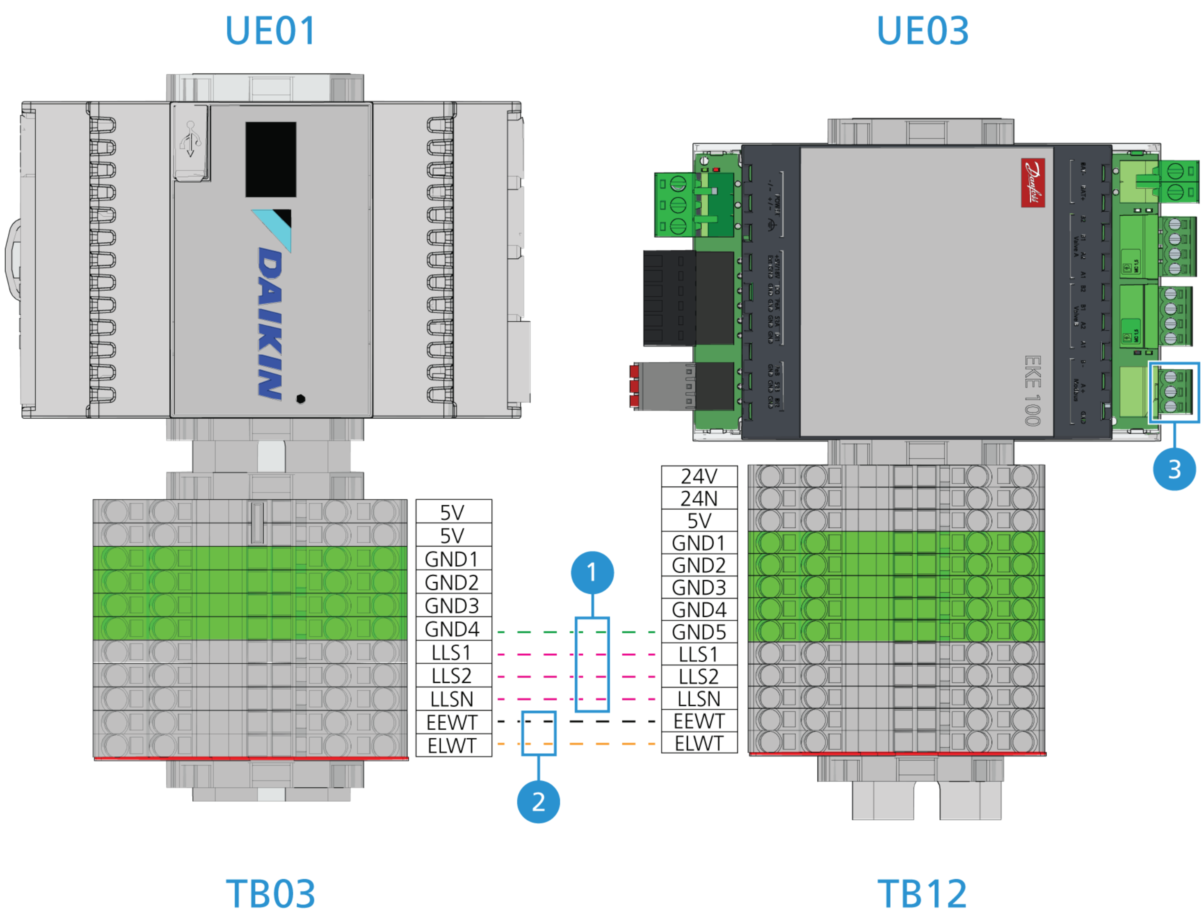


Table 21: Remote Evaporator Wiring Specifications

No.	Description
1	Individual wire interconnects (for 120V) - field provided 14 AWG (red x2 ea., white x1 ea., green x1 ea.)
2	18 AWG 2-conductor shield cable (field provided unit evaporator sensor box connect cable - TB03 - TB12 for terminals: EEWT & ELWT
3	18 AWG 3-conductor shielded communications cable for Modbus cable routed to chiller unit controller UC01:FBUS2

NOTICE
All wires in Figure 23 are specified by Daikin Applied and field provided.

Sensor Wiring

The Remote Evaporator AGZ-F units come with sensors wired to the remote evaporator sensor box, including the following:

- Evaporator Water Inlet and Outlet Temperature Sensor
- Suction Line Temperature Sensors for Piping at the Evaporator for both Circuit #1 and #2
- Suction Transducer Wiring for Installation on Evaporator Suction Piping for both Circuit #1 and #2
- Liquid Line Solenoid Valves are supplied as part of the Refrigerant Specialties Kit with a DIN connector

Field wiring from the unit mounted sensor box (Figure 24) to the remote evaporator sensor box (Figure 25) is required. All wires between the unit control box and the remote sensor box are Daikin Applied specified and field provided, as shown in Figure 23.

All wiring should be run in conduit as required by local and national code. See Field Wiring Diagram included in unit, or Figure 26 for wiring schematic.

Figure 24: Unit-Mounted Sensor Box Wiring

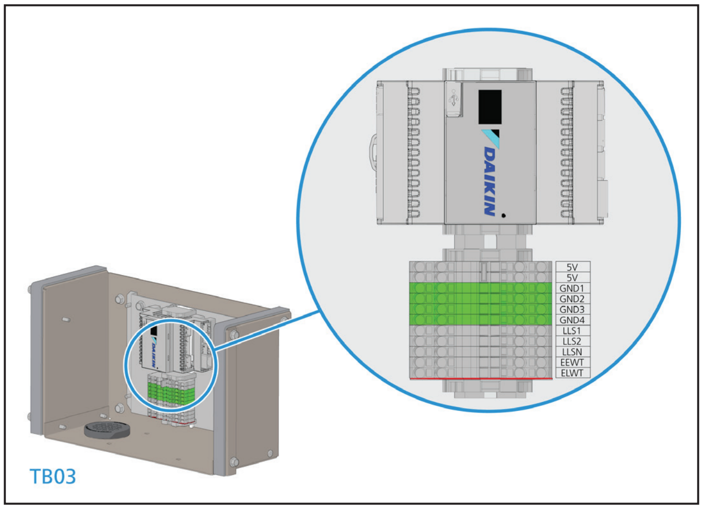
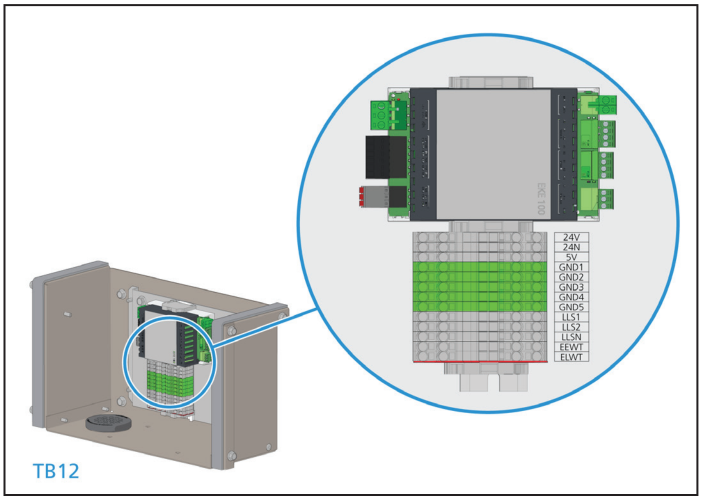


Figure 25: Remote Evaporator Sensor Box



Service Pumpdown

The service pumpdown capacity of AGZ units with microchannel condenser coils is less than models with tube and fin coils. Care should be exercised to include all equipment and lines when calculating the system charge relative to the unit's pumpdown (storage) capacity.

While the AGZ-F remote evaporators have an insignificant operating charge, the amount of refrigerant in interconnecting refrigerant piping can be considerable.

Due to the decreased refrigerant capacity of microchannel condenser coils, isolating refrigerant charge in the condenser is not recommended for remote evaporator applications.

⚠ WARNING

Failure to follow condenser volume limits when isolating refrigerant charge in the condenser may result in unit damage, personal injury, and unintentional loss of refrigerant to atmosphere if condenser refrigerant volume exceeds published capacity limits.

It is mandatory that the liquid line solenoid valve be located close to the evaporator so that pumpdown does not have to remove and store a large quantity of liquid refrigerant from the liquid line.

Remote Evaporator Field Wiring

Figure 26: Remote Evaporator Wiring Schematic

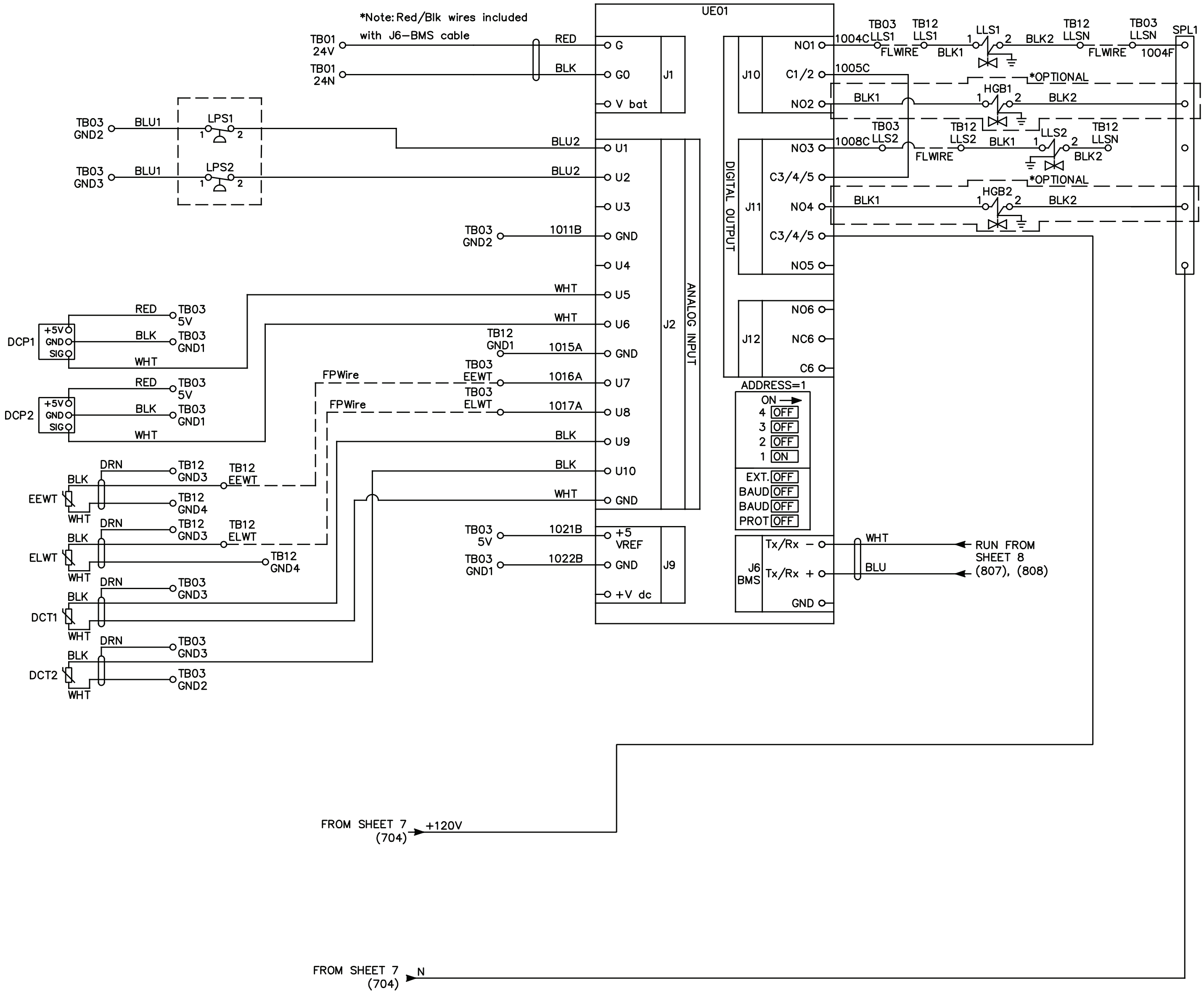
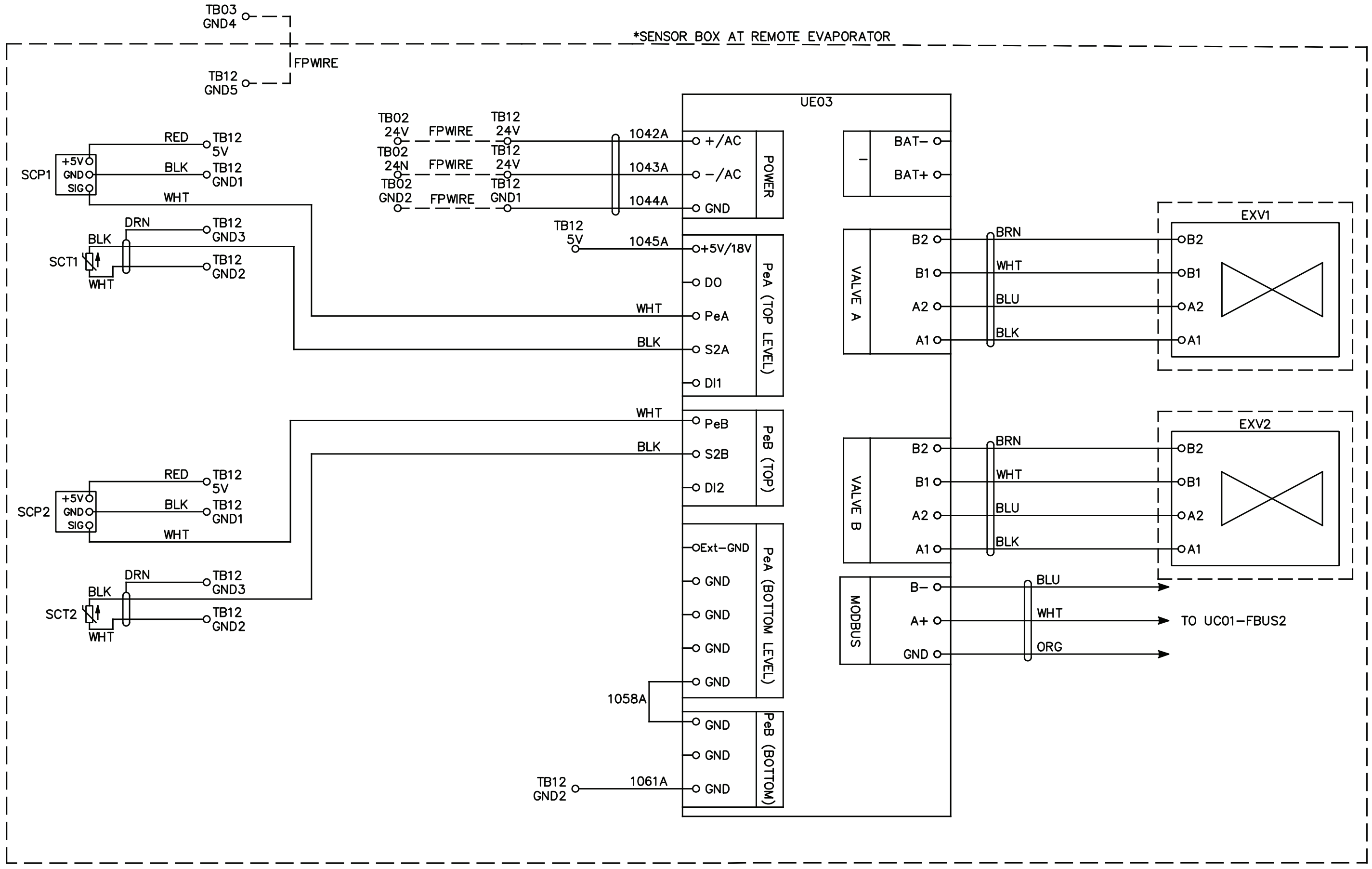


Figure 27: Remote Evaportator Wiring Schematic (Continued)



Pressure Drop Data

Evaporator Pressure Drop Data

Table 22: ACK240-DQ Data

Evaporator Part Number	Evaporator Model	Minimum Flow Rate				Nominal Flow Rate				Maximum Flow Rate			
		GPM	DP ft	l/s	DP kPa	GPM	DP ft	l/s	DP kPa	GPM	DP ft	l/s	DP kPa
332955701	ACK240DQ-58AH	36.0	1.3	2.3	4.0	72.0	7.2	4.5	21.6	144.0	32.7	9.1	97.9
332955702	ACK240DQ-66AH	42.0	1.6	2.6	4.7	84.0	7.8	5.3	23.4	168.0	34.4	10.6	102.8
332955703	ACK240DQ-78AH	54.0	2.2	3.4	6.6	108.0	9.7	6.8	29.0	216.0	40.7	13.6	121.6
332955704	ACK240DQ-86AH	60.0	2.4	3.8	7.2	120.0	10.0	7.6	30.0	240.0	41.1	15.1	122.9
332955705	ACK240DQ-98AH	66.0	2.5	4.2	7.4	132.0	9.6	8.3	28.8	264.0	38.0	16.7	113.6
332955706	ACK240DQ-106AH	72.0	2.7	4.5	8.0	144.0	10.0	9.1	29.8	288.0	38.5	18.2	114.9
332955707	ACK240DQ-114AH	66.0	2.1	4.2	6.4	132.0	7.5	8.3	22.5	264.0	28.1	16.7	84.0
332955708	ACK240DQ-122AH	78.0	2.7	4.9	8.1	156.0	9.3	9.8	27.7	312.0	33.9	19.7	101.4
332955710	ACK240DQ-138AH	84.0	2.8	5.3	8.4	168.0	8.9	10.6	26.5	336.0	30.7	21.2	91.9
332955711	ACK240DQ-142AH	90.0	3.1	5.7	9.2	180.0	9.6	11.4	28.7	360.0	33.1	22.7	98.9
332955712	ACK240DQ-154AH	96.0	3.2	6.1	9.6	192.0	9.6	12.1	28.8	360.0	28.5	22.7	85.1
332955713	ACK240DQ-170AH	108.0	3.6	6.8	10.9	216.0	10.3	13.6	30.8	360.0	24.0	22.7	71.6
332955714	ACK240DQ-194AH	120.0	4.0	7.6	11.8	240.0	10.5	15.1	31.3	360.0	19.5	22.7	58.3
332955715	ACK240DQ-210AH	138.0	4.6	8.7	13.8	276.0	11.8	17.4	35.4	360.0	17.5	22.7	52.3

NOTE: Exceeding max flow rates can cause erosion damage to the evaporator.
Each channel count has its own maximum flow rate and the frame itself has an maximum flow rate of 360 GPM.

Table 23: ACK502-DQ Data

Evaporator Part Number	Evaporator Model	Minimum Flow Rate				Nominal Flow Rate				Maximum Flow Rate			
		GPM	DP ft	l/s	DP kPa	GPM	DP ft	l/s	DP kPa	GPM	DP ft	l/s	DP kPa
332956501	ACK502-DQ-162	150.0	2.9	9.5	8.7	300.0	11.2	18.9	33.4	501.0	30.7	31.6	91.7
332956503	ACK502-DQ-190	168.0	3.3	10.6	9.8	336.0	11.1	21.2	33.0	528.0	25.4	33.3	76.0
332956504	ACK502-DQ-206	192.0	4.0	12.1	11.8	384.0	12.6	24.2	37.8	528.0	22.3	33.3	66.6
332956505	ACK502-DQ-234	204.0	4.2	12.9	12.5	408.0	12.1	25.7	36.2	528.0	18.5	33.3	55.3
332956506	ACK502-DQ-254	216.0	4.5	13.6	13.4	432.0	12.2	27.3	36.6	528.0	16.7	33.3	50.0

NOTE: Exceeding max flow rates can cause erosion damage to the evaporator.
Each channel count has its own maximum flow rate and the frame itself has an maximum flow rate of 360 GPM.

Table 24: ACH1000-DQ Data

Evaporator Part Number	Evaporator Model	Minimum Flow Rate				Nominal Flow Rate				Maximum Flow Rate			
		GPM	DP ft	l/s	DP kPa	GPM	DP ft	l/s	DP kPa	GPM	DP ft	l/s	DP kPa
332956402 332956452	ACH1000DQ-166AH	240.0	3.8	15.1	11.3	480.0	13.4	30.3	40.2	801.6	35.6	50.6	106.3
332956403 332956453	ACH1000DQ-178AH	264.0	4.0	16.7	12.0	528.0	14.2	33.3	42.4	881.0	37.3	55.6	111.4
332956404 332956454	ACH1000DQ-182AH	276.0	4.2	17.4	12.6	552.0	14.8	34.8	44.2	881.0	35.7	55.6	106.8

NOTE: Exceeding max flow rates can cause erosion damage to the evaporator.
Each channel count has its own maximum flow rate and the frame itself has an maximum flow rate of 360 GPM.

Table 25: Strainer Pressure Drop (2.5in): P/N 331775460 and 335043702

Flow (gpm)	Pressure Drop (ft)
40	0.3
60	0.7
100	2.0
150	4.3
300	16.1

Table 26: Strainer Pressure Drop (3in): P/N 335043703 and 331775463

Flow (gpm)	Pressure Drop (ft)
50	0.3
100	1.0
200	3.5
300	8.1
400	16.2

Table 27: Strainer Pressure Drop (4in): P/N 335043704 and 331775465

Flow (gpm)	Pressure Drop (ft)
100	0.4
200	1.4
300	2.8
400	5.1
500	7.8
600	11.5
700	16.1

Table 28: Strainer Pressure Drop (6in): 335043706

Flow (gpm)	Pressure Drop (ft)
200	0.3
300	0.7
400	1.3
500	1.9
600	2.7
700	3.7
800	4.6

Electrical Data

Electrical Connection

Trailblazer units can be ordered with either standard single-point power or optional multi-point power connections and with various disconnect and circuit breaker options. Wiring within the unit is sized in accordance with the NEC®.

NOTICE

Wiring, fuse, and wire size must be in accordance with the National Electrical Code® (NEC). The voltage to these units must be within ±10% of nameplate voltage (415V units must have voltage within -13% and +6% of nameplate voltage) and the voltage unbalance between phases must not exceed 2%. Since a 2% voltage unbalance will cause a current unbalance of 6 to 10 times the voltage unbalance per the current version of the NEMA MG-1 Standard, it is most important that the unbalance between phases be kept at a minimum.

Table 29: Power Connection Availability

Power Connection	Disc. Swt.	Comp. Circuit Breakers	Panel High Short Circuit Current Rating
Std. Single Point	Std.	Std.	Std.
Opt. Multi-Point	Opt.	Opt.	Opt.

Required field wiring varies depending on unit configuration. See wiring diagram information. Voltage limitations are:

1. Voltage must be within 10 percent of nameplate rating.
2. Voltage imbalance not to exceed 2%. Since a 2% voltage imbalance can cause a current imbalance of 6 to 10 times the voltage imbalance per the NEMA MG-1 Standard, it is important that the imbalance between phases be kept at a minimum.

⚠ DANGER

Qualified, licensed electricians must perform wiring. Electrical shock hazard exists that can cause severe injury or death.

⚠ DANGER

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

Power wiring connections to the chiller may be done with either copper or aluminum wiring, provided the wire size and count fit in the chiller lugs provided. All wiring must be done in accordance with applicable local and national codes, including NECA/AA 10402012, Standard for Installing Aluminum Building Wire and Cable (ANSI). Wiring within the unit is sized in accordance with the NEC®. Refer to the unit nameplate and the unit selection report for the correct electrical ratings.

1. 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.
2. Wire sizing supplied to the control panel shall be in accordance with field wiring diagram.
3. 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.
4. All field wire lug range values given unit selection report apply to 75°C rated wire per NEC.
5. Must be electrically grounded according to national and local electrical codes.

⚠ CAUTION

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

Panel High Short Circuit Current Rating

The AGZ F control panels are designed with High Short Circuit Capacity (HSCCR) ratings, these ratings can vary by size and voltage. Please consult the unit data plate or submittal data for the value.

Use with On-Site Generators

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

Generator Sizing

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

Transfer Back to Grid Power

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

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

To properly reconnect power from the generator back to the utility grid, configure the transfer switch provided with the generator to automatically shut down the chiller before transfer is made. The automatic shut-off function can be accomplished through a BAS interface or with the “remote on/off” wiring connection shown in the field wiring diagrams.

A start signal can be given any time after the unit has stopped since the unit will use the normal start up sequence to restart.

Field Wiring

Figure 28: Field Wiring for Single Point

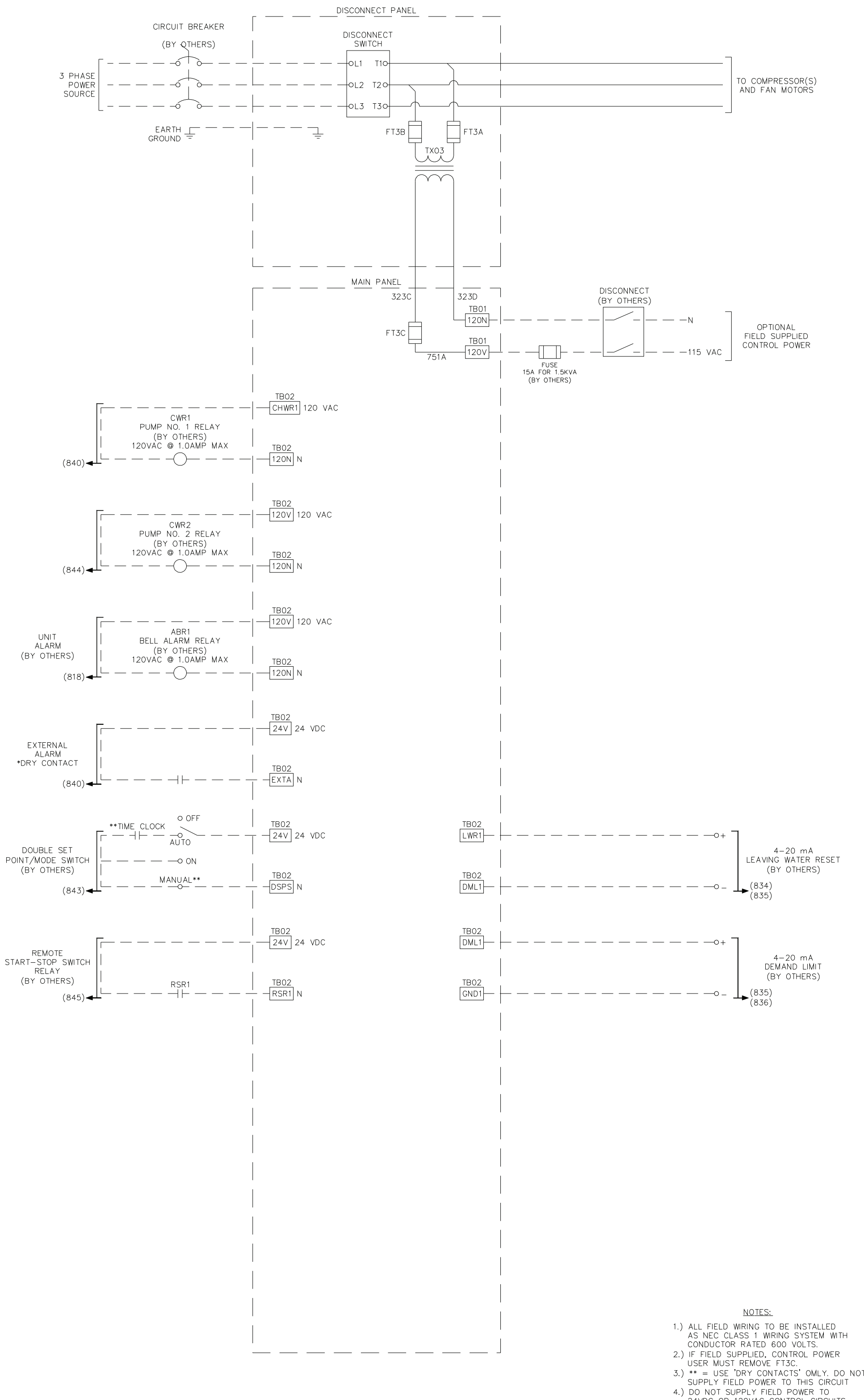
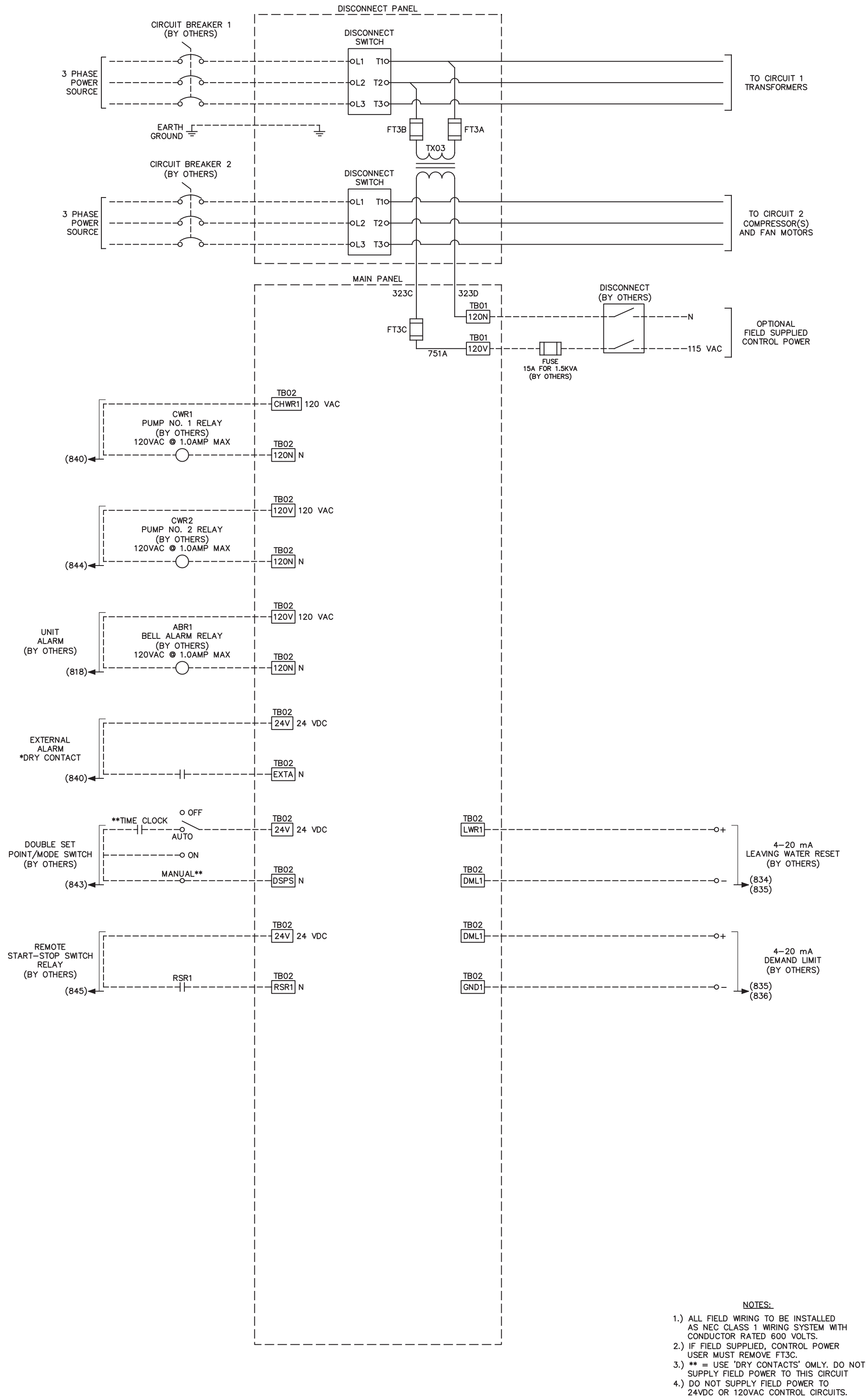


Figure 29: Field Wiring for Multi-Point



Unit Controller Operation

General Description

The MicroTech unit controller's design not only permits the chiller to run more efficiently, but also can simplify troubleshooting if a system failure occurs. Every MicroTech unit 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 unit 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 chiller controller will also retain and display the date/time the fault occurred. In addition to displaying alarm diagnostics, the MicroTech chiller controller also provides the operator with a warning of limit (pre-alarm) conditions.

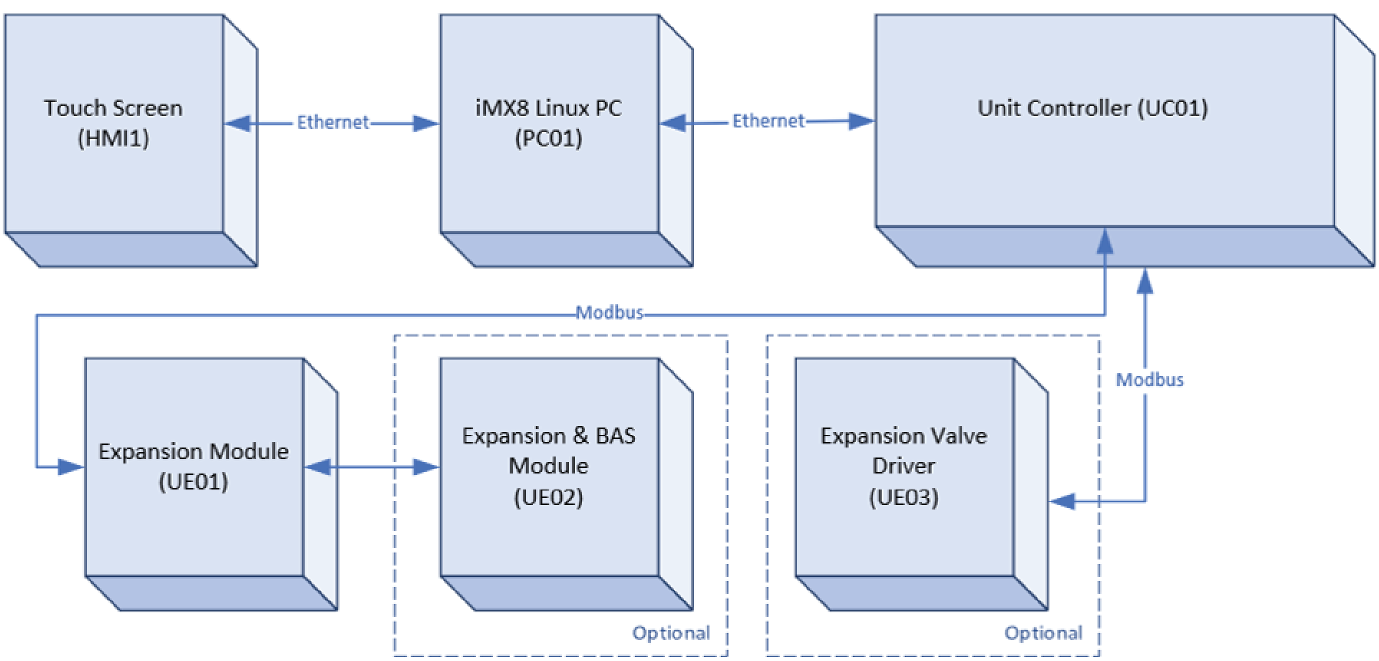
System Architecture

The overall controls architecture uses the following:

- One MicroTech® unit controller
- One iMX8 PC
- One touch screen HMI
- I/O extension modules as needed depending on the configuration of the unit
- Communications interface(s) as needed based on installed options

The touch screen HMI and the iMX8 Linux PC will connect to the unit controller via ethernet. Communication interface modules and I/O extensions will connect to the unit controller via Modbus protocol.

Figure 30: System Architecture



Controller Inputs and Outputs

Unit Controller

Table 30: Analog Inputs

#	Description	Signal Type
U1	Transformer Temperature (TX1T)(OPT for TX01)	NTC 10k Thermistor
U4	Outside Ambient Temperature (OAT1)	NTC 10k Thermistor
U7	LWT Reset (LWR1)	4-20 mA Current
U8	Demand Limit (DML1)	4-20 mA Current

Table 31: Digital Inputs

#	Description	Signal Off	Signal On
ID1	Unit Switch	Unit Disable	Unit Enable
ID2	Motor Protect Relay Circuit 1 (MP01)	Fault	No Fault
ID3	Motor Protect Relay Circuit 2 (MP02)	Fault	No Fault
ID4	High Press Switch Circuit 1 (HPR1)	Fault	No Fault
ID5	High Press Switch Circuit 2 (HPR2)	Fault	No Fault
ID6	Transformer High Temperature Switch (TX1R) (OPT for TX01)	Fault	No Fault
ID7	Evaporator Flow Switch	No Flow	Flow
ID8	Phase Voltage Monitor Circuit 1 (PVM1)	Fault	No Fault
ID9	Phase Voltage Monitor Circuit 2 (PVM1)	Fault	No Fault
ID10	Ground Fault Circuit 1 (GFM1) (OPT)	Fault	No Fault
ID11	Ground Fault Circuit 2 (GFM2) (OPT)	Fault	No Fault
ID12	External Alarm/Event	External Fault	No External Fault
ID13	Double Set Point/Mode Switch	Use alternate mode or LWT set point. See sections on Unit Mode Selection and LWT Target.	
ID14	Remote Switch	Remote Disable	Remote Enable

Table 32: Digital Outputs

#	Description	Output Off	Output On
N01	Alarm Indicator	Alarm Not Active	Alarm Active
N02	Fan Contactor (K101)	Fan(s) Off	Fan(s) On
N03	Fan Contactor (K102)	Fan(s) Off	Fan(s) On
N04	Compressor #1 (CMK1)	Compressor Off	Compressor On
N05	Compressor #3 (CMK3)	Compressor Off	Compressor On
N06	See Table 33 and Table 34 Below		
N07	Fan Contactor (K201)	Fan(s) Off	Fan(s) On
N08	Fan Contactor (K202)	Fan(s) Off	Fan(s) On
N09	Compressor #2 (CMK2)	Compressor Off	Compressor On
N010	Compressor #4 (CMK4)	Compressor Off	Compressor On
N011	See Table 33 and Table 34 Below		
N012	Evaporator Water Pump 1	Pump Off	Pump On
N013	Evaporator Water Pump 2	Pump Off	Pump On

NOTE: Digital outputs N06 and N011 are dependent on how the unit is configured. There are two options as outlined in Table 33 and Table 34 below.

Table 33: Digital Outputs (Less than 6 Compressors)

#	Description	Output Off	Output On
N06	Fan Contactor (K103)	Fans Off	Fans On
N011	Fan Contactor (K203)	Fans Off	Fans On

Table 34: Digital Outputs (6 Compressors)

#	Description	Output Off	Output On
N06	Compressor #5 (CMK5)	Compressor Off	Compressor On
N011	Compressor #6 (CMK6)	Compressor Off	Compressor On

Table 35: Expansion Valve Outputs

#	Description	Signal Output
J27	Circuit 1 EEV (EXV1)	Four Wire Stepper Motor Signal
J28	Circuit 2 EEV (EXV2)	Four Wire Stepper Motor Signal

NOTE: Expansion Valve Outputs in UC01 are only used when the unit is NOT configured for Remote Evaporator

Expansion Module (Sensor Box)

Universal channels U1-U4 are dependent on how the unit is configured. There are two options as outlined below:

1. The unit does NOT have a Remote Evaporator

Table 36: Analog Inputs

#	Description	Signal Type
U1	Circuit 1 Suction Pressure (SCP1)	Ratiometric 0.5-4.5 Vdc
U2	Circuit 2 Suction Pressure (SCP2)	Ratiometric 0.5-4.5 Vdc
U3	Circuit 1 Suction Temperature (SCT1)	NTC 10k Thermistor
U4	Circuit 2 Suction Temperature (SCT2)	NTC 10k Thermistor

2. The unit has a Remote Evaporator

Table 37: Analog Inputs

#	Description	Signal Type
U1	Circuit 1 Low Pressure Switch (LPS1)	Digital Input
U2	Circuit 2 Low Pressure Switch (LPS2)	Digital Input
U3	None	N/A
U4	None	N/A

Table 38: Digital Outputs

	Description	Output Off	Output On
N01	Liquid Line Solenoid Circuit 1 (LLS1)	Solenoid Off	Solenoid On
N02	Hot Gas Bypass Circuit 1 (SV1)	Solenoid Off	Solenoid On
N03	Liquid Line Solenoid Circuit 2 (LLS2)	Solenoid Off	Solenoid On
N04	Hot Gas Bypass Circuit 2 (SV2)	Solenoid Off	Solenoid On
N05	Four Way Valve Circuit 1 (FWV1)	Solenoid Off (Cool)	Solenoid On (Heat)
N06	Four Way Valve Circuit 2 (FWV2)	Solenoid Off (Cool)	Solenoid On (Heat)

Expansion Module (Main Box)

Table 39: Digital Outputs

#	Description	Output Off	Output On
N01	Fan Contactor (K103)	Fan(s) Off	Fan(s) On
N02	Fan Contactor (K104)	Fan(s) Off	Fan(s) On
N03	Fan Contactor (K203)	Fan(s) Off	Fan(s) On
N04	Fan Contactor (K204)	Fan(s) Off	Fan(s) On

Expansion Module (Remote Evaporator Models Only)

Table 40: Analog Inputs

#	Description	Signal Type
U1	Circuit 1 Suction Pressure (SCP1)	Ratiometric 0.5-4.5 Vdc
U2	Circuit 2 Suction Pressure (SCP2)	Ratiometric 0.5-4.5 Vdc
U3	Circuit 1 Suction Temperature (SCT1)	NTC 10k Thermistor
U4	Circuit 2 Suction Temperature (SCT2)	NTC 10k Thermistor

Table 41: Analog Inputs

#	Description	Signal Type
Valve A	Circuit 1 EEV (EXV1)	Four Wire Stepper Motor Signal
Valve B	Circuit 2 EEV (EXV2)	Four Wire Stepper Motor Signal

EXV Information

NOTICE

The values below are determined based on user entered EXV type. Current unit design and software supports only one valve type at this time resulting in the default EXV values being appropriate.

Table 42: Stepper Motor Driver Configuration - Packaged Unit Models)

Parameter	Value	Unit
Total Steps	600	steps
Movement Speed	160	steps/sec
Move Current	800	mA
Hold Current	160	mA
Duty Cycle	50	%
Full Close Steps	600	steps
Extra Open Enable	False	n/a
Extra Close Enable	True	n/a

Table 43: Stepper Motor Driver Configuration (Remote Evaporator Models)

Parameter	Value	Unit
Valve Configuration	See Table Below	N/A
Overdriver Enable OD	1	%
Overdrive Block Time	1440	min
Valve Neutral Zone	0	%
Preset OD	0	%

Table 44: Danfoss Driver Configuration

EXV Size	Value
ETS Colibri 12C (7/8”)	29
ETS Colibri 25C (7/8”)	30
ETS Colibri 50C (7/8”)	31

EXV Size	Value
ETS Colibri 50C (1-1/8”)	31
ETS Colibri 100C (1-1/8”)	32
ETS Colibri 11C (1-3/8”)	32

Set Points

Set points are initially set to the values in the Default column, and can be adjusted to any value in the Range column. Set points are stored in permanent memory. Basic unit configuration set points will require the unit to be off in order to make a change and then require rebooting the controller in order to apply a change. If an option is not included on the unit, the respective set point may not be visible. Data and settings that only apply to a specific operation mode will only be visible if that mode is selected.

Table 45: Unit Level Set Point Defaults and Ranges

Description	Default	Range
Basic Unit Configuration		
Unit Model	Not Set	AGZ002 – AGZ014
Fan Configuration	Not Set	AF, DC, DD, DE, DF, DG, DH, DV, HA, HB
Compressor Code	Not Set	Valid 8 Character Code – Item Detail
Nominal Voltage	Not Set	208V, 230V, 380V, 400V, 460V, 575V
Evaporator Configuration	Packaged	Packaged, Remote Evap, Heat Pump
Evaporator Glycol	No	No, Yes
Available Modes	Cool	Cool, Cool/Ice, Ice (see note below table)
Ground Fault Protection	No	No, Yes
Circuit 1 EXV Size	Not Set	ETS 12C, ETS 25C, ETS 50C, ETS 100C
Circuit 2 EXV Size	Not Set	ETS 12C, ETS 25C, ETS 50C, ETS 100C
Power Connection Configuration	Single Point	Single Point, Multi Point
Mode/Enabling		
Unit Enable	Enable	Disable, Enable
Control source	Local	Local, Remote, Network
Unit Test Mode	Off	Off, On
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
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)
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
Expansion Valve Manual Settings - The parameters below can be changed to override the automatic calculations. These setpoints should only be changed if in a non-nominal condition and the automatic calculations are not sufficient.		
EXV Manual Preopen	0.0 %	0.0 to 60.0 %
EXV Manual Stage Up Bump	0.0 %	0.0 to 25.0 %
EXV Manual Stage Down Bump	0.0 %	0.0 to 25.0 %
Power Conservation and Limits		
LWT Reset Enable	Disable	Disable, Enable
Demand Limit Enable	Disable	Disable, Enable
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)
Transformer Temperature Sensor Offset	0°C (0°F)	-5.0 to 5.0°C (-9.0 to 9.0°F)
Alarm and Limit Settings - Units		
Evaporator Water Freeze	2.2°C (36°F)	See Dynamic Set Point Ranges
Evaporator Flow Loss Delay	5 sec	5 to 15 sec
Evaporator Recirculate Timeout	3 min	1 to 10 min
External Fault Configuration	None	None, Event, Alarm
Low Ambient Lockout	1.7°C (35.1°F)	See Dynamic Set Point Ranges
Low OAT Lockout Configuration	Lockout & Stop	Lockout & Stop, Lockout Only, Disabled
Alarm and Limit Settings - Circuits		
Low Evap Pressure Hold	696.4 kPa (103 PSI)	See Dynamic Set Point Ranges
Low Evap Pressure Unload	689.5 kPa (102 PSI)	See Dynamic Set Point Ranges
Low Evaporator Pressure Fault	151.7 kPa (22 PSI)	138 to 207 KPA (20 to 30 PSI)
Evaporator Maximum Operating Pressure	1310 kPa (190 PSI)	979 to 1379 KPA (142 to 200 PSI)
High Condenser Pressure Hold	3550.8 KPA (515 PSI)	3241 to 4206 KPA (470 to 610 PSI)
High Condenser Pressure Unload	4137 KPA (600 PSI)	3241 to 4206 KPA (470 to 610 PSI)
High Condenser Pressure Fault	4206 KPA (610 PSI)	3310 to 4275 KPA (480 to 620 PSI)
High Discharge Temperature Fault	121°C (250°F)	93.3 to 149°C (200 to 300°F)
High Transformer Temperature Unload	65.6°C (150°F)	54.4 to 104.4°C (130 to 220°F)
Low OAT Start Time	165 sec	150 to 240 sec
Network Communication Configuration		
BACnet Module Dev Instance	0	0 to 4194302
BACnet Module Unit Support	English	Metric, English
BACnet Module Reset Out of Service	Done	Done, False, True

Description	Default	Range
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
The following apply to both BACnet MSTP and Modbus, depending on the selected protocol.		
Module Address	1	0 to 127
Module Baud Rate	38400	9600, 19200, 38400, 76800
Module Max Master	0	0 to 127
Module Max Info Frame	0	0 to 255
Module Parity	Even	Even, Odd, None
Module Stop bits	1	0 to 2
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	4.39°C (39.9°F)	-9.5 to 4.4°C (14.9 to 39.9°F)
Network Capacity Limit	100%	0 to 100%
Network Alarm Clear Command	Normal	Normal, Clear Alarm

Dynamic Set Point Ranges

Table 46 to Table 49 provide settings that have different ranges of adjustment based on other settings.

Table 46: Cool LWT 1 and Cool LWT2 Set Point Ranges

Evaporator Glycol	Unit Vintage	Range
No	F vintage	4.4 to 21.1°C (39.9 to 70°F)
Yes	F vintage	-9.5 to 21.1°C (14.9 to 70°F)

Table 47: Evaporator Water Freeze

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

Table 48: Low Ambient Lockout

Condenser Fan Configuration	Range
All Single Speed (AF)	0 to 15.6°C (32 to 60.1°F)
First Fan or All Fan Variable Speed (DC, DD, DE, DF, DG, DH, DV, HA, HB)	-23.3 to 15.6°C (-9.9 to 60.1°F)

Table 49: Low Evaporator Pressure

Available Mode Selection	Range
No	620.5 to 827.4 KPA (90 to 120 PSI)
Yes	317 to 827.4 KPA (46 to 120 PSI)

Table 50: EXV Preopen Parameters

Parameter	Nominal EXV (Design LWT >= 50°F)	Low EXV (Design LWT >= 50°F)
Preopen Position	20-30%	35-45%
Stage Up Bump Percent Change	+7%	+15%
Stage Down Bump Percent Change	-10%	-15%

Circuit Level Set Points

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

Table 51: Set Points for Individual Circuits

Description	Default	Range
Circuit and Compressor Enable		
Circuit Enable	Enable	Disable, Enable
Compressor 1 Enable (Circuit 1 Only)	Auto	Auto, Off
Compressor 3 Enable (Circuit 1 Only)	Auto	Auto, Off
Compressor 5 Enable (Circuit 1 Only)	Auto	Auto, Off
Compressor 2 Enable (Circuit 2 Only)	Auto	Auto, Off
Compressor 4 Enable (Circuit 2 Only)	Auto	Auto, Off
Compressor 6 Enable (Circuit 2 Only)	Auto	Auto, Off
Condenser EXV Control		
Condenser Target Mode	Auto	Auto, Manual
Manual Condenser Target	37.8 °C (100 °F)	21.1 to 48.9 °C (70 to 120 °F)
SSH Target	5.6 °C (10 °F)	2.8 to 11.1 °C (5 to 20 °F)
EXV Control Mode	Auto	Auto, Manual
Manual EXV Setpoint	Matches Current Automatic Setpoint	5 to 100 %
Sensor Offsets		
Suction Pressure Sensor Offset	0 kPa (0 PSI)	-100 to 100 kPa (-14.5 to 14.5 PSI)
Discharge Pressure Sensor Offset	0 kPa (0 PSI)	-100 to 100 kPa (-14.5 to 14.5 PSI)
Suction Temperature Sensor Offset	0°C (0°F)	-5.0 to 5.0°C (-9.0 to 9.0°F)
Discharge Temperature Sensor Offset	0°C (0°F)	-5.0 to 5.0°C (-9.0 to 9.0°F)

Unit Functions

Unit Model Configurations

Basic configuration of the unit is done via the unit configuration sequence.

The unit model and compressor code chosen in the unit configuration sequence should match to one of the configurations in the tables below. There are other parameters needed for configuration that are found on the unit's item detail. The total list of parameters is in the Basic Unit Configuration section under Set Points.

The digits at the end of the Unit Model represent the number of fans on the unit. For example, AGZ008 has 8 Fans. Each letter in the eight-letter compressor code identifies either a compressor (by size) or an "N" which means no compressor. The first four letters correspond to circuit one and the second four letters correspond to circuit two. The Compressor Type section in Circuit Functions has more information about the size of each compressor by letter.

Configuration Validation

A configuration will be marked as invalid if the operator enters an invalid compressor code. An invalid compressor code is a code not listed in the tables above.

Calculations

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.

$$Evap\ Delta\ T = Evap\ Temp\ In - Evap\ Temp\ Out$$

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°F/min.

LWT Error

LWT error is calculated as:

$$LWT_{error} = LWT - LWT_{target}$$

Unit Capacity

Unit capacity calculations are based on the nominal horsepower of the running compressors in relation to the total nominal horsepower of all compressors.

$$Unit\ Capacity\ (\%) = \frac{Total\ hp\ of\ running\ compressors}{Total\ hp\ of\ all\ compressors}$$

Capacity Staging Deadbands

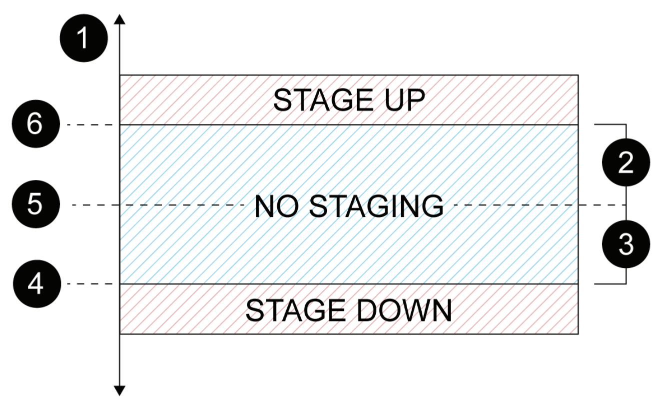
The staging deadbands the band in which unit capacity will not be increased or decreased. They are based off a relation of the evaporator temperature delta, the unit capacity, and the capacity change of staging up or down a compressor. The largest compressor available for stage up or stage down is used in the following calculations for a conservative estimate. The stage up and stage down deadbands are each determined from a three-part calculation, then limited to stay within defined boundaries of the range:

$$1.0°F < staging\ deadband < 10.0°F$$

The stage up deadband is the measure of how far the leaving water temperature be must above the target to trigger a stage up in capacity.

The stage down deadband is the measure of how far the leaving water temperature be must below the target to trigger a stage down in capacity.

Figure 31: Capacity Staging Deadbands



No.	Description
1	Leaving Water Temperature
2	Stage Up Control Band
3	Stage Down Control Band
4	LWT Target + Stage Down Control Band
5	LWT Target
6	LWT Target + Stage Up Control Band

Stage Up Deadband

To calculate the stage up deadband, first the largest compressor available for stage up is determined. With that information, the percent change if this compressor were to stage up is calculated.

$$\Delta\%_{stage\ up} = \left[\frac{capacity_{running,hp} + capacity_{largest\ stage\ up\ compressor,hp}}{capcity_{total,hp}} - \frac{capacity_{running,hp}}{capcity_{total,hp}}\right] * 100$$

Using the predicted capacity change for staging up, the resulting change in leaving water temperature is predicted.

$$\Delta LWT_{stage\ up} = \left(\frac{\Delta\%_{stage\ up}}{\%_{running}}\right) * (evap\ temp\ in - evap\ temp\ out)$$

Using the change in leaving water temperature, the stage up control band is calculated.

$$Stage\ Up\ Deadband = (\Delta LWT_{stage\ up} + 0.5)\ /\ 2$$

Stage Down Deadband

To calculate the stage down deadband, first the largest compressor available for stage down is determined. With that information, the percent change if this compressor were to stage down is calculated.

$$\Delta\%_{stage\ down} = \left[\frac{capacity_{running,hp} + capacity_{largest\ stage\ down\ compressor,hp}}{capcity_{total,hp}} - \frac{capacity_{running,hp}}{capcity_{total,hp}}\right] * 100$$

Using the predicted capacity change for staging down, the resulting change in leaving water temperature is predicted. The result of the first two equations will be a negative value, reflecting a decrease in capacity.

$$\Delta LWT_{stage\ down} = \left(\frac{\Delta\%_{stage\ down}}{\%_{running}}\right) * (evap\ temp\ in - evap\ temp\ out)$$

Using the change in leaving water temperature, the stage down control band is calculated. The sign is flipped so the stage down control band is a positive value.

$$Stage\ Down\ Deadband = -(\Delta LWT_{stage\ down} + 0.5)\ /\ 2$$

Start Up Temperature

$$Start\ Up\ Temperature\ = LWT\ Target + Stage\ Up\ Deadband\ + Start\ Up\ Delta\ Set\ Point$$

Shut Down Temperature

$$Shut\ Down\ Temperature\ = LWT\ Target - Stage\ Down\ Deadband - Shut\ Down\ Delta\ Set\ Point$$

Unit Enable

Enabling and disabling the chiller is accomplished using set points and inputs to the chiller. The Unit Switch input and the Unit Enable HMI Set Point are both required to be On/Enable for the unit to be enabled when the control source is set to 'Local'. If the control source is set to 'Remote', the Unit Switch and Remote Switch inputs are both required to be On/Enable for the unit to be enabled. If the control source is set to 'Network', the Unit Switch input and BAS Enable set point must both be On/Enable for the unit to be enabled.

Table 52: Unit Enable

Control Source Set Point	Unit Switch	Unit Enable HMI Set Point	Remote Switch	BAS Enable Set Point	Unit Enable/ Disable State
-	Off	-	-	-	Disable
Local	-	Disable	-	-	Disable
	On	Enable	-	-	Enable
Remote	-	-	Off	-	Disable
	On	-	On	-	Enable
Network	-	-	-	Disable	Disable
	On	-	-	Enable	Enable

Unit Mode Selection

The operating mode of the unit is determined by set points and inputs to the chiller. The Available Modes set point determines what modes of operation can be used. The Control Source set point determines where a command to change modes will come from.

The Mode Switch digital input switches between cool mode and ice mode if they are both 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'.

Unit Mode is selected according to the following table:

Table 53: Unit Mode Settings

Available Modes Set Point	Control Source Set Point	Mode Switch	BAS Mode Command	Unit Mode
Cool	-	-	-	Cool
Cool/Ice	Local/Remote	Off	-	Cool
		On	-	Ice
	Network	-	Cool	Cool
		-	Ice	Ice
Ice	-	-	-	Ice

Unit States

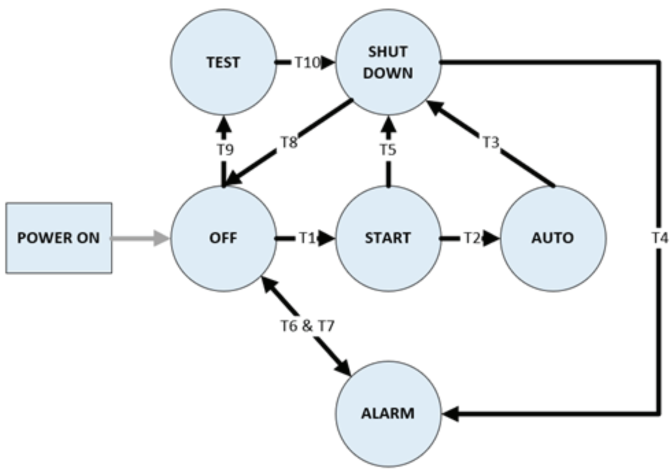
The unit will always be in one of three states:

Off – Unit is not enabled to run

Auto – Unit is enabled to run

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

Figure 32: Transitions between these states are shown in the following diagram.



T1 – Off to Start

All of the following are required:

- Unit Enable = On
- No Unit Alarms active
- If Unit Mode = Ice then Ice Delay is not active
- There is at least one compressor available to start
- Low Ambient Lockout is not active
- Unit configuration settings are valid

T2 – Start to Auto

All of the following are required:

- Evaporator flow is seen and recirculated

T3 - Auto to Shut Down

Any of the following are required:

- Unit Enable = Off
- Unit Mode = Ice AND LWT target is reached
- Low Ambient Lockout is active
- A Unit Fault is present

T4 – Shut Down to Alarm

All of the following are required:

- A Unit Fault is present

T5 – Start to Shut Down

Any of the following are required:

- A Unit Fault is present
- Unit Enable = Off

T6 – Off to Alarm

All of the following are required:

- A Unit Fault is present

T7 – Alarm to Off

All of the following are required:

- No Unit Faults are present

T8 – Shut Down to Off

All of the following are required:

- No Unit Faults are present

T9 – Off to Test

All of the following are required:

- No Unit Faults are present
- Unit Enable = Off
- Test Mode = True

T10 – Test to Shut Down

Any of the following are required:

- A Unit Fault is present
- Unit Enable = On
- Test Mode = False

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 variable speed condenser fans. 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 VFDs, 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. Low ambient lockout logic resides on the PC.

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 will perform a normal shutdown if any circuits are running. Once all circuits shut off, the unit 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).

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 Option

When the chiller is configured to disable low ambient lockout, the unit will not enter the low ambient lockout condition or shut down any running circuits regardless of the OAT.

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 setpoint is set to On and the low ambient lockout is active, the following alarm will trigger:

Table 54: Low OAT Lockout

Alarm	Low OAT Lockout			
Type	Problem			
Displayed Text	Message Code	Module Type	Module ID	Payload
Alarm Parts	65	1	0	0
Alarm Code	1090584576			
Trigger	Trigger conditions are defined in the sections above			
Action Taken:	No Action			
Reset	Clearing conditions are defined in the section above			

Unit Status

Unit Status is displayed to indicate the general operating condition of the unit. The following table lists the text displayed for each unit status and the conditions that enable each status. If more than one status is enabled at the same time, the highest numbered status overrides the others and is displayed.

Table 55: Unit Status

#	Status	Conditions
0	None	There is an initialization error
1	Auto	Unit State = Auto
2	Off:Low OAT Lockout	Unit State = Off and low ambient lockout is active
3	Auto:All Disabled	Unit State = Auto and all circuits or compressors are disabled
4	Alarm	Unit State = Off and Unit Alarm active
5	Off:HMI Disable	Unit State = Off, Control Source = Local, and Local Enable = Disable
6	Off:Remote Switch	Unit State = Off, Control Source = Remote, and Remote Switch is open
7	Off:BAS Disable	Unit State = Off, Control Source = Network, and BAS Enable = false
8	Off:Unit Switch	Unit State = Off and Unit Switch = Disable
9	Off:Test Mode	Unit State = Off and Unit Mode = Test
10	Off:Ice Mode Timer	Unit State = Off and Unit Mode = Ice and Ice Mode Timer = Active
11	Auto:Wait For load	Unit State = Auto, no circuits running, and LWT is less than startup temp
12	Auto:Evap Recirculate	Unit State = Auto and Evaporator State = Start
13	Auto:Wait For Flow	Unit State = Auto, Evaporator State = Start, and Flow Switch is open
14	Shutdown	Unit State = Shutdown
15	Auto:Max PDR	Unit State = Auto, max pulldown rate has been met or exceeded
16	Auto:Unit Cap Limit	Unit State = Auto, unit capacity limit has been met or exceeded
17	Auto:Trns Hold	Unit State = Auto and transformer high temperature hold is active
18	Auto:High Amb Limit	Unit State = Auto and high ambient capacity limit is active
19	Auto:Rapid Restore	Unit State = Auto and normal Rapid Restore is active

#	Status	Conditions
20	Auto:Backup Chiller	Unit State = Auto and Backup Chiller Rapid Restore is active
21	Off:Invalid Config	The selected unit configuration is not valid.

Evaporator Pump Control

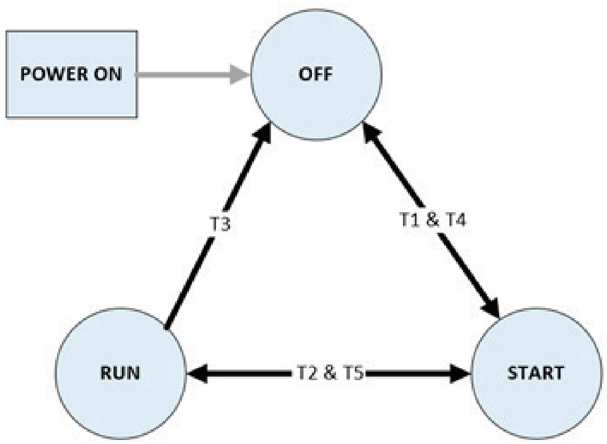
For control of the evaporator pumps, three evaporator pump control states should be used:

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.

Figure 33: 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

Requires flow switch input off for time longer than the Flow Loss Delay set point.

Freeze Protection

To protect the evaporator from freezing, the evaporator pump will be started to circulate water through the loop as a last resort. Other countermeasures should avoid water temperatures dropping to a dangerous level, but, if need be, this freeze protection function will be activated.

Freeze protection should start if all of the following are true:

- LWT ≤ Evap Freeze set point for at least three seconds
- LWT sensor fault isn't active
- Evaporator Flow Loss alarm is not active

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

- [LWT ≥ 1.11°C + Evap Freeze set point OR LWT sensor fault is active] and pump has been in start or run state for at least 15 minutes
- Evaporator Flow Loss alarm is active

Pump Selection

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

Table 56: Pump Selection

Pump Selection Mode	Description
Pump 1 Primary	Pump 1 is used normally, with pump 2 as a backup
Pump 2 Primary	Pump 2 is used normally, with pump 1 as a backup
Pump Load Balancing	The primary pump is the one with the least run hours, the other is used as a backup
Pump 1 Only	Pump 1 will always be used
Pump 2 Only	Pump 2 will always be used

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 Loss Delay 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.

Pump Load Balancing

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 various settings and inputs. A base LWT Target is selected, and a reset can be used to offset the target to a higher value when the chiller is operating in Cool mode. In Ice mode, no reset can be applied.

The base LWT target is selected as shown in the following table:

Table 57: LWT Target

Available Modes Set Point	Control Source Set Point	Mode Switch	BAS Mode Command	Base LWT Target
Cool	Local/Remote	Off	-	Cool LWT 1 Set Point
		On	-	Cool LWT 2 Set Point
	Network	-	-	BAS Cool Set Point
Cool/Ice	Local/Remote	Off	-	Cool LWT 1 Set Point
		On	-	Ice LWT Set Point
	Network	-	Cool	BAS Cool Set Point
		-	Ice	BAS Ice Set Point
Ice	Local/Remote	-	-	Ice LWT Set Point
	Network	-	-	BAS Ice Set Point

Leaving Water Temperature (LWT) Reset

Leaving water reset raises the leaving water temperature set-point when the building load is at less-than-design conditions. Producing warmer chilled water lessens the burden on the compressors, which means that the chiller is more efficient.

The base LWT target may be reset if LWT reset is enabled via the setpoint. When the setpoint is set to off, no leaving water reset will happen and the leaving water setpoint will remain the same.

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 70°F for F vintage.

Unit Capacity Control

Capacity control is responsible for the overall output of the chiller. Compressors are staged to meet the active evaporator leaving fluid temperature target.

Compressor Staging

The compressors will stage until the leaving water temperature reaches its setpoint within a dead band. Once the unit is enabled, if the water delta is sufficient for start, capacity control will stage up a compressor, triggering the corresponding circuit to start. Capacity control will continue to stage compressors on with a stage up delay after each to meet the leaving fluid target. Before a compressor can stage on, the pulldown rate is checked to make sure staging up will not result in a pulldown rate higher than the max setpoint.

Staging Up a Compressor

Requirements for staging up:

- LWT > Stage Up Temperature
- Pulldown Rate < Max Pulldown Rate
- Stage Up Delay Timer has Expired (see exception below)
- If a transformer is present, the temperature is more than 10°F below the unload setpoint
- The staging circuit has a discharge pressure less than the High Condenser Pressure Hold setpoint
- The resulting capacity will not exceed the demand limit

Stage Up Delay

A minimum amount of time, defined by the Stage Up Delay set point, should pass after a capacity change before a compressor can be staged on again.

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.

Choosing compressor to stage up

In general, compressors with fewer starts will normally start first. When selecting the next compressor to turn on, first each circuit is evaluated. The circuit that has more available capacity to start is chosen. This is measured by taking the sum of the nominal horsepower of each compressor available for start. If both circuits are equal, circuit 1 is chosen.

The available compressor with the least starts on the chosen circuit will be staged up. If a compressor is already running, is disabled, or has an active start-start timer it will be marked as un-available. In addition, if the resulting capacity from a stage up is over the demand limit (if active), that compressor will be marked as un-available. Capacity predictions are based on nominal horsepower, so larger compressors may be over the demand limit but a smaller sized compressor on the same circuit may be available to start. If multiple compressors are equal, the compressor with the lowest ID number is chosen.

Staging Down a Compressor

Requirements for staging up:

- Water Delta < Stage Down Dead Band
- Stage Down Timer has Expired

Stage Down Delay

A minimum amount of time, defined by the Stage Down Delay set point, should pass after a capacity change before a compressor can be staged off again.

However, if the LWT drops below the Shut Down Temperature the stage down delay is ignored and the unit will shut down immediately.

Choosing compressor to stage down

In general, compressors with more run hours will normally stop first. When selecting the next compressor to turn off, first each circuit is evaluated. The circuit that has more running capacity is chosen. This is measured by taking the sum of the nominal horsepower of each compressor that is currently running. If both circuits are equal, circuit 1 is chosen.

The running compressor with the most run hours on the chosen circuit will be staged down. If a compressor has an active start-stop timer, it will be marked as un-stoppable until the start-stop timer is expired. If multiple compressors are equal, the compressor with the lowest ID number is chosen.

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 to not exceed the calculated max capacity reflected demand limit.

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. The compressors are staged as to not exceed the calculated max capacity.

Maximum LWT Pulldown Rate

The maximum rate at which the leaving water temperature can drop will be limited by the Maximum Pulldown Rate set point, only when the unit mode is Cool.

If the rate exceeds this set point, no more compressors will 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 current could be exceeded at high ambient temperatures.

If the power connection is single point and the OAT rises to 46.67°C (116°F), the high ambient limit becomes active. This limit is removed when the OAT drops back down to 45.56°C (114°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:

- Unit was running at a capacity greater than 0% at the time of power loss
- Unit is enabled

Rapid Restore 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

Evaporator Recirculation Time

Only the value used in the evaporator state logic will be limited, and only if the set point exceeds the 100 second limit.

This action will ensure that the chiller is ready to start after the motor protection module delay has expired.

When Rapid Restore is triggered, the evaporator recirculation time must be limited to a time that will allow the chiller to start within the allowed time. This time limit value will depend on which firmware/software combination is used.

Note that the evaporator recirculation time set point is not changed as a result of this. Only the value used in the evaporator state logic will be limited, and only if the set point exceeds the limit value.

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 while Rapid Restore is active. This is done via changes to the stage up delays and max pulldown rate.

Capacity Changes

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

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

Max Pulldown Rate

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

Backup Chiller Operation

If the Backup Chiller digital input is on, then the chiller is considered a 'backup chiller'. When a 'backup chiller' is enabled to run, 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 above in the fast loading section.

With the backup chiller option enabled, the unit can achieve full capacity even faster than during a power loss scenario.

Compressor Starting

During normal operation, chiller controls will limit compressor starts by enforcing the circuit configuration timers listed in Table 51 on page 43. During RapidRestore operation, the compressor cycle timers are not maintained through power cycling. The following table shows the approximate best case scenario for start time and loading time with the RapidRestore operation.

Figure 34: RapidRestore Mode Response Times

# of compressors		Maximum Re-start 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

On AGZ-F chillers, sound reduction is built into the fan code which is input in the unit commissioning sequence. The condenser control section contains information about rpm ranges corresponding to the codes. Only the fan code the unit was configured for should be used.

Test Mode

Test mode is a variation of manual control that is not meant to make cold water, but to test individual components. Test mode is useful in situations like opening the EXVs and solenoids manually to allow for pump down. In test mode, compressors will "bump" when started, so they will turn themselves off after a few seconds with no additional action.

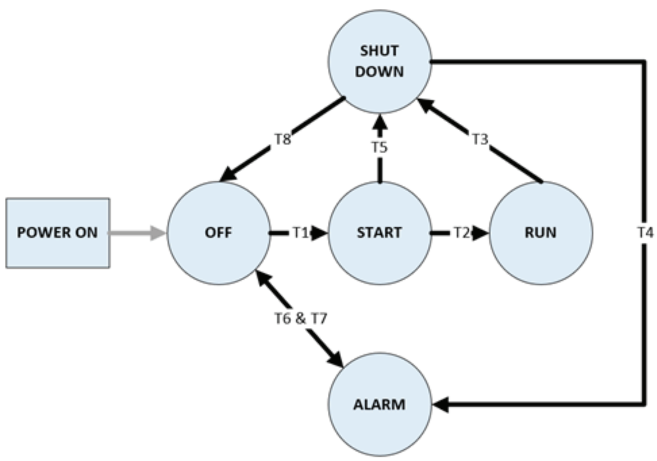
Circuit Functions

Circuit States

Table 58: Circuit States

State	Description
Off	Circuit is off. EXV is at 0.2%, solenoids are closed and no fans or compressors running.
Start	EXV is going through the preopen sequence.
Run	Circuit is running with at least one compressor.
Shut Down	Circuit is going through shut down procedures. Can transition to Off or Alarm.
Alarm	Circuit fault is active.

Figure 35: Circuit State Transitions



T1 – Off to Start

All of the following are required:

- Circuit Enable = Enable
- No Circuit Alarms active
- There is at least one compressor available to start
- Unit State = Auto

T2 – Start to Run

All of the following are required:

- The EXV preopen procedure has finished
- The first compressor to start is running

T3 - Run to Shut Down

Any of the following are required:

- Unit Enable = Off
- Circuit Enable = Disable
- A Circuit Fault is present
- There are no compressors running on the circuit

T4 – Shut Down to Alarm

All of the following are required:

- A Circuit Fault is present

T5 – Start to Shut Down

Any of the following are required:

- Unit Enable = Off
- Circuit Enable = Disable
- A Circuit Fault is present

T6 – Off to Alarm

All of the following are required:

- A Circuit Fault is present

T7 – Alarm to Off

All of the following are required:

- No Circuit Faults are present

T8 – Shut Down to Off

All of the following are required:

- No Circuit Faults are present

Circuit Status

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

#	Status	Conditions
0	None	There is an initialization error.
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

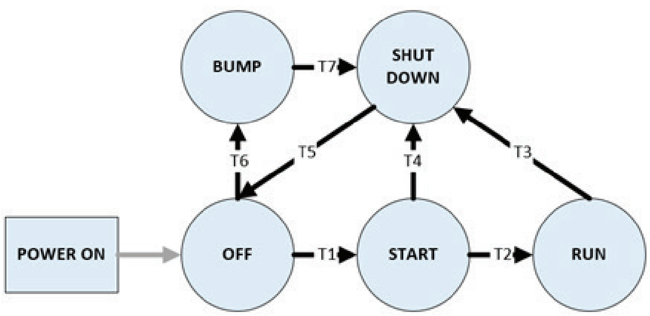
The AGZ Compressor class controls the compressors within the circuit it is instantiated.

Compressor State

Table 59: Compressor State

State	Description
Off	Compressor is off.
Start	Compressor contactor is closed and the compressor is starting.
Run	Compressor is running.
Shut Down	Compressor contactor is opened, and the compressor is stopping.
Alarm	Compressor is on for a duration of three seconds then turns itself off for testing.

Figure 36: Compressor State Transitions



T1 – Off to Start

All of the following are required:

- Compressor Enable = Enable
- Start-Start timer expired
- Capacity control initiates start

T2 – Start to Run

All of the following are required:

- Ten second start timer expires
- Contactor is closed

T3 - Run to Shut Down

Any of the following are required:

- Compressor Enable = Disable
- Capacity control initiates shut down

T4 – Start to Shut Down

Any of the following are required:

- Compressor Enable = Disable
- Capacity control initiates shut down

T5 – Shut Down to Off

All of the following are required:

- Contactor is opened

T6 – Off to Bump

All of the following are required:

- Unit State = Test
- Compressor bump initiated from the HMI

T7 – Bump to Shut Down

All of the following are required:

- Three second bump timer expires

Compressor Types

The AGZ-F compressors are single speed scrolls. The compressors can be different sizes, which are reflected in the table below.

Table 60: Compressor Types

Compressor Code	Nominal Horsepower
D	7.5
F	9.0
G	10
H	12
J	13
L	16
P	22
S	27
U	40
V	43
N	No Compressor

These individual compressor codes make up the unit compressor code, an eight-letter representation of which compressors are on the unit. For example, VVSNSSSN.

Condenser Fan Control

Condenser fan control will activate and deactivate fans as needed any time the circuit is the start or run state. All fans will be off when the circuit is in the off or alarm state. There are special cases when the fans will be on in the circuit start state. Condenser fan digital outputs will be turned on or off immediately for condenser stage changes.

The condenser is configured in the unit commissioning sequence from the Unit Model and the Fan Code.

Table 61: Condenser State

State	Description
Off	All fans are off.
Start	Condenser is starting.
Run	Condenser is running, staging fans to target the condenser setpoint.
Shut Down	All fans are turned off.

Figure 37: Condenser State Transitions

T1 – Off to Start

All of the following are required:

- Circuit State = Start

T2 – Start to Run

Any of the following are required:

- Circuit State = Run
- Outdoor Air Temperature > 80°F

T3 - Run to Shut Down

All of the following are required:

- Circuit State is not Start
- Circuit State is not Run

T4 – Start to Shut Down

All of the following are required:

- Circuit State is not Start
- Circuit State is not Run

T5 – Shut Down to Off

All of the following are required:

- Commands to shut down fans sent

Condenser Types

There are three main categories of condenser configurations.

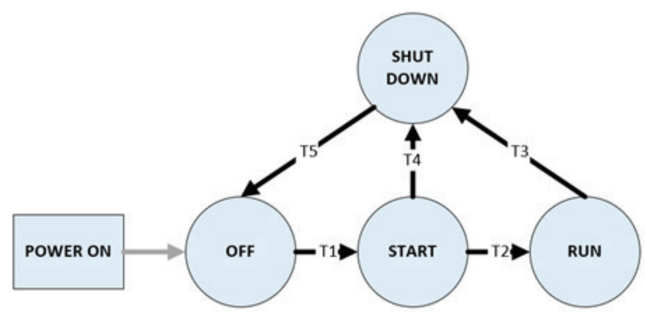
All On/Off Fans (AF)

The AF configuration contains only on/off fans. The fans are AC induction type and are controlled via digital outputs to contactors in the unit control box. In AF condenser configurations with a more than four fans, the fans are put in groups and controlled by the four digital outputs. When groups of two or three stage down, single, or double fan groups stage to compensate, so every sequential stage changes the total condenser output by a difference of one fan. The AF configuration is only designed to run at outdoor air temperatures of greater than 32°F.

First Fan ECM (DV)

The DV configuration contains one variable speed ECM fan, and the rest are on/off induction fans. The DV fans ramp up and down as the on/off fans stage to smooth out the transitions.

Table 62: First Fan ECM



Type	Description	Minimum Speed	Maximum Speed	Horsepower
DV	DC Fan Motors	300 rpm	850 rpm	2 hp

All ECM Fans (H[X])

H[X] represents a category of all ECM fans, there are multiple configurations within this category, represented by the variable [X].

Table 63: All ECM Fans

Type	Description	Minimum Speed	Maximum Speed	Horsepower
HA	High Static DC Fan Motors	300 rpm	950 rpm	3 hp
HB	High Static DC Fan Motors	300 rpm	900 rpm	3 hp
DC	DC Fan Motors	300 rpm	850 rpm	2 hp
DD	DC Fan Motors	300 rpm	800 rpm	2 hp
DE	DC Fan Motors	300 rpm	750 rpm	2 hp
DF	DC Fan Motors	300 rpm	700 rpm	2 hp
DG	DC Fan Motors	300 rpm	650 rpm	2 hp
DH	DC Fan Motors	300 rpm	600 rpm	2 hp

Condenser Stages

Condenser staging on each refrigerant circuit will use up to 4 digital outputs for control of condenser fans. When equipped with variable speed (ECM) condenser fans, the speed signal(s) sent to the fans(s) via Modbus starts and stops the fan or fans. The variable speed (ECM) fans do not use digital outputs.

The tables in the following sections show the output states for each stage of condenser control with all the supported unit configurations.

F Vintage Models - No ECM Fans (AF)

Table 64: 2 Fans - AF

Circuit 1				
Description	**Output**	**Contactor**	**Fans**	**Stage 1**
Fan Output 1	UC NO2	K101	101	On
Circuit 2				
Description	**Output**	**Contactor**	**Fans**	**Stage 1**
Fan Output 1	UC NO7	K201	201	On

Table 65: 4 Fans - AF

Circuit 1					
Description	**Output**	**Contactor**	**Fans**	**Stage**	
				1	**2**
Fan Output 1	UC NO2	K101	101	On	On
Fan Output 2	UC NO3	K102	102		On
Circuit 2					
Description	**Output**	**Contactor**	**Fans**	**Stage**	
				1	**2**
Fan Output 1	UC NO7	K201	201	On	On
Fan Output 2	UC NO8	K202	202		On

Table 66: 6 Fans - AF

Circuit 1							
Description	**Output**	**Contactor**	**Fans**	**Stage**			
				1	**2**	**3**	**4**
Fan Output 1	UC NO2	K101	101	On	On	On	On
Fan Output 3	UC NO5	K103	102			On	On
Fan Output 2	UC NO3	K102	103		On		On
Fan Output 3	UC NO6	K103	104			On	On
Circuit 2							
Description	**Output**	**Contactor**	**Fans**	**Stage**			
				1	**2**	**3**	**4**
Fan Output 1	UC NO7	K201	201	On	On		
Fan Output 2	UC NO8	K202	202		On		

Table 67: 8 Fans - AF

Circuit 1							
Description	**Output**	**Contactor**	**Fans**	**Stage**			
				1	**2**	**3**	**4**
Fan Output 1	UC NO2	K101	101	On	On	On	On
Fan Output 3	UC NO6	K103	102			On	On
Fan Output 2	UC NO3	K102	103		On		On
Fan Output 3	UC NO6	K103	104			On	On
Circuit 2							
Description	**Output**	**Contactor**	**Fans**	**Stage**			
				1	**2**	**3**	**4**
Fan Output 1	UC NO7	K201	201	On	On	On	On
Fan Output 3	UC NO11	K203	202			On	On
Fan Output 2	UC NO8	K202	203		On		On
Fan Output 3	UC NO11	K203	204			On	On

Table 68: 10 Fans - AF - 4 Compressors

Circuit 1									
Description	**Output**	**Contactor**	**Fans**	**Stage**					
				1	**2**	**3**	**4**	**5**	**6**
Fan Output 1	UC NO2	K101	101	On		On	On		On
Fan Output 3	UC NO6	K103	102				On	On	On
Fan Output 2	UC NO3	K102	103		On	On		On	On
Fan Output 3	UC NO6	K103	104				On	On	On
Fan Output 2	UC NO3	K102	105		On	On		On	On
Fan Output 3	UC NO6	K103	106				On	On	On
Circuit 2									
Description	**Output**	**Contactor**	**Fans**	**Stage**					
				1	**2**	**3**	**4**	**5**	**6**
Fan Output 1	UC NO7	K201	201	On	On	On	On		
Fan Output 3	UC NO11	K203	202			On	On		
Fan Output 2	UC NO8	K202	203		On		On		
Fan Output 3	UC NO11	K203	204			On	On		

Table 69: 10 Fans - AF - 6 Compressors

Circuit 1									
Description	**Output**	**Contactor**	**Fans**	**Stage**					
				1	**2**	**3**	**4**	**5**	**6**
Fan Output 1	UC NO2	K101	101	On		On	On		On
Fan Output 3	UE2 NO1	K103	102				On	On	On
Fan Output 2	UC NO3	K102	103		On	On		On	On
Fan Output 3	UE2 NO1	K103	104				On	On	On
Fan Output 2	UC NO3	K102	105		On	On		On	On
Fan Output 3	UE2 NO1	K103	106				On	On	On
Circuit 2									
Description	**Output**	**Contactor**	**Fans**	**Stage**					
				1	**2**	**3**	**4**	**5**	**6**
Fan Output 1	UC NO7	K201	201	On	On	On	On		
Fan Output 3	UC NO11	K203	202			On	On		
Fan Output 2	UC NO8	K202	203		On		On		
Fan Output 3	UC NO11	K203	204			On	On		

Table 70: 12 Fans - AF - 4 Compressors

Description	Output	Contactor	Fans	Stage					
Circuit 1									
				1	2	3	4	5	6
Fan Output 1	UC NO2	K101	101	On		On	On		On
Fan Output 3	UC NO6	K103	102				On	On	On
Fan Output 2	UC NO3	K102	103		On	On		On	On
Fan Output 3	UC NO6	K103	104				On	On	On
Fan Output 2	UC NO3	K102	105		On	On		On	On
Fan Output 3	UC NO6	K103	106				On	On	On
Circuit 2									
Description	**Output**	**Contactor**	**Fans**	**Stage**					
				1	2	3	4	5	6
Fan Output 1	UC NO7	K201	201	On		On	On		On
Fan Output 3	UC NO11	K203	202				On	On	On
Fan Output 2	UC NO8	K202	203		On	On		On	On
Fan Output 3	UC NO11	K203	204				On	On	On
Fan Output 2	UC NO8	K202	205		On	On		On	On
Fan Output 3	UC NO11	K203	206				On	On	On

Table 71: 12 Fans - AF - 6 Compressors

Description	Output	Contactor	Fans	Stage					
Circuit 1									
				1	2	3	4	5	6
Fan Output 1	UC NO2	K101	101	On		On	On		On
Fan Output 3	UE2 NO1	K103	102				On	On	On
Fan Output 2	UC NO3	K102	103		On	On		On	On
Fan Output 3	UE2 NO1	K103	104				On	On	On
Fan Output 2	UC NO3	K102	105		On	On		On	On
Fan Output 3	UE2 NO1	K103	106				On	On	On
Circuit 2									
Description	**Output**	**Contactor**	**Fans**	**Stage**					
				1	2	3	4	5	6
Fan Output 1	UC NO7	K201	201	On		On	On		On
Fan Output 3	UE2 NO4	K203	202				On	On	On
Fan Output 2	UC NO8	K202	203		On	On		On	On
Fan Output 3	UE2 NO4	K203	204				On	On	On
Fan Output 2	UC NO8	K202	205		On	On		On	On
Fan Output 3	UE2 NO4	K203	206				On	On	On

Table 72: 14 Fans - AF

Circuit 1											
Description	**Output**	**Contactor**	**Fans**	**Stage**							
				1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Fan Output 1	UC NO2	K101	101	On		On	On		On		On
Fan Output 3	UE2 NO1	K103	102				On	On	On	On	On
Fan Output 2	UC NO3	K102	103		On	On		On	On	On	On
Fan Output 3	UE2 NO1	K103	104				On	On	On	On	On
Fan Output 2	UC NO3	K102	105		On	On		On	On	On	On
Fan Output 3	UE2 NO1	K103	106				On	On	On	On	On
Circuit 2											
Description	**Output**	**Contactor**	**Fans**	**Stage**							
				1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Fan Output 1	UC NO7	K201	201	On		On	On		On		
Fan Output 3	UE2 NO4	K203	202				On	On	On		
Fan Output 2	UC NO8	K202	203		On	On		On	On		
Fan Output 3	UE2 NO4	K203	204				On	On	On		
Fan Output 2	UC NO8	K202	205		On	On		On	On		
Fan Output 3	UE2 NO4	K203	206				On	On	On		

F Vintage Model - First Fan ECM (DV)

Table 73: 2 Fans - DV

Circuit 1				
Description	**Output**	**Contactor**	**Fans**	**Stage 1**
Speed Signal 1	Modbus	n/a	101	On
Circuit 2				
Description	**Output**	**Contactor**	**Fans**	**Stage 1**
Speed Signal 1	Modbus	n/a	201	On

Table 74: 4 Fans - DV

Circuit 1					
Description	**Output**	**Contactor**	**Fans**	**Stage**	
				1	**2**
Speed Signal 1	Modbus	n/a	101	On	On
Fan Output 2	UC NO2	K101	102		On
Circuit 2					
Description	**Output**	**Contactor**	**Fans**	**Stage**	
				1	**2**
Speed Signal 1	Modbus	n/a	201	On	On
Fan Output 2	UC NO7	K201	202		On

Table 75: 6 Fans - DV

Circuit 1							
Description	**Output**	**Contactor**	**Fans**	**Stage**			
				1	**2**	**3**	**4**
Speed Signal 1	Modbus	n/a	101	On	On	On	On
Fan Output 3	UC NO3	K102	102			On	On
Fan Output 2	UC NO2	K101	103		On		On
Fan Output 3	UC NO3	K102	104			On	On
Circuit 2							
Description	**Output**	**Contactor**	**Fans**	**Stage**			
				1	**2**	**3**	**4**
Speed Signal 1	Modbus	n/a	201	On	On		
Fan Output 2	UC NO7	K201	202		On		

Table 76: 8 Fans - DV

Circuit 1							
Description	**Output**	**Contactor**	**Fans**	**Stage**			
				1	**2**	**3**	**4**
Speed Signal 1	Modbus	n/a	101	On	On	On	On
Fan Output 3	UC NO3	K102	102			On	On
Fan Output 2	UC NO2	K101	103		On		On
Fan Output 3	UC NO3	K102	104			On	On
Circuit 2							
Description	**Output**	**Contactor**	**Fans**	**Stage**			
				1	**2**	**3**	**4**
Speed Signal 1	Modbus	n/a	201	On	On	On	On
Fan Output 3	UC NO8	K202	202			On	On
Fan Output 2	UC NO7	K201	203		On		On
Fan Output 3	UC NO8	K202	204			On	On

Table 77: 10 Fans - DV - 4 Compressors

Circuit 1									
Description	Output	Contactor	Fans	Stage					
				1	2	3	4	5	6
Speed Signal 1	Modbus	n/a	101	On		On	On	On	On
Fan Output 4	NO6	K103	102				On	On	On
Fan Output 2	NO2	K101	103		On	On			On
Fan Output 4	NO6	K103	104				On	On	On
Fan Output 3	NO3	K102	105		On	On		On	On
Fan Output 3	NO3	K102	106				On	On	On
Circuit 2									
Description	**Output**	**Contactor**	**Fans**	**Stage**					
				1	**2**	**3**	**4**	**5**	**6**
Speed Signal 1	Modbus	n/a	201	On	On	On	On		
Fan Output 3	NO8	K202	202			On	On		
Fan Output 2	NO7	K201	203		On		On		
Fan Output 3	NO8	K202	204			On	On		

Table 78: 10 Fans - DV - 6 Compressors

Circuit 1									
Description	Output	Contactor	Fans	Stage					
				1	2	3	4	5	6
Speed Signal 1	Modbus	n/a	101	On	On	On	On	On	On
Fan Output 4	UE2 NO1	K103	102					On	On
Fan Output 2	NO2	K101	103		On		On		On
Fan Output 4	UE2 NO1	K103	104					On	On
Fan Output 3	NO3	K102	105			On	On	On	On
Fan Output 3	NO3	K102	106			On	On	On	On
Circuit 2									
Description	**Output**	**Contactor**	**Fans**	**Stage**					
				1	**2**	**3**	**4**	**5**	**6**
Speed Signal 1	Modbus	n/a	201	On	On	On	On		
Fan Output 3	UC NO8	K202	202			On	On		
Fan Output 2	UC NO7	K201	203		On		On		
Fan Output 3	UC NO8	K202	204			On	On		

Table 79: 12 Fans - DV - 4 Compressors

Circuit 1									
Description	Output	Contactor	Fans	Stage					
				1	2	3	4	5	6
Speed Signal 1	Modbus	n/a	101	On	On	On	On	On	On
Fan Output 3	UC NO6	K103	102					On	On
Fan Output 2	UC NO3	K101	103		On		On		On
Fan Output 3	UC NO6	K103	104					On	On
Fan Output 2	UC NO3	K102	105			On	On	On	On
Fan Output 3	UC NO6	K102	106			On	On	On	On
Circuit 2									
Description	**Output**	**Contactor**	**Fans**	**Stage**					
				1	**2**	**3**	**4**	**5**	**6**
Speed Signal 1	Modbus	n/a	201	On	On	On	On	On	On
Fan Output 3	UC NO11	K203	202			On	On	On	On
Fan Output 2	UC NO8	K201	203		On		On		On
Fan Output 3	UC NO11	K203	204			On	On	On	On
Fan Output 2	UC NO8	K202	205					On	On
Fan Output 3	UC NO11	K202	206					On	On

Table 80: 12 Fans - DV - 6 Compressors

Circuit 1									
Description	Output	Contactor	Fans	Stage					
				1	2	3	4	5	6
Speed Signal 1	Modbus	n/a	101	On	On	On	On	On	On
Fan Output 3	UE2 NO1	K103	102					On	On
Fan Output 2	UC NO3	K101	103		On		On		On
Fan Output 3	UE2 NO1	K103	104					On	On
Fan Output 2	UC NO3	K102	105			On	On	On	On
Fan Output 3	UE2 NO1	K102	106			On	On	On	On
Circuit 2									
Description	**Output**	**Contactor**	**Fans**	**Stage**					
				1	**2**	**3**	**4**	**5**	**6**
Speed Signal 1	Modbus	n/a	201	On	On	On	On	On	On
Fan Output 3	UE2 NO4	K203	202			On	On	On	On
Fan Output 2	UC NO8	K201	203		On		On		On
Fan Output 3	UE2 NO4	K203	204			On	On	On	On
Fan Output 2	UC NO8	K202	205					On	On
Fan Output 3	UE2 NO4	K202	206					On	On

Table 81: 14 Fans - DV

Circuit 1											
Description	Output	Contactor	Fans	Stage							
				1	2	3	4	5	6	7	8
Speed Signal 1	Modbus	n/a	101	On	On	On	On	On	On	ON	On
Fan Output 5	UE2 NO2	K104	102					On	On	On	On
Fan Output 2	UC NO2	K101	103		On		On		On		On
Fan Output 5	UE2 NO2	K104	104					On	On	On	On
Fan Output 3	UC NO3	K102	105			On	On	On	On	On	On
Fan Output 4	UE2 NO1	K103	106							On	On
Fan Output 3	UC NO3	K102	107			On	On	On	On	On	On
Fan Output 4	UE2 NO1	K103	108							On	On
Circuit 2											
Description	**Output**	**Contactor**	**Fans**	**Stage**							
				1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Speed Signal 1	Modbus	n/a	201	On	On	On	On	On	On		
Fan Output 3	UE2 NO4	K203	202			On	On	On	On		
Fan Output 2	UC NO7	K201	203		On		On		On		
Fan Output 3	UE2 NO4	K203	204			On	On	On	On		
Fan Output 2	UC NO8	K202	205					On	On		
Fan Output 3	UC NO8	K202	206					On	On		

Condenser Target

The condenser target varies for the type of condenser. The controlled variable that the condenser is targeting is the saturated condenser temperature. The controlled device in this case is condenser output, with the controlled agent being refrigerant in the condenser.

For all configurations in all conditions, the condenser target is 100°F for the first 60 seconds after starting the condenser. This has two purposes. For low ambient conditions, the circuit must build suction head pressure to achieve a successful low ambient start. During this process, if a condenser fan stages up, it will knock the suction pressure down making it more difficult to successfully start. At low ambient, the condenser target is often well below 100°F on startup (see below sections). Setting the target to 100°F forces the condenser fans to wait longer than they would otherwise wait before staging up. At high ambient, the condenser target is often well above 100°F (see below sections). With a high target, the fans may wait too long to stage up. In other words, the discharge pressure might rise to a fault level before the condenser saturated temperature reaches a value where the fans would stage up. Once the 60 second timer is complete, the target goes right to the value calculated as outlined in the sections below.

Condenser Target for AF Configurations (Fantrol)

The condenser target for AF configurations is selected based on circuit capacity using the condenser target set points. Since the AF configuration has a lower resolution for targeting a setpoint, more conservative targets are used. There are set points that establish the condenser target for part load and 100% capacity.

Load	Range
Part Load	90.0°F
Full Load	100.0°F

A minimum condenser target will also be enforced. This minimum will be calculated based on the saturated evaporator temperature and is designed to keep the compressors within their envelopes.

The 20°F is added as a buffer to make sure that even if the Tc overshoots below the target, the compressor is not in danger of leaving the envelope. The condenser target takes the maximum value of the two, the target and the lower bound Tc. This makes it so the target Tc is never outside of the compressor envelope.

Condenser Target for DV and H[X] Configurations (Variable Speed)

The condenser target for DV and H[X] configurations is selected based on circuit capacity, outdoor air temperature, and the compressor envelope for the most conservative compressor in the product line. The primary target is calculated from a curve developed for maximizing efficiency of the form:

$$Optimum\ Tc_{circuit\ x} = c_0 + c_1 * OAT + c_2 * Nominal\ Capacity_{circuit\ x}$$

$$c_0 = 25.36663, \quad c_1 = 0.92436314, \quad c_2 = 0.058656092$$

Where *Optimum* $Tc_{circuit\ x}$ is in Fahrenheit, outdoor air temperature is in Fahrenheit, and nominal capacity is in nominal horsepower calculated:

$$Nominal\ Capacity_{circuit\ x} = \sum_{Active\ Compressors} Nominal\ Horsepower_{Active\ compressors}$$

Simultaneously, using the compressor envelope of the most conservative compressor in the product line, a minimum bound for the condenser target is calculated:

$$Lower\ Bound\ Tc_{circuit\ x} = \begin{cases} 50 + 20; & Sat\ Evap\ Temp_{circuit\ x} < 32F \\ (1.2 * Sat\ Evap\ Temp_{circuit\ x}) + 11.6 + 20; & Sat\ Evap\ Temp_{circuit\ x} \geq 32F \end{cases}$$

The 20°F is added as a buffer to make sure that even if the Tc overshoots below the target, the compressor is not in danger of leaving the envelope. The condenser target takes the maximum value of the two, the optimum Tc and the lower bound Tc. This makes it so the target Tc is never outside of the compressor envelope.

The calculated condenser target is capped at a high bound of 133°F. A 133°F saturated condenser temperature correlates to a discharge pressure of about 509.4 PSI (gauge). If the discharge pressure is higher than 515 PSI (gauge), the circuit will not have room to start another compressor. When looking to stage up a compressor, capacity control monitors discharge pressure and will not stage up that circuit is the pressure is higher than 515 PSI. This cap makes it so the condenser fans will ramp to 100% output to keep the discharge pressure below 515 PSI to allow more compressors to start.

Staging Up

Regular State Up Logic

The first fan will not start until the circuit is in the run state and the stage up error has accumulated past the limit. The only exception to this is a high ambient start (special stage up case #1).

When the saturated condenser temperature is above the target plus the active deadband, stage up error is accumulated.

$$Stage\ Up\ Error\ Step = Saturated\ Condenser\ Temperature - (Target + Stage\ Up\ Deadband)$$

The Stage Up Error Step is added to a 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 the Stage Up Limit the fan stage is increased by one stage if the stage up timer has expired. If the chiller is in a low ambient condition the low ambient staging conditions must be satisfied (see low ambient starts and staging section).

Outdoor Air Temperature (°F)	< 20	20-50	50-80	80-110	>110
Stage Up Dead-band (°F)	5.0	5.0	5.0	5.0	5.0
Stage Down Deadband (°F)	30.0	23.0	29.8	19.8	15.0

The only exception to the above table is if there are no fans running on a circuit (circuit just started).

Outdoor Air Temperature (°F)	All
Stage Up Deadband (°F)	1.0
Stage Down Deadband (°F)	1.0

High Ambient Starts

When a circuit is called to start, if the saturated condenser temperature is greater than 90°F before the preopen sequence, a high ambient start is initiated.

AF and DV

In an AF or DV high ambient start, the goal is to have the first one or two fans on the circuit running at maximum capacity before the compressor is turned on. In the high ambient start logic, the stage up accumulation term is overridden and set to the limit value, triggering an immediate stage up. By triggering a regular stage up by maxing out the stage up accumulator, the logic evaluates if a “skipping first stage” case should be utilized (see section below). In most cases this results in the condenser skipping the first stage. Another feature of the high ambient start is that the PID output to the ECM fans (if applicable) is overridden and set to the maximum value. By setting the fan output to the maximum before the compressor starts, the fans have time to ramp up in time to curb the discharge pressure rise. If the outdoor air temperature is greater that 105°F, all fans are staged up immediately.

H[X]

In an H[X] high ambient start, the goal is to turn all available ECM fans on. This allows the fans to skip staging up individually and go directly to their most efficient stage for high ambient. If the outdoor air temperature is greater than 105°F, the fan speed setpoint is set to the maximum speed. Otherwise, the fan speed is set to the minimum speed. In the latter case, once at minimum speed the fans can ramp up together to the max speed if needed to hit the condenser target.

Low Ambient Starts and Staging

On units with ECM fans (DV and H[X]), if the ambient temperature is less than 50°F when the first fan is staged on, the speed command is held at the minimum for 5 seconds after staging the first fan on. This mitigates windup in the PID integrator term as the fan ramps up to its minimum speed. Since there is a delay in condenser temperature change between when the fan is activated and when it has ramped up to speed, the PID loop sees this as a need to increase output, the condenser output could overshoot the target and cause an unnecessary drop in suction pressure.

Another low ambient consideration on units with AF and DV configurations is when a sequential compressor starts and the saturated condenser temperature increases, the regular stage up logic may call an additional on/off fan to stage up. This additional fan is often too much condenser output at low temperatures and causes a compressor to stage down on low suction pressure unloading. Units with the AF and DV configurations at ambient temperatures under 30F with at least one fan already running must wait to stage up until the output term of the PID loop is greater than 90%. This allows extra time before staging up an additional fan to bring the condenser temperature back to the target area at the current stage. Even if the condenser configuration is AF, the PID loop still runs in the background, so this logic still holds true.

Skipping First Stage

- Case 1: If the circuit has 4 or more fans and OAT is at least 21.11°C (70°F) when the first condenser stage would normally be started.
- Case 2: If the circuit has an H[X] configuration and OAT is at least 10° (50°F) when the first condenser stage would normally be started.
- Case 3: If the circuit has a DV configuration and OAT is at least 65°F when the first condenser stage would normally be started.
- Case 4: If the circuit has an AF configuration and OAT is at least 100°F when the first condenser stage would normally be started.

Additional Stage Up Triggers

- Trigger 1: If the stage up timer has not expired but:
  - The saturated condenser temperature is greater than 134°F
  - The saturated condenser temperature is rising
  - 5 seconds have passed since the previous stage up

Staging Down

Regular State Up Logic

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

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

The Stage Down Error Step is added to Stage Down Accumulator once every 5 seconds. When the Stage Down Error Accumulator is greater than the Stage Down Limit the fan stage is decreased by one stage if the stage down timer has expired.

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.

The stage down timer is 60 seconds divided by the number of fans on the circuit. The stage down deadband and limit do not vary with conditions:

Outdoor Air Temperature (°F)	All
Stage Down Deadband (°F)	5.0
Stage Down Limit (°F)	6.0

Variable Speed Fan Control

Condenser configurations of DV and H[X] have variable speed fan control.

Speed Setpoint Calculations

The speed command is calculated using a PID loop targeting the condenser saturated temperature target. The control loop monitors condenser temperature slope, and if the temperature is moving toward the target at a fast enough rate, the PID loop will be frozen to allow the change in temperature to stabilize before changing fan speed again. If a circuit has more than one variable speed fan, all variable speed fans on the circuit are run at the same speed.

Staging Compensation

To create a smoother transition when the condenser stages up, the speed command compensates by slowing down initially. This is accomplished by setting the speed command to the minimum speed when a fan is stages up, and the maximum speed when a fan is staged down. After the fan speed is changed the PID loop takes over again.

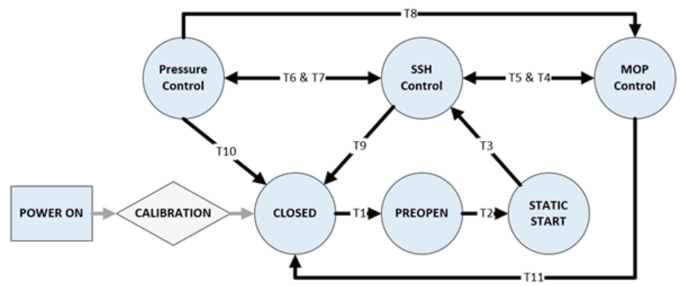
EXV Control

EXV control has three distinct run time modes. Under normal conditions, the EXV targets SSH. When the evaporator pressure is too low for the condition, the EXV switches to Pressure Control where it targets a higher pressure. If the evaporator pressure is too high for the condition, for example high LWT, the EXV targets just below the maximum operating pressure of the evaporator to avoid a dangerous condition. In SSH mode blends into the other two modes for a smooth transition between states.

Table 82: EXV Control States

EXV Control State	Description
Closed	EXV is closing or in the closed position
Preopen	EXV is opening prior to compressor start
Static Start	EXV constricts flow 5% less than preopen position to build a liquid seal
Pressure Control	EXV is controlling to evaporator pressure target in low pressure situation
MOP Control	EXV is controlling to evaporator MOP target in high pressure situation
SSH Control	EXV is controlling to suction superheat target in a normal situation

Figure 38: EXV Control Transitions



T1 – Closed to Preopen

All of the following are required:

- Circuit State = Start

T2 – Preopen to Static Start

Any of the following are required:

- Liquid Line Solenoid = Engaged
- EXV Position = Preopen Position
- Ten second Preopen timer has expired

T3 – Static Start to SSH Control

All of the following are required:

- EXV Position = Preopen Position – 5.0 %
- Fifteen second Static Start timer has expired

T4 – SSH Control to MOP Control

All of the following are required:

- Evaporator Pressure > (Evaporator Maximum Operating Pressure Setpoint – 10.0 PSI)

T5 – MOP Control to SSH Control

All of the following are required:

- Evaporator Pressure < (Evaporator Maximum Operating Pressure Setpoint – 10.0 PSI)
- Two minute maximum operating pressure control timer has expired

T6 – SSH Control to Pressure Control

All of the following are required:

- Evaporator Pressure < (Evaporator Pressure Control Target – 25.0 PSI)
- One minute suction superheat control timer has expired

T7 – Pressure Control to SSH Control

All of the following are required:

- Evaporator Pressure > Evaporator Pressure Hold Setpoint
- Thirty second pressure control timer has expired
- The slope of the evaporator delta T is within plus or minus two degrees per minute
- Or Any of the following are required:
- Suction Superheat < 5°F

T8 – Pressure Control to MOP Control

All of the following are required:

- Evaporator Pressure > Evaporator Pressure Hold Setpoint
- Evaporator Pressure > (Evaporator Maximum Operating Pressure Setpoint – 10.0 PSI)

T9 – SSH Control to Closed

All of the following are required:

- Circuit State is not Start
- Circuit State is not Run

T10 – Pressure Control to Closed

All of the following are required:

- Circuit State is not Start
- Circuit State is not Run

T11 – MOP Control to Closed

All of the following are required:

- Circuit State is not Start
- Circuit State is not Run

Preopen Position Calculations

The preopen position of the EXV depends on the expected mass flow at the start of the system. The factors that affect mass flow the greatest are outdoor ambient temperature and starting entering water temperature. The function takes these two parameters as inputs and returns a preopen position.

- Preopen Position Range: 20-30% (Large EXV), 35-45% (Small EXV)
- Outdoor Ambient Temperature Range (OAT): 60-90F
- Starting Entering Water Temperature Range (EWT): 60-100F

Take the higher of the two.

For the Larger EXV:

$$Preopen\%_{OAT} = 20\% + \frac{OAT - 60F}{3}$$

$$Preopen\%_{EWT} = 20\% + \frac{EWT - 60F}{4}$$

For the Smaller EXV:

$$Preopen\%_{OAT} = 35\% + \frac{OAT - 60F}{3}$$

$$Preopen\%_{EWT} = 35\% + \frac{EWT - 60F}{4}$$

If the calculation returns a value outside of the EXV preopen range, the closest value inside of the range will be taken. This ensures the preopen position is always inside of the range.

Control Error Calculations

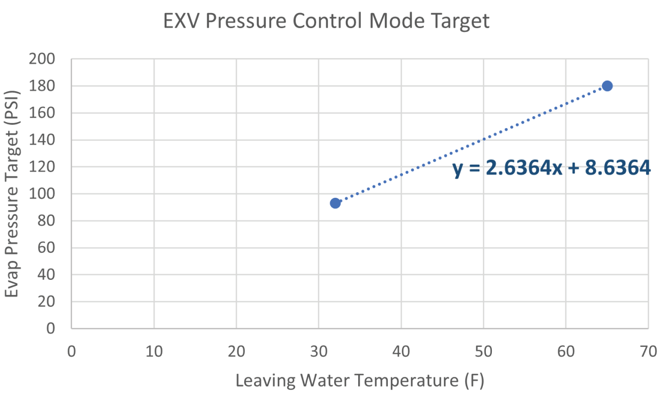
Regardless of the EXV control state, control error calculations are made for Pressure Control, SSH Control, and MOP Control. The error equation is as follows:

$$error = target\ setpoint - measured\ feedback$$

Pressure Control Target

The pressure control target setpoint is dynamic and depends on leaving water temperature. Bounds: high range: 65°F, 180 PSI low range: 32°F, 93 PSI.

Figure 39: Pressure Control Target



Maximum Operating Pressure Control Target

The maximum operating pressure control target is always the maximum operating pressure setpoint – 10 PSI.

Suction Superheat Control Target

The suction superheat control target is set via the HMI by the end user/technician. Valid targets are around 5°F to 15°F.

Position Change Calculations

Regardless of the EXV control state, position change calculations are made for Pressure Control, SSH Control, and MOP Control. The current EXV control state determines which position change is applied.

The control states, Pressure Control, SSH Control, and MOP Control, each have their own independent PID loops. The output of these loops is calculated every program cycle for use in control state transitions. In addition to proportional, integral, and derivative gains, there are a couple of additional features to increase stability. There is a small SSH dead band to allow the SSH to settle close to the setpoint in the case of the EXV resolution being too large to match the target precisely under the circumstances. For SSH and pressure control, there is a slope locking feature that will lock the EXV in position while the measured value is moving towards the setpoint at a certain rate. This helps prevent unstable overshoot. Below is an illustration showing the EXV control modes.

Figure 40: EXV Control Modes

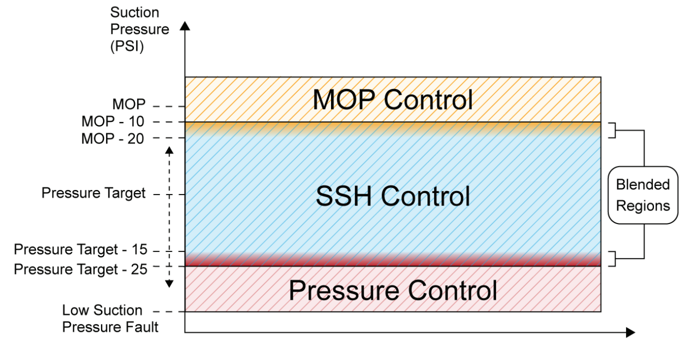
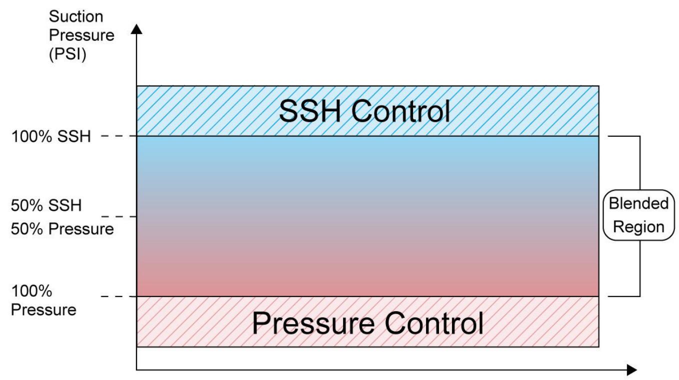


Figure 41: Close up of Blended Region



NOTICE
Blended transitions between EXV modes help with stability.

Liquid Line Solenoid

The liquid line solenoid is activated when the circuit state is in either the START or RUN states. This output should be off at all other times.

Hot Gas Bypass Solenoid

A hot gas bypass solenoid is only activated when there is one compressor running on the entire unit. The circuit that is running activates its hot gas bypass solenoid. The hot gas bypass solenoid is only activated if the leaving water temperature is two degrees above the leaving water temperature target or less. If additional compressors are staged on or the chiller is shut off the hot gas bypass valve will immediately deactivate.

Capacity Overrides - Limit 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 events are triggered, the circuit capacity may be limited or reduced.

High Condenser Pressure

If the High Condenser Pressure Unload event is triggered, the circuit capacity may be limited or reduced.

High Transformer Temperature

On unit equipped with a transformer, if the ambient temperature inside of the transformer housing reaches a value greater than the setpoint, unit capacity may be limited or reduced.

Alarm and Events

Alarm Digital Output

The alarm digital output will be operated based on active alarm scenarios as shown in the table below.

State	Scenario
Off	No alarms preventing the chiller or an individual circuit from running
On	A fault is preventing the chiller or either circuit from running

List and Logs

Active Alarms List

All alarms appear in the active alarm list while active. This active alarm list is accessed by pressing the alarm icon at the top right of the HMI. The alarm icon will flash when there are alarms active. The alarm list will display the six highest priority alarms. The format of the entries in this list is found in the User Interface section of this document where the layout and format of the screens is specified.

Alarm Log

All alarms are added to the alarm log when triggered. This alarm log will be found on the 'Alarm Log' screen. This log can be downloaded as a CSV file through the 'Trend' page.

The format of the entries in this list is found in the User Interface section of this document where the layout and format of the screens is specified.

Event Log

The event log should be set up and behave in a way similar to the alarm log.

Sort order should be based on time and date, most recent first in the log. All events will be added to the event log when triggered.

Alarms

Unit Alarms Summary

This table lists all the unit alarms. For further details about each alarm, see the following sections. For details on auto clear see the section below.

Table 83: Unit Alarm Summary

No.	Unit Alarm	Type	Action	Manual Clear
1	Unit PVM/GFP Fault	Fault	Unit Shut-down	Controller HMI or BAS
2	Evaporator Flow Loss	Fault	Unit Shut-down	Controller HMI or BAS
3	Evaporator Water Freeze Protect	Fault	Unit Shut-down	Controller HMI or BAS
4	Evaporator LWT Sensor Fault	Fault	Unit Shut-down	Controller HMI or BAS
5	Evaporator EWT Sensor Fault	Warning	None	n/a
6	OAT Sensor Fault	Fault	Unit Shut-down	Controller HMI or BAS
7	External Alarm	Warning	Unit Shut-down	n/a
8	Evaporator Pump #1 Failure	Problem	Backup pump is used	Controller HMI or BAS
9	Evaporator Pump #2 Failure	Problem	Backup pump is used	Controller HMI or BAS
10	External Event	Fault	Unit Shut-down	Controller HMI or BAS
11	Bad Demand Limit Input	Warning	Demand Limit Ig-nored	n/a
12	Bad LWT Reset Input	Warning	LWT Reset Ignored	n/a
13	Transformer Overtemperature Fault	Fault	Unit Shut-down	Controller HMI or BAS
14	Transformer Temp Sensor Error	Problem	Transform-er Unload Ignored	Controller HMI or BAS
15	Peripheral Mod-ule Comm Failure	Fault	Unit Shut-down	Controller HMI or BAS

Circuit Alarm Summary

This table lists all the circuit alarms, which will exist for each circuit. For further details about each alarm, see the following sections.

Table 84: Circuit Alarm Summary

No.	Unit Alarm	Type	Action	Manual Clear
1	Circuit PVM/GFP Fault	Fault	Circuit Shutdown	Controller HMI or BAS
2	Low Evaporator Pressure	Fault	Circuit Shutdown	Controller HMI or BAS
3	High Condenser Pressure	Fault	Circuit Shutdown	Controller HMI or BAS
5	Mechanical High Pressure Switch	Fault	Circuit Shutdown	Controller HMI or BAS
6	Mechanical Low Pressure Switch	Fault	Circuit Shutdown	Controller HMI or BAS
7	Motor Protection Fault	Fault	Circuit Shutdown	Controller HMI or BAS
8	Low OAT Restart Fault	Fault	Circuit Shutdown	Controller HMI or BAS
9	No Pressure Change After Start	Fault	Circuit Shutdown	Controller HMI or BAS
10	Low Suction SH Fault	Fault	Circuit Shutdown	Controller HMI or BAS
11	Low Condenser Sat. Temperature	Fault	Circuit Shutdown	Controller HMI or BAS
12	Evaporator Pressure Sensor Fault	Fault	Circuit Shutdown	Controller HMI or BAS
13	Condenser Pressure Sensor Fault	Fault	Circuit Shutdown	Controller HMI or BAS
14	Suction Temperature Sensor Fault	Fault	Circuit Shutdown	Controller HMI or BAS
15	Discharge Temperature Sensor Fault	Fault	Circuit Shutdown	Controller HMI or BAS
16	High Discharge Temperature	Fault	Circuit Shutdown	Controller HMI or BAS
17	EEXV Module Comm Failure	Fault	Circuit Shutdown	Controller HMI or BAS
18	DC Fan Fault	Problem	Ignore Affected Fan	Controller HMI or BAS

Alarm Detail Explanation

Details for each alarm are listed in a table format as shown below. The table below briefly explains each row in the tables.

Alarm	Description of Alarm			
Type	Category the alarm should be configured as per the GCP (fault/problem/warning).			
Display Text	Text to be displayed on HMI in the alarm lists.			
Alarm Parts	Alarm message parts that should be generated for the alarm per the GCP.			
	Message Code	Module Type	Module ID	Payload
	GCP Alarm Index	Reference Table Below	ID Corresponding to Module Type	Additional Alarm Information
Alarm Code	Alarm code that should be generated for the alarm per the GCP.			
Trigger	Conditions required to trigger the alarm.			
Action Taken	Actions that should be taken when the alarm triggers.			
Reset	Conditions required for clearing. Method for clearing defined in the auto clear section below.			

Module Type Information

#	Module Type	Associated Module IDs	Associated Payloads
1	Unit	“0”: Unit	“0”: “None”
3	Fans	“11”: Fan 1 on Circuit 1, “12”: Fan 2 on Circuit 1, “13”: Fan 3 on Circuit 1, “14”: Fan 4 on Circuit 1, “15”: Fan 5 on Circuit 1, “16”: Fan 6 on Circuit 1, “17”: Fan 7 on Circuit 1, “18”: Fan 8 on Circuit 1, “21”: Fan 1 on Circuit 2, “22”: Fan 2 on Circuit 2, “23”: Fan 3 on Circuit 2, “24”: Fan 4 on Circuit 2, “25”: Fan 5 on Circuit 2, “26”: Fan 6 on Circuit 2	“0”: “Modbus Communication Error”, “1”: “Short Circuit Fault”, “2”: “Motor Stalled Fault”, “3”: “Module NTC Fault”, “4”: “Module Over Temp Fault”, “5”: “Bus Over Voltage Fault”, “6”: “Bus Low Voltage Fault”, “7”: “Output Phase Lost Fault”, “8”: “Input Phase Lost Fault”, “9”: “Overload Fault”, “10”: “Comm Fail Fault”, “11”: “Bus Unbalance Fault”, “12”: “AC Low Fault”, “13”: “AC High Fault”, “14”: “External Fault”, “15”: “EEPROM Fault”, “16”: “Inner Comm Fault”,
4	cpCOe Expansion Module	“1”: Expansion Module – Sensor Box (UE01)	“0”: “None”
5	Sensor	“0”: Unit, “1”: Circuit 1, “2”: Circuit 2	“0”: “None”

#	Module Type	Associated Module IDs	Associated Payloads
6	EXV	"0": Dual EXV Driver, "1": Circuit 1 EXV, "2": Circuit 2 EXV	"0": "None"
7	BAS Expansion Module	"0": Expansion Module – Main Box (UE02)	"0": "None"
8	Circuit	"1": Circuit 1, "2": Circuit 2	"0": "None", "1": "Ground Fault Monitor", "2": "Phase Voltage Monitor"
100	PC	"0":Unit	"0":"None"

PVM/GFP Fault

Alarm	PVM/GFP Fault			
Type	Fault			
Displayed Text	PVM/GFP Fault			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	228	1	0	1
Alarm Code	3825270785			
Trigger	Alarm is trigged if all of the following are true for at least one second: -Power Configuration = Single Point -PVM/GFP Input #1 is off			
Action Taken	Shutdown all circuits and lock out unit from running			
Reset	Reset when input is on for at least 5 seconds or if Power Configuration = Multi Point			

Evaporator Flow Loss

Alarm	Evaporator Flow Loss			
Type	Fault			
Displayed Text	Evaporator Flow Loss			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	150	1	0	0
Alarm Code	2516647936			
Trigger	1: Evaporator Pump State = Run AND Evaporator Flow input is off 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 input is off			
Action Taken	Shutdown all circuits and lock out unit from running			
Reset	Alarm trigger no longer exists			

Evaporator Water Freeze Protect

Alarm	Evaporator Water Freez Protect			
Type	Fault			
Displayed Text	Evaporator Water Freeze Protect			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	151	1	0	0
Alarm Code	2533425152			
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	Shutdown all circuits and lock out unit from running			
Reset	Alarm trigger no longer exists – Cannot be auto cleared			

Evaporator LWT Sensor Fault

Alarm	Evaporator LWT Sensor Fault			
Type	Warning			
Displayed Text	Evaporator LWT Sensor Fault			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	162	5	0	0
Alarm Code	2718236672			
Trigger	Trigger any time sensor status is other than "10" and UC01 communication with UE01 module is OK, for at least one second			
Action Taken	Shutdown all circuits and lock out unit from running			
Reset	Sensor status returns to "10"			

Evaporator EWT Sensor Fault

Alarm	Evaporator EWT Sensor Fault			
Type	Warning			
Displayed Text	Evaporator Water Freeze Protect			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	2	5	0	0
Alarm Code	33882112			
Trigger	Trigger any time sensor status is other than "10" and UC01 communication with UE01 module is OK, for at least one second			
Action Taken	Ignore sensor value in applicable calculations			
Reset	Sensor status returns to "10"			

OAT Sensor Fault

Alarm	OAT Sensor Fault			
Type	Warning			
Displayed Text	OAT Sensor Fault			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	128	5	0	0
Alarm Code	2147811328			
Trigger	Trigger any time sensor status is other than “10” and UC01 communication with UE01 module is OK, for at least one second			
Action Taken	Shutdown all circuits and lock out unit from running			
Reset	Sensor status returns to “10”			

External Alarm

Alarm	External Alarm			
Type	Fault			
Displayed Text	External Alarm			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	194	1	0	0
Alarm Code	3254845440			
Trigger	External Alarm/Event input is off for at least 5 seconds and external fault input is configured as a fault			
Action Taken	Shutdown all circuits and lock out unit from running			
Reset	Alarm trigger no longer exists			

Evaporator Pump #1 Failure

Alarm	Evaporator Pump #1 Failure			
Type	Fault			
Displayed Text	Evaporator Pump #1 Failure			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	81	1	0	0
Alarm Code	1359020032			
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 controller HMI or BAS command			

Evaporator Pump #2 Failure

Alarm	Evaporator Pump #2 Failure			
Type	Fault			
Displayed Text	Evaporator Pump #2 Failure			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	81	1	0	0
Alarm Code	1375797248			
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 controller HMI or BAS command			

External Event

Alarm	External Event			
Type	Fault			
Displayed Text	External Event			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	13	1	0	0
Alarm Code	218169344			
Trigger	External Alarm/Event input is off for at least 5 seconds and external fault input is configured as a warning			
Action Taken	None			

Bad Demand Limit Input

Alarm	Bad Demand Limit Input			
Type	Warning			
Displayed Text	Bad Demand Limit Input			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	9	1	0	0
Alarm Code	151060480			
Trigger	Demand limit input out of range and Demand Limit set point is set to On. For this alarm out of range is considered to be a signal less than 3mA or more than 21mA			
Action Taken	Demand limit function and signal are ignored			
Reset	Demand Limit set point is set to Off or demand limit input back in range for 5 seconds			

Bad LWT Reset Input

Alarm	**Bad LWT Reset Input**			
Type	Warning			
Displayed Text	Bad LWT Reset Input			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	8	1	0	0
Alarm Code	134283264			
Trigger	LWT Reset is enabled and LWT reset input out of range. For this alarm out of range is considered to be a signal less than 3mA or more than 21mA			
Action Taken	LWT reset signal and function are ignored			
Reset	LWT Reset Type set point is not 4-20mA or LWT reset input back in range for 5 seconds			

Low OAT Lockout

Alarm	**Low OAT Lockout**			
Type	Warning			
Displayed Text	Low OAT Lockout			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	65	1	0	0
Alarm Code	1090584576			
Trigger	Low OAT Lockout is active and BAS Alert setpoint is enabled			
Action Taken	Specified in Low OAT Lockout Section			
Reset	Alarm trigger no longer exists			

Transformer Overtemperature Fault

Alarm	Transformer Overtemperature Fault			
Type	Fault			
Displayed Text	Transformer Overtemperature Fault			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	247	1	0	0
Alarm Code	4144037888			
Trigger	The unit is configured with a transformer and the transformer over-temperature input is off			
Action Taken	Shutdown all circuits and lock out unit from running			
Reset	Alarm trigger no longer exists, or the unit is reconfigured to not have a transformer			

Transformer Temperature Sensor Error

Alarm	Transformer Temperature Sensor Error			
Type	Fault			
Displayed Text	Transformer Temperature Sensor Error			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	246	5	0	0
Alarm Code	4127522816			
Trigger	The unit is configured with a transformer and the sensor status is other than “10” and UC01 communication with UE01 module is OK, for at least one second			
Action Taken	Ignore transformer unload logic			
Reset:	Sensor status returns to “10”, or the unit is reconfigured to not have a transformer			

Peripheral Module Comm Failure

Alarm	Peripheral Module Comm Failure			
Type	Fault			
Displayed Text	Peripheral Module Comm Failure			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	188	4,6,7	0	0
Alarm Code	Expansion Module – Sensor Box: 3154380800 Expansion Module – Main Box: 3154575360 Dual EXV Driver: 3154509824			
Trigger	Modbus communication is lost with any of the above modules, only if applicable to current configuration			
Action Taken	Shutdown all circuits and lock out unit from running			
Reset	Alarm trigger no longer exists, or the unit is reconfigured to not the affected module			

Circuit Alarms

PVM/FFP Fault

Alarm	PVM/FFP Fault			
Type	Fault			
Displayed Text	PVM/FFP Fault			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	228	8	1,2	1,2
Alarm Code	Circuit 1 GFM: 3825730561 Circuit 2 GFM: 3825731585 Circuit 1 PVM: 3825730562 Circuit 2 PVM: 3825731586			
Trigger	[Power Configuration = Multi Point and PVM/GFP input is off] for longer than one second			
Action Taken	Shutdown circuit and lock circuit out from running			
Reset	PVM/GFP input is on for at least 5 seconds or if Power Configuration = Single Point			

Mechanical High Pressure Switch

Alarm	Mechanical High Pressure Switch			
Type	Fault			
Displayed Text	Mechanical High Pressure Switch			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	166	8	1,2	0
Alarm Code	Circuit 1: 2785543168 Circuit 2: 2785544192			
Trigger	Mechanical High Pressure switch input is off for longer than one second			
Action Taken	Shutdown circuit and lock circuit out from running			
Reset	Alarm trigger no longer exists– Cannot be auto cleared			

Mechanical Low Pressure Switch

Alarm	Mechanical Low Pressure Switch			
Type	Fault			
Displayed Text	Mechanical Low Pressure Switch			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	186	8	1,2	0
Alarm Code	Circuit 1: 3121087488 Circuit 2: 3121088512			
Trigger	Mechanical Low Pressure switch input is off for longer than 40 seconds and the circuit state is run. This alarm requires Evaporator configuration = Remote Evap to trigger			
Action Taken	Shutdown circuit and lock circuit out from running			
Reset	Alarm trigger no longer exists – Cannot be auto cleared			

Low Evaporator Pressure

Alarm	Low Evaporator Pressure			
Type	Fault			
Displayed Text	Low Evaporator Pressure			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	153	8	1,2	0
Alarm Code	Circuit 1: 2567439360 Circuit 2: 2567440384			
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 Pressure < Low Evaporator Pressure Fault setpoint and Circuit State = Run] for longer than one 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 shell and tube type evaporator: 80 – (freeze error/6.895), limited to a range of 40 to 80 seconds • For units with plate frame 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	Shutdown circuit and lock circuit out from running			
Reset	Evaporator Pressure > Low Evaporator Pressure Fault setpoint			

High Condenser Pressure

Alarm	High Condenser Pressure			
Type	Fault			
Displayed Text	High Condenser Pressure			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	145	8	1,2	0
Alarm Code	Circuit 1: 2433221632 Circuit 2: 2433222656			
Trigger	Condenser Pressure > High Condenser Pressure Fault setpoint for longer than one second			
Action Taken	Shutdown circuit and lock circuit out from running			
Reset	If the Condenser Pressure < High Condenser Pressure Fault setpoint			

High Discharge Temperature

Alarm	High Discharge Temperature			
Type	Fault			
Displayed Text	High Discharge Temperature			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	148	8	1,2	0
Alarm Code	Circuit 1: 2483553280 Circuit 2: 2483554304			
Trigger	Discharge Temperature > High Discharge Temperature Fault setpoint for longer than one second			
Action Taken	Shutdown circuit and lock circuit out from running			
Reset	If the Discharge Temperature < High Discharge Temperature Fault setpoint			

Motor Protection Fault

Alarm	Motor Protection Fault			
Type	Fault			
Displayed Text	Motor Protection Fault			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	133	8	1,2	0
Alarm Code	Circuit 1: 2231895040 Circuit 2: 2231896064			
Trigger	[Motor Protection input is off and power up start delay is not active] for longer than one second			
Action Taken	Shutdown circuit and lock circuit out from running			
Reset	Motor Protection input is on			

Low OAT Restart Fault

Alarm	Low OAT Restart Fault			
Type	Fault			
Displayed Text	Low OAT Restart Fault			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	161	8	1,2	0
Alarm Code	Circuit 1: 2701657088 Circuit 2: 2701658112			
Trigger	Circuit has failed three low OAT start attempts			
Action Taken	Shutdown circuit and lock circuit out from running			
Reset	This alarm can be cleared manually via the controller HMI or via BAS command, or auto cleared as outlined in the section below			

No Pressure Change After Startup

Alarm	No Pressure Change After Start			
Type	Fault			
Displayed Text	No Pressure Change After Start			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	189	8	1,2	0
Alarm Code	Circuit 1: 3171419136 Circuit 2: 3171420160			
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			
Action Taken	Shutdown circuit and lock circuit out from running			
Reset	This alarm can be cleared manually via the controller HMI or via BAS command, or auto cleared as outlined in the section below			

Low Suction SH Fault

Alarm	Low Suction SH Fault			
Type	Fault			
Displayed Text	Low Suction SH Fault			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	219	8	1,2	0
Alarm Code	Circuit 1: 3674735616 Circuit 2: 3674736640			
Trigger	SSH < 3F for 5 minutes consecutive.			
Action Taken	Shutdown circuit and lock circuit out from running for 30 minutes			
Reset	This alarm can be cleared manually via the controller HMI or via BAS command, or auto cleared as outlined in the section below once the 30-minute timer has expired			

Low Condenser Sat. Temperature

Alarm	Low Condenser Sat. Temperature			
Type	Fault			
Displayed Text	Low Condenser Sat. Temperature			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	155	8	1,2	0
Alarm Code	Circuit 1: 3691512832 Circuit 2: 3691513856			
Trigger	Condenser Sat. Temperature is less than the limit for 5 consecutive minutes, where the limit is defined as:			
	Evaporator Sat. Temperature <= 30°F		**Evaporator Sat. Temperature > 30°F**	
	Limit = 50°F		Limit = (1.2 * Evaporator Sat. Temperature) + 11.6 (all in °F)	
Action Taken	Shutdown circuit and lock circuit out from running for 60 minutes.			
Reset	This alarm can be cleared manually via the controller HMI or via BAS command, or auto cleared as outlined in the section below once the 60-minute timer has expired			

Evaporator Pressure Sensor Fault

Alarm	Evaporator Pressure Sensor Fault			
Type	Fault			
Displayed Text	Evaporator Pressure Sensor Fault			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	155	5	1,2	0
Alarm Code	Circuit 1: 2600797184 Circuit 2: 2600798208			
Trigger	Trigger any time sensor status is other than “10” and UC01 communication with UE01 module is OK, for at least one second			
Action Taken	Shutdown circuit and lock circuit out from running			
Reset	Sensor status returns to “10”			

Condenser Pressure Sensor Fault

Alarm	Condenser Pressure Sensor Fault			
Type	Fault			
Displayed Text	Condenser Pressure Sensor Fault			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	142	5	1,2	0
Alarm Code	Circuit 1: 2382693376 Circuit 2: 2382694400			
Trigger	Trigger any time sensor status is other than “10” and UC01 communication with UE01 module is OK, for at least one second			
Action Taken	Shutdown circuit and lock circuit out from running			
Reset	Sensor status returns to “10”			

Discharge Temperature Sensor Fault

Alarm	Discharge Temperature Sensor Fault			
Type	Fault			
Displayed Text	Discharge Temperature Sensor Fault			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	147	5	1,2	0
Alarm Code	Circuit 1: 2466579456 Circuit 2: 2466580480			
Trigger	Trigger any time sensor status is other than “10” and UC01 communication with UE01 module is OK, for at least one second.			
Action Taken	Shutdown circuit and lock circuit out from running			
Reset	Sensor status returns to “10”			

Suction Temperature Sensor Fault

Alarm	Suction Temperature Sensor Fault			
Type	Fault			
Displayed Text	Suction Temperature Sensor Fault			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	183	5	1,2	0
Alarm Code	Circuit 1: 3070559232 Circuit 2: 3070560256			
Trigger	Trigger any time sensor status is other than “10” and UC01 communication with UE01 module is OK, for at least one second			
Action Taken	Shutdown circuit and lock circuit out from running			
Reset	Sensor status returns to “10”			

Evaporator EXV Module Communication Faults

Alarm	Evaporator EXV Module Communications Fault			
Type	Fault			
Displayed Text	Evap EXV Module Communications Fault			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	32	6	1,2	0
Alarm Code	Circuit 1: 537265152 Circuit 2: 537266176			
Trigger	Trigger any time EXV connection status is false and UC01 communication with Dual EXV Driver module is OK, for at least one second.			
Action Taken	Shutdown circuit and lock circuit out from running			
Reset	Sensor status returns to good			

DC Fan Fault

Alarm	**DC Fan Fault**			
Type	Problem			
Displayed Text	DC Fan Fault			
Alarm Parts	**Message Code**	**Module Type**	**Module ID**	**Payload**
	33	3	See Module Type Table Above	See Module Type Table Above
Alarm Code	Generated on a case-by-case basis			
Trigger	Triggered when a DC fan reports an alarm			
Action Taken	Ignore affected fan in condenser staging logic			
Reset	DC fan reports alarm is cleared			

Auto Clearing Alarms

Alarm auto-clearing only occurs if there are no alarms present that cannot be auto cleared. Alarms that cannot be auto cleared are noted in the alarm descriptions above.

The auto clearing process is equivalent to if the user manually cleared the alarms from the HMI or sent the clear alarms command via the BAS system.

A successful auto-clear means all alarms have been cleared.

The first successful auto-clear starts an hour-long timer, while the timer is active, no more than 3 successful auto-clears can occur. After the third successful auto-clear, there will be no more attempts until the timer expires.

Events

The following table lists all the events. For further details about each event, see the following sections.

Table 85: Events

Event	**Text for Selection Set Point**	**Level**	**Action**
Low Evaporator Pressure Hold	Low Pressure Hold	Circuit	Inhibit capacity increase
Low Evaporator Pressure Unload	Low Pressure Unload	Circuit	Reduce capacity
High Condenser Pressure Unload	High Pressure Unload	Circuit	Reduce capacity

Event Detail Explanation

Event	**Description of the event**
Displayed Text	Text to be displayed in the event log
Trigger	Conditions required to trigger the event
Action Taken	Action that should be taken when the event triggers and while active
Reset	Conditions for the event to reset

Circuit Events

The events in this section exist for both circuit one and circuit two.

Low Evaporator Pressure - Hold

Alarm	**Low Evaporator Pressure - Hold**
Displayed Text	Cn Low Evap Pr 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 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.

Low Evaporator Pressure - Unload

Alarm	Low Evaporator Pressure - Unload
Displayed Text	Cn Low Evap Pr Unld
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
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.

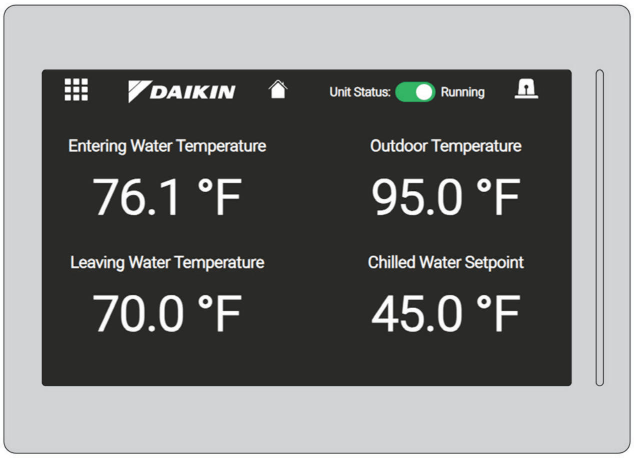
High Condenser Pressure - Unload

Alarm	High Condenser Pressure – Unload
Displayed Text	Cn High Cond Pr Unld
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.

Touchscreen Controller

Home Screen

Figure 42: Home Screen



When power is applied to the control circuit, the controller screen will be active. Tap the touchscreen to display the Home screen. From the home screen you can see the status of the unit as well as key temperature readings.

Press the Home Screen icon at the top of the screen to return to this page at any time.

Login Screen

Figure 43: Login Screen

There are 4 levels of access for the user interface:

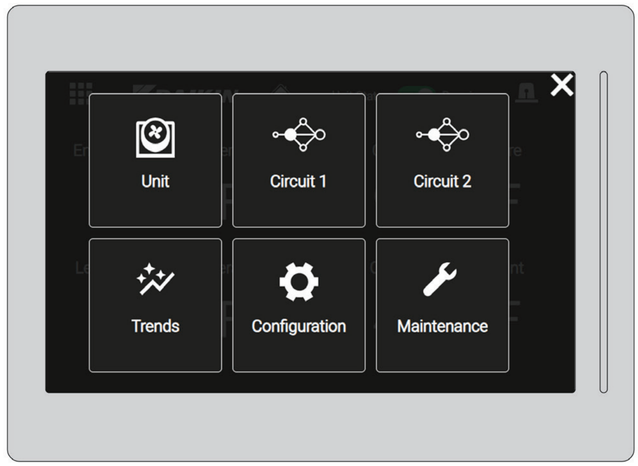
- No password
- Operator level - 5321
- Technician/Manager level - 2526
- Daikin Applied service technician level

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 Menu

Figure 44: Navigation Menu



Tap the Navigation Menu icon in the upper left corner of the display screen to access the Navigation Menu.

From the Navigation Menu you can select the following options:

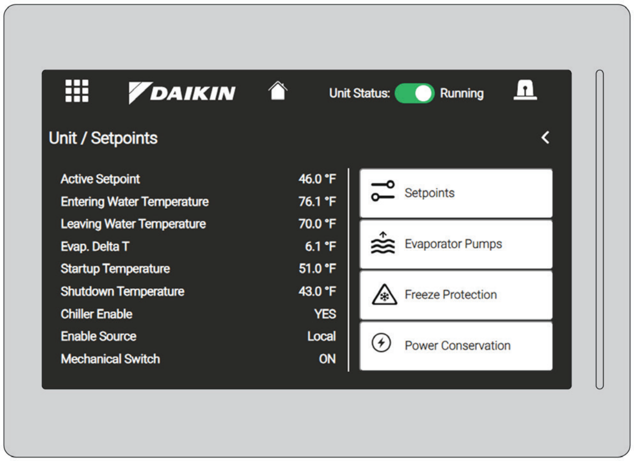
- Unit
- Circuit 1
- Circuit 2
- Trends
- Configuration
- Maintenance

To close the Navigation Menu, tap the “X” in the upper right corner of the display screen.

Unit/Setpoints

The Unit Home screen displays important information about the unit, including the active setpoint, entering water temperature, startup temperature, and more.

Figure 45: Unit Home Screen



From the Unit screen you can view and modify the following settings:

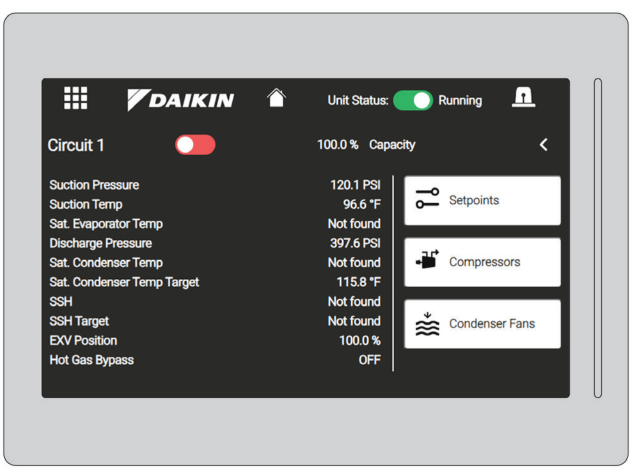
- Setpoints
- Evaporator Pumps
- Freeze Protection
- Power Conservation

Circuit 1/Circuit 2

From the Circuit 1 and Circuit 2 screens you can view key information for each circuit and access the following settings:

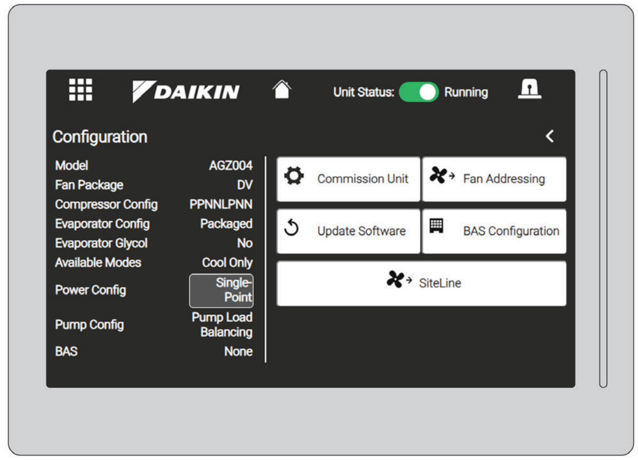
- Setpoints
- Compressors
- Condenser Fans

Figure 46: Circuit Screen



Configuration

Figure 47: Configuration Screen

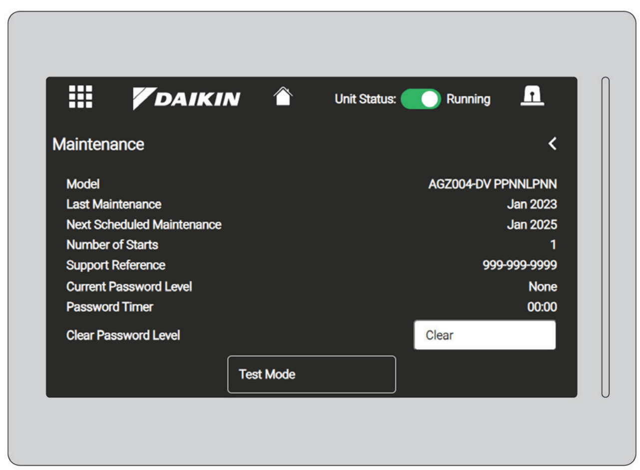


Use the Configuration screen to properly setup and configure the unit. From the Configuration screen you can perform the following actions:

- Commission Unit
- Fan Addressing
- Update Software
- Configure BAS
- Setup SiteLine

Maintenance

Figure 48: Maintenance Screen



Navigate to the Maintenance screen to view maintenance information about the unit, such as model number, last maintenance date, next scheduled maintenance date, and to access test mode.

Startup/Shutdown Procedures

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 on page 101 and return to Daikin Applied prior to startup date.

⚠ CAUTION

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

⚠ CAUTION

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

Startup Checkout

1. Verify chilled water piping requirements from page 49 are met.
2. Check the pump operation and vent all air from the system.
3. Circulate evaporator water, checking for proper system pressure and evaporator pressure drop. Compare the pressure drop to the evaporator water pressure drop curve.
4. Flush System and clean all water strainers before placing the chiller into service.
5. Check water treatment and proper glycol percentage by volume, if used.
6. Check all exposed brazed joints for evidence of leaks. Joints may have been damaged during shipping or when the unit was installed.
7. Check that all refrigerant valves are either opened or closed as required for proper operation of the chiller.
8. A thorough leak test must be done using an electronic leak detector. Check all valve stem packing for leaks. Replace all refrigerant valve caps and tighten.
9. Check all refrigerant lines to insure that they will not vibrate against each other or against other chiller components and are properly supported.
10. Check all connections and all refrigerant threaded connectors.
11. Look for any signs of refrigerant leaks around the condenser coils and for damage during shipping or installation.
12. Connect refrigerant service gauges to each refrigerant circuit before starting unit.

Startup Electrical Check Out

⚠ DANGER

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

⚠ WARNING

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

1. Open all electrical disconnects and check all power wiring connections. Start at the power block and systematically check all connections through all components to and including the compressor terminals. These should be checked again after 3 months of operation and at least yearly thereafter.
2. Check all control wiring by pulling on the wire at connections and tighten all screw connections. Check plug-in relays for proper seating and to insure retaining clips are installed.
3. 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.
4. Check at the power block or disconnect for the proper voltage between phases. Check power for proper phasing using a phase sequence meter before starting unit.
5. Check for 120 Vac at the control transformer and at TB-2 terminal #1 and the neutral block (NB).
6. Check between TB-2 terminal #7 and NB for 120 Vac supply for transformer #2.
7. Check between TB-2 terminal #2 and NB for 120 Vac control voltage. This supplies the compressor crank case heaters.
8. Check between TB-3 terminal #17 and #27 for 24 Vac control voltage.

Startup Steps

Refer to the MicroTech unit controller information on page 39 to become familiar with unit operation before starting the chiller.

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

Be prepared to record all operating parameters required by the “Warranty Registration Form” on page 102. Return this information within 10 working days to Daikin Applied as instructed on the form to obtain full warranty benefits.

- Verify chilled water flow rate.
- Calibrate thermal dispersion flow switch, see instructions on page 82
- 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 controller will stage on cooling.)
- Check the controller setpoints to be sure that factory defaults are appropriate.

Table 86: Unit Enable Button Light Legend

Light Activity	Unit Status Description
Off	Not Enabled or No Power
Slow Pulse (3 Second Period)	Enable and Not Running
On	Running
On with Fast Pulse (1 Second On, 1 Second Double Pulse)	Running with Alarm
Fast Pulse	Not Running with Alarm

Post Startup

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

- Compressor oil level.
- Refrigerant sight glass for flashing.
- Rotation of condenser fans.
- Complete the “Equipment Warranty Registration Form,” found at the end of this manual, within 10 days of start-up in order to comply with the terms of Daikin Applied Limited Product Warranty.

Shutdown

Temporary Shutdown

1. Use the LED Enable button on the Main control box door to disable the unit.
2. Turn off chilled water pump. Chilled water pump to operate while compressors are pumping down.
3. To start the chiller after a temporary shutdown, follow the startup instructions.

Extended Shutdown

1. Front seat both condenser liquid line service valves.
2. Use the LED Enable button on the Main control box door to disable the unit.
3. Front seat both refrigerant circuit discharge valves (if applicable).
4. If chilled water system is not drained, maintain power to the evaporator heater to prevent freezing. Maintain heat tracing on the chilled water lines.
5. Drain evaporator and water piping and flush with glycol to prevent freezing.
6. 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.
7. If electrical power is off, make provisions to power the evaporator heater (if chilled water system is not drained or is filled with suitable glycol). Tag all opened electrical disconnect switches to warn against startup before the refrigerant valves are in the correct operating position.

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

Pre-Startup (Pumps)

Follow the chiller startup procedure beginning on page 81 and complete the pre-start checklist for scroll compressor chillers found in the front of this manual as well as the pump commissioning startup form.

Other operational guidelines are as follows:

- Check the rotation of the pump using a phase rotation meter.
- Do not run the pump without fluid in the system. Fluid is required to cool and lubricate the pump.
- Before starting pump(s) and with water in the pump, purge the seal flush line by cracking the vent valve until water appears. The valve will protrude from the pump insulation. The seal is the highest point in the pump and requires water for sealing and lubrication.
- VFD equipped pumps are shipped with the pump VFD controller in the AUTO mode. Confirm this by checking the

VFD controller and pressing the Auto key if necessary. The AUTO ON button is located at the bottom of the controller.

- Check that the "Y" strainer valve is open (horizontal position) and the triple-duty valve is open.

In addition to making any settings required, it is often desirable to run the pumps without the chiller running to check the chilled water circuit. Energize the unit by closing the main disconnect located in the right-hand panel door. Non-VFD pumps can then be operated using the switch located on the door of the pump control panel. Use the display keypad on VFD unit for operation. Press the Hand on key and use the ▲ or ▼ key to regulate the pump speed and flow. The VFD should be changed to the Auto mode for normal operation.

Setting the Operating Mode

For convenience, the operating parameters for each of the three operating modes have pre-programmed setups.

Setup #1 Sensorless

The pump control is factory set for this mode and no field changes or programming is required.

NOTICE
Sensorless operation is only allowed for single chiller systems. Systems with parallel chiller operation must use one of the other control methods.

Setup #2 External Sensor

Normally a differential pressure sensor.

Setup #3 BAS

"BAS Integration of Pumps" on page 22.

Hand On

Manual operation - not programmed.

Change from the sensorless default setup #1 to setup #2 or #3 on the graphic keypad display as follows:

1. Press the OFF key. The keypad display will remain powered.
2. Press the MAIN MENU key. Should show parameter "0- ** Operations/Display".
3. Press OK.
4. Press ▼ key to 0-1 "Set UP Operations".
5. Press "OK". Display goes to 0-10 "Active Setup"
6. Press "OK". Display will show boxed #1, #2, or #3
7. Press ▼ or ▲ key to select either mode #2 or #3. #1 is factory default.
8. Press OK. The upper right-hand corner of the display should show 2(2) or 3(3) depending on the choice.
9. Press AUTO for normal operation.
10. Press STATUS to return to the normal operating screen.

Startup (Pumps)

Occasionally the impeller may be temporarily bound up and will not turn at start up. If this is the case, loosen the insulation and loosen the hold-down bolts holding the motor assembly to the pump casing (do not remove them) and bump the pump.

The pump package is shipped with three strainers:

- A "Y" type strainer at the unit inlet connection.
- A perforated strainer located in the inlet guide assembly at the inlet of the pump.
- A fine mesh temporary start-up strainer located in the inlet guide.

The "Y" strainer has a finer mesh than the inlet guide strainer and should catch most debris before it reaches the inlet guide strainer which also functions as suction flow direction device.

No special attention need be paid to the Suction Guide strainer at initial start-up. It will strain the pumped fluid and stabilize the flow into the pump suction automatically.

Removing Temporary Strainer

The temporary strainer **must** be removed following system clean up as follows:

After all debris has been removed from the system, or a maximum of 24 running hours, stop the pump and close the pump isolation valves. Drain the Suction Guide by removing the drain plug or opening the blowdown valve, if installed. Remove the insulation disc held on with Velcro (the disc has a "CAUTION Remove Startup Strainer After 24 Hours" sticker). Remove the suction guide cover and remove the strainer assembly from the valve body.

The temporary fine-mesh start-up strainer is tack-welded to the permanent stainless steel strainer. This temporary strainer should now be removed from the permanent strainer. The fine-mesh strainer is designed to remove small particulate from new piping systems and could easily clog with debris if left in place. This will be detrimental to the operation of the pump.

Replace the permanent strainer into the fitting body once the temporary strainer is removed.

Inspect the cover O-ring and replace if necessary. Replace the cover into the body. Ensuring that the strainer is properly seated, tighten the cover bolts diagonally, evenly and firmly.

The seal may drip at initial start up as it breaks in. If the drip continues for more than a few hours, service may be required.

Seasonal Shutdown (Pumps)

Follow the instructions in the chiller unit for seasonal shutdown procedures.

In addition for the pump package:

No components or piping on the pump package are heat traced. If heat tracing is field installed, carefully remove the factory insulation, install the heat tracing and carefully replace the insulation, being careful to seal it against moisture penetration.

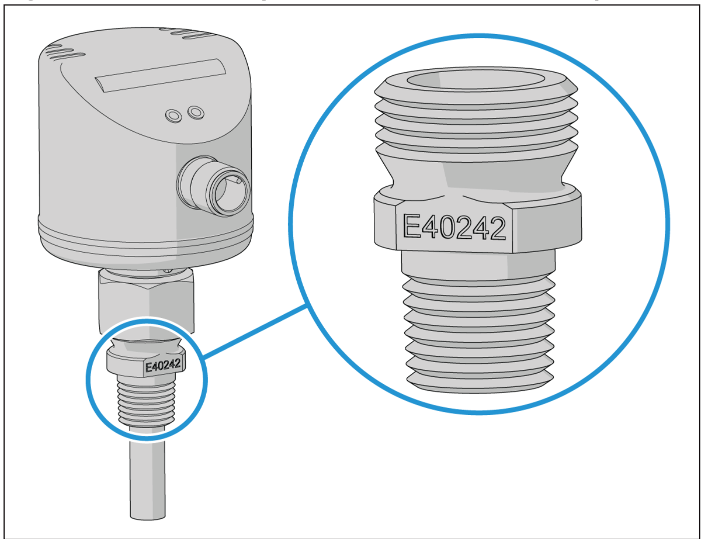
If draining the chilled water system, see diagrams beginning on page 14 for the location of drain points in the piping and pumps, both of which must be thoroughly drained.

Flow Switch Installation and Calibration

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

The thermal dispersion flow switch supplied by Daikin Applied, shown in Figure 49, comes as a 2 part unit consisting of a flow switch and an adapter labeled E40242 by the supplier.

Figure 49: Thermal Dispersion Flow Switch and Adapter



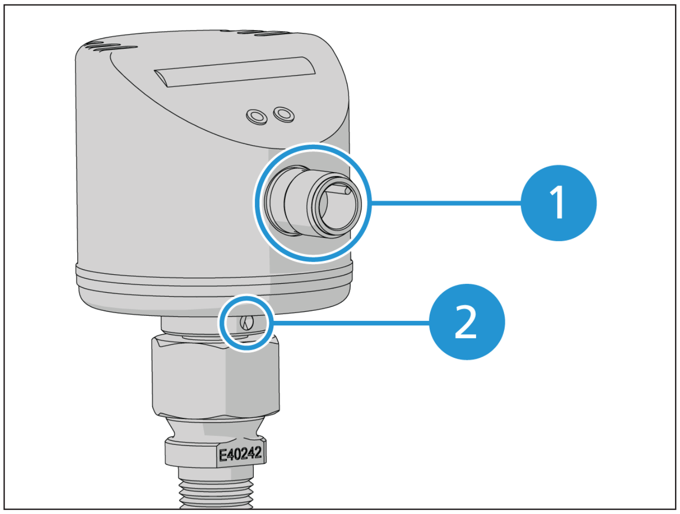
NOTICE

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

Mounting

Figure 50 highlights the position of the electrical connector and indentation ‘mark’ on flow switch.

Figure 50: Flow Switch Details

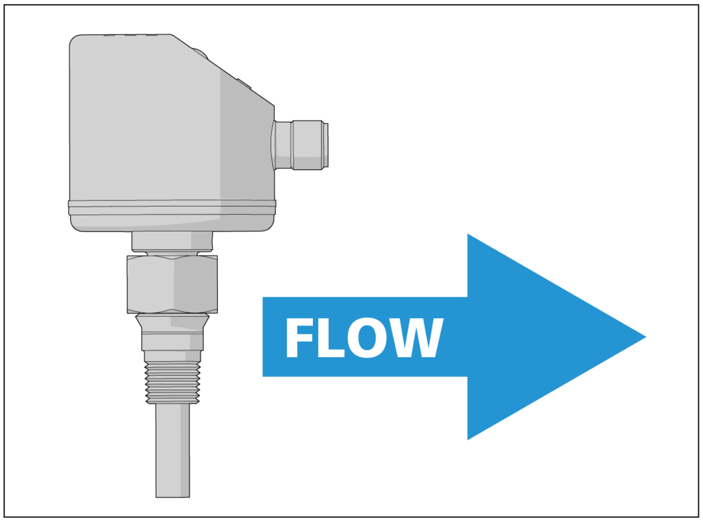


No.	Descriptions
1	Electrical Connector
2	Indentation

It is required that the flow switch be mounted such that the electrical connection and indentation ‘mark’ are pointed in the direction of flow as shown in Figure 51.

If the flow sensor is to be mounted away from the unit, the sensor should be mounted on the wall of the inlet pipe of evaporator, or in a run of straight pipe that allows 5 to 10 pipe diameters prior to the sensor and 3 to 5 pipe diameters of straight pipe after the sensor. Flow switch is placed in inlet pipe to reflect flow entering the evaporator.

Figure 51: Mount in Direction of Flow



It is important that the flow switch be mounted so that the probe is sufficiently inserted into the fluid stream. Figure 52 illustrates the recommended orientation of the sensor. It may not be mounted directly on top or directly on the bottom of a horizontal pipe.

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

Figure 52: Remote Mounting Guidelines for Flow Switch

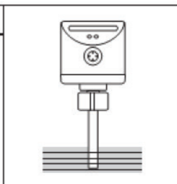
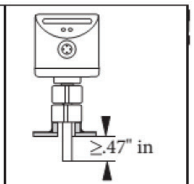
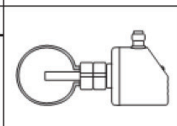
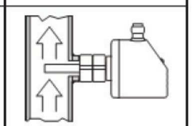
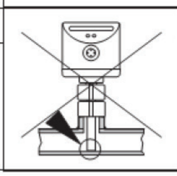
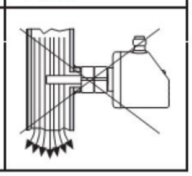
General • The sensor tip is to be completely surrounded by the medium. • Insertion depth of the sensor: minimum .47" in.		
Recommended • For horizontal pipes: mounting from the side. • For vertical pipes: mounting in the rising pipe.		
To avoid • The sensor tip must not be in contact with the pipe wall. • Do not mount in downpipes that are open at the bottom!		

Table 87: Flow Volume Calculation

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

Flow Switch Adapter

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

Wiring

Refer to wiring diagram in the unit control panel.

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

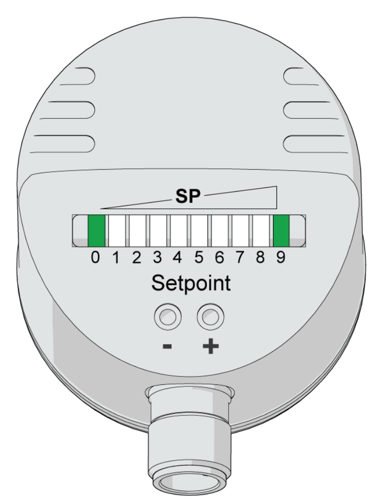
Flow Switch Setup

The flow switch comes from the factory set at a default velocity of 20cm/s. This value is typically well below the minimum water flow specified for the unit's evaporator and condenser so field adjustment is required for adequate low flow protection. Table 87 shows the calculated gallons per minute (gpm) for Schedule 40 steel pipe for various fluid velocities from 15 cm/s to 60 cm/s. The flow switch has a range of adjustment from 3 cm/s to 300 cm/s.

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

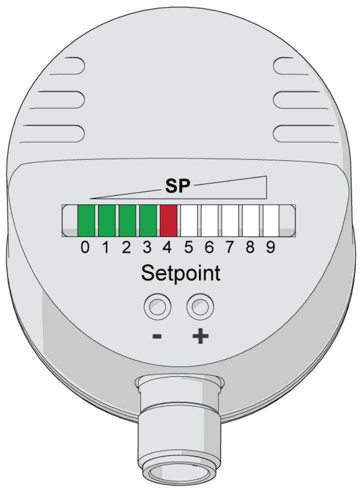
Step 2: Once steady state minimum desired operating flow is obtained, perform the 'Teach' function on the flow switch. The 'Teach' function is initiated by holding down the minus '-' button on the face of the flow switch for 15 seconds. During this 15 second period, LEDs '0' and '9' will be lit green. Once the 'Teach' function is completed, the outer LEDs will flash green as shown in Figure 53.

Figure 53: Automatic Teach of Setpoint



Step 3: After the 'Teach' function is completed and the outer LEDs flashed, the flow switch will indicate a new set point based upon the current flow which should still be at the steady state minimum desired operating flow. Figure 54 shows a typical display for this condition. All LEDs to the left of the SP LED are lit green. The SP LED is lit RED (or may toggle amber) which indicates that the flow switch is OPEN. Typically, an increase in fluid flow is between 15% to 30% above the 'Teach' function flow is required for the SP LED to turn AMBER and the flow switch to CLOSE indicating acceptable flow.

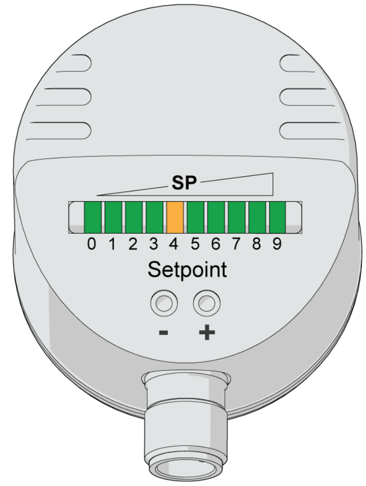
Figure 54: Teach Adjustment Complete



In Step 3, the 'Teach' function re-adjusted the flow switch set point (SP) while flow was at the minimum desired operating flow. The chiller will not operate at this flow because the flow switch is OPEN after performing the 'Teach' function. The benefit of the 'Teach' function is to quickly set the set point within the desired operating range. Additional 'manual' adjustment of set point is required in order to allow for chiller operation at this minimum flow. The '+' and '-' buttons on the face of the flow switch allow for the manual adjustment of the SP. Pressing the '+' button reduces the flow set point while pressing the '-' button increases the flow set point. Each button press, '+' or '-', changes the flow set point by 2.5 cm/s.

Step 4: Press the '+' button until LED '9' begins to flash, as shown in Figure 55. Opening of flow switch should now occur at approximately 80% to 90% of minimum flow.

Figure 55: Upper Range of Minimum Flow



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

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

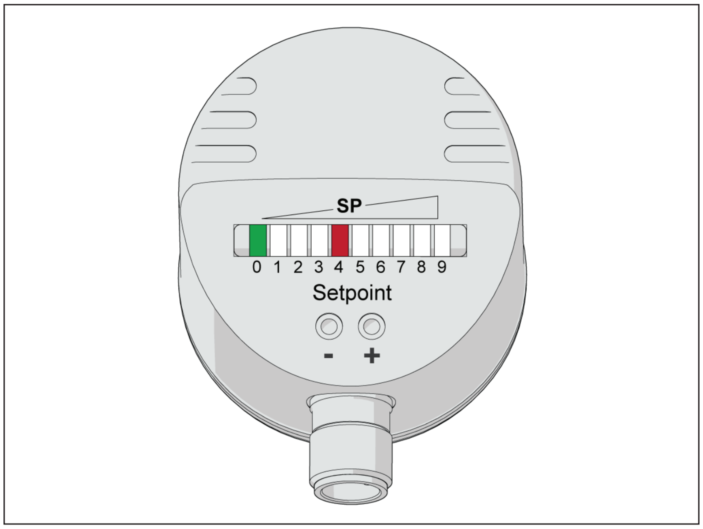
2. Each LED represents 5 cm/s, or two presses of the '+' or '-' buttons.

3. When power is initially applied to the flow switch, all green LEDs light and go out step by step. During this time, the output is closed. The unit is in the operating mode.

4. When making manual adjustments to the set point (SP), if no button is pressed for 2 seconds, the unit returns to the operating mode with the newly set value.

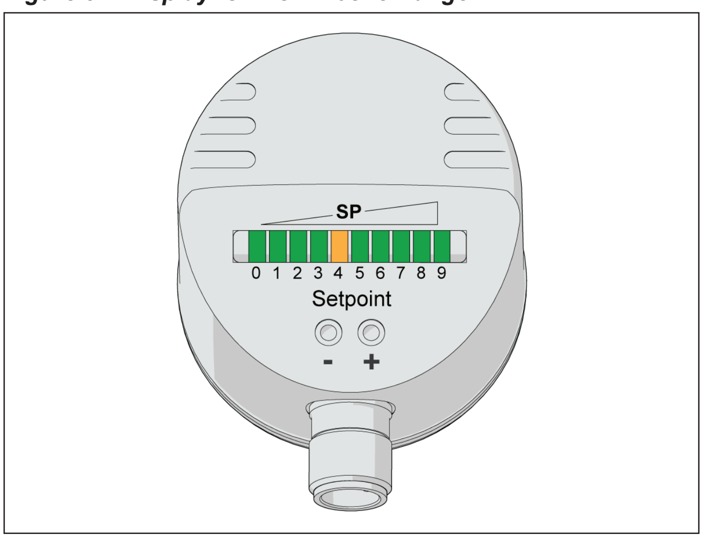
Flow below display range: The SP LED will be lit red and the leftmost LED will be flashing green. For example, if the SP was set to 200 cm/s, the flashing labeled '0' would indicate that the flow was below 180 cm/s. This would be shown if no flow through chiller or lowered than desired flow.

Figure 56: Display for Flow Below Range



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

Figure 57: Display for Flow Above Range



Unit Maintenance

General

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

⚠ WARNING

If removal of the wire guards is required to perform service checks, ensure guards are properly re-installed after the maintenence is complete. The guards must be in place prior to start up. Failure to do so can result in damage to the unit or personal injury.

Electrical Terminals

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

⚠ DANGER

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

⚠ DANGER

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

⚠ WARNING

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. Failure to do can result in property damage, personal injury, or death.

⚠ WARNING

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

⚠ CAUTION

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

Compressor Maintenance

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

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

Crankcase Heaters

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

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

Lubrication

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

POE type oil is used for compressor lubrication. Further details and warnings are listed on page 93.

⚠ WARNING

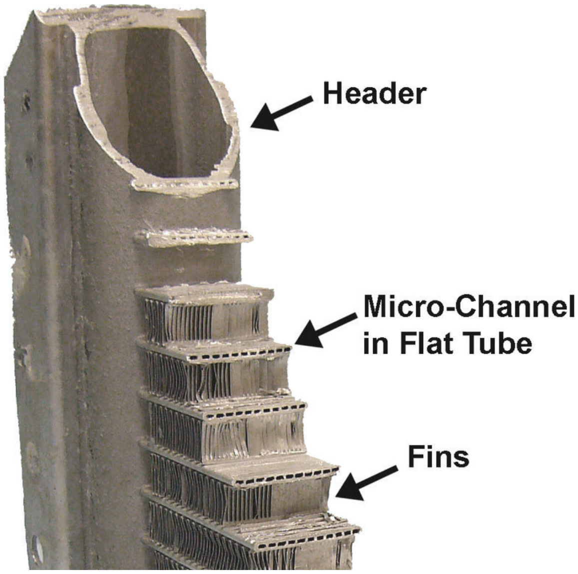
POE oil must be handled carefully using proper protective equipment (gloves, eye protection, etc.). The oil must not come in contact with certain polymers (e.g. PVC), as it may absorb moisture from this material. Daikin Applied recommends against the use of PVC and CPVC piping for chilled water systems.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

All-Aluminum Condenser Coils

The condenser coils are an all-aluminum design including the connections, microchannel, fins (an oven brazing process brazes the fins to the microchannel flat tube), and headers (see Figure 58), which eliminates the possibility of corrosion normally found between dissimilar metals of standard coils.

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

Figure 58: 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.

When performing coil maintenance ensure that no support member, baffle, or foreign object has made unintended contact with the coil (aluminum). If steel/aluminum contact is identified, apply measures to separate employing rubber strips or bending the leading edge of support away from the coil.

⚠ WARNING

Prior to cleaning the coils, turn off and lock out the main power switch to the unit and open all access panels. Failure to do can result in property damage, personal injury, or death.

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.

NOTICE

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

Periodic Clean Water Rinse

A monthly clean water rinse is recommended for all coils according to Table 73. Coils should be rinsed with water at a lower pressure such as from a hose. Pressure washers are not recommended as the higher pressure may damage the fins.

Regular water rinsing of epoxy coated coils that are applied in coastal or industrial environments will help to remove chlorides, dirt and debris. An elevated water temperature (not to exceed 130ºF) will reduce surface tension, increasing the ability to remove chlorides and dirt.

Table 88: Coil Cleaning Guidelines

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

Cleaning Epoxy Coated Coils

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

Routine Quarterly Cleaning of Epoxy Coated Coil Surfaces

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

For routine quarterly cleaning, first clean the coil with a coil cleaner (see Table 74). After cleaning the coils with a cleaning agent, use the chloride remover to remove soluble salts and revitalize the unit.

Recommended Coil Cleaning Agents

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

Table 89: Epoxy Coated Coil Recommended Cleaning Agents

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

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

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

Harsh Chemical and Acid Cleaners

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

High Velocity Water or Compressed Air

High velocity water or compressed air may damage the coil fins and must only be used at a pressure lower than 100 psig and 130°F to prevent fin and/or coil damage. Nozzles must have a diffuse pattern, as a concentrated jet may damage the fins. Never use a pressure washer for coil cleaning. The force of the water or air jet may bend the fin edges and increase airside pressure drop. Reduced unit performance or nuisance unit shutdowns may occur.

Evaporator

On AGZ-F models, the evaporator is a compact, high efficiency, dual circuit, brazed plate-to-plate type heat exchanger consisting of parallel stainless steel plates. The evaporator is protected with an electric resistance heater and insulated with 3/4" (19mm) thick closed-cell polyurethane insulation. This combination provides freeze protection down to -20°F (-29°C) ambient air temperature. Evaporators are designed and constructed according to, and listed by, Underwriters Laboratories (UL). Other than cleaning and testing, no service work should be required on the evaporator.

Liquid Line Solenoid Valve

The liquid line solenoid valves that shut off refrigerant flow in the event of a power failure do not normally require any maintenance.

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 ECM fan (low ambient option).
- Check inlet filters periodically and clean as required. Verify that the fan is operational.

Liquid Line Sight Glass and Subcooling

⚠ WARNING

A2L

This unit contains R-32, a class A2L refrigerant that is flammable. This unit should only be installed, serviced, repaired, and disposed of by qualified personnel licensed or certified in their jurisdiction to work with R-32 refrigerant. Installation and maintenance must be done in accordance with this manual. Improper handling of this equipment can cause equipment damage or personal injury.

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

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

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

Expansion Valve

The expansion valve's function is to keep the evaporator supplied with the proper amount of refrigerant to satisfy the load conditions. Before adjusting superheat, check that unit charge is correct and liquid line sight glass is full with no bubbles and that the circuit is operating under stable, full load conditions.

Electronic Expansion Valve - For suction superheat targets, see "Circuit Level Set Points" on page 43.

Filter-Driers

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

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

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

AGZ-F units come equipped with replaceable core filter driers. The core assembly of the replaceable core drier consists of a filter core held tightly in the shell in a manner that allows full flow without bypass.

Hot Gas Bypass (Optional)

The hot gas bypass (HGBP) option allows the system to operate at lower loads without excessive on/off compressor cycling. HGBP is required to be on both refrigerant circuits because of the lead / lag feature of the controller. HGBP allows passage of discharge gas into the evaporator inlet (between the electronic expansion valve and the evaporator) which generates a false load to supplement the actual chilled water or air handler load.

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

The pressure regulating valve is factory set to begin opening at 120 psig with R-32 and can be changed by adjusting the pressure setting. To raise the pressure setting, remove the cap and turn the adjustment screw clockwise. To lower the setting, turn the screw counterclockwise. Do not force the adjustment beyond the range it is designed for as this will damage the adjustment assembly. The regulating valve opening point can be determined by slowly reducing the system load while observing the suction pressure. When the bypass valve starts to open, the refrigerant line on the evaporator side of the valve will begin to feel warm to the touch.

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

NOTICE
It may be necessary to wire the HGBP solenoid in parallel with the Liquid Line Solenoid on variable flow systems.

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

A field installed HGBP kit can be added to units already installed. If a 120-V version of the kit is ordered, the solenoid valve comes with a DIN connector and has to be wired.

The wiring should be two 14 AWG wires, one red and one white to be run in conduit. Field to wire:

- Circuit 1 Red to NO2 on UE01 and white to SPL1 (splice connector)
- Circuit 2 Red to NO4 on UE01 and white to SPL1 (splice connector)

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

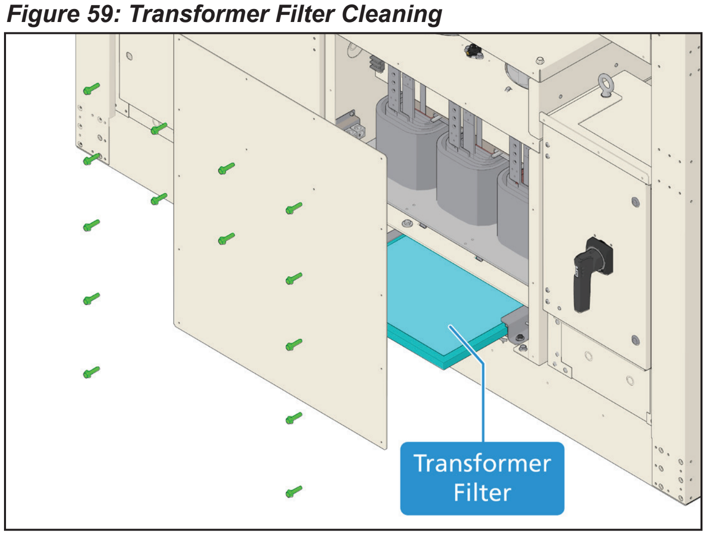
Transformer Filter

Check transformer filter periodically and clean as required (non-460V unit only). Verify that the fan is operational.

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

NOTICE
The transformer filter should be inspected and cleaned regularly. Failure to do so can result in loss of performance.

Figure 59: Transformer Filter Cleaning



To clean the transformer filter, do the following:

1. Remove the screws securing the transformer cover to the unit and detach the transformer cover.
2. Remove the transformer filter.
3. Vacuum the transformer filter and clean with water.

⚠ **CAUTION**
High velocity water or compressed air may damage the filter and must only be used at a pressure lower than 100 psig.

4. Reinstall transformer filter and transformer cover before starting up unit.

Figure 60: Refrigerant Schematic

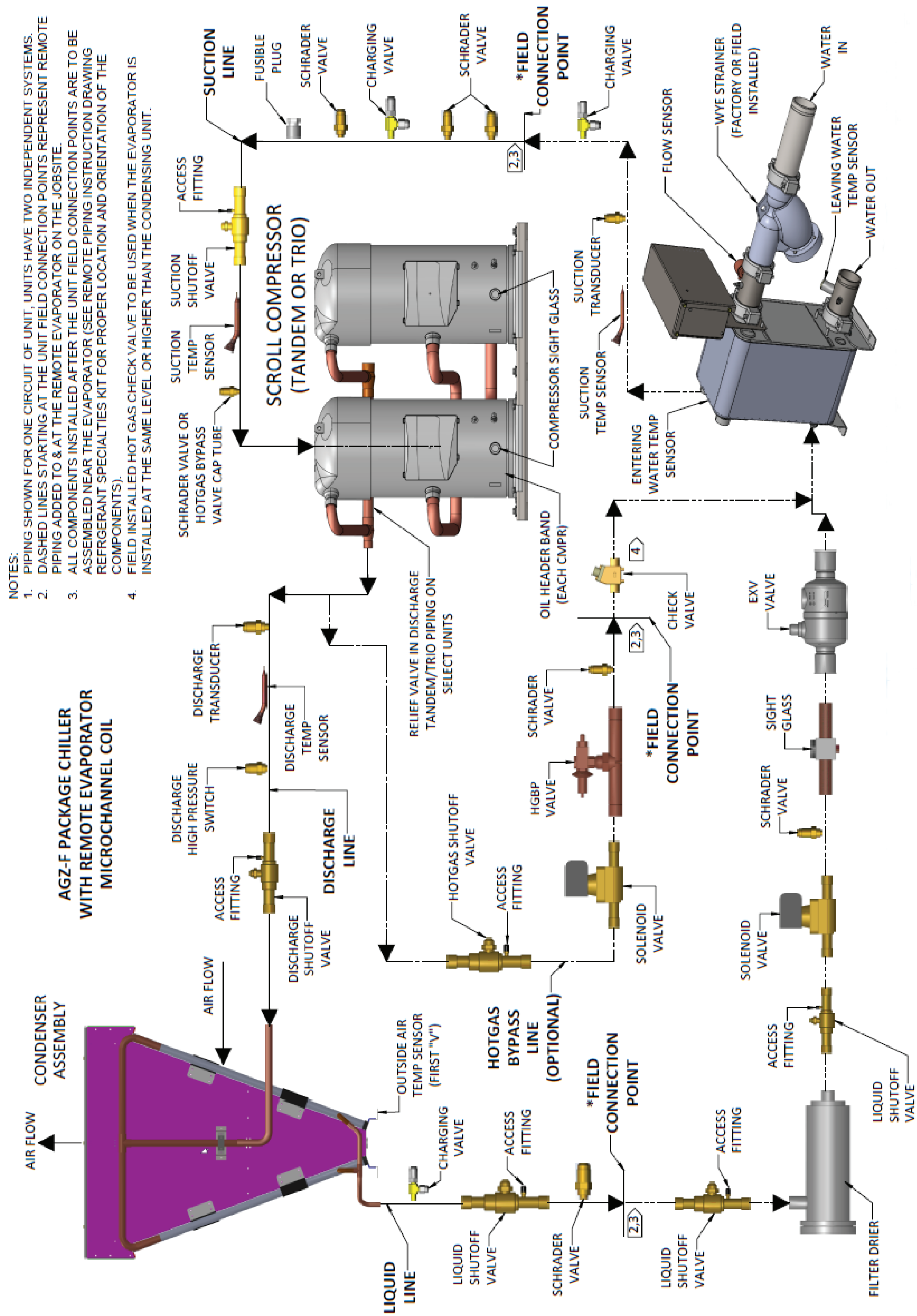


Table 90: Planned Maintenance Schedule

Operation	Weekly	Monthly (Note 1)	Quarterly	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
Verify solenoid plug(s) tightness and gasket integrity				X
Refrigeration				
Leak test		X		
Check sight glasses for clear flow	X			
Check filter-drier pressure drop		X		
Perform compressor vibration test				X
Acid test oil sample				X
Condenser (air-cooled)				
Rinse condenser coils (Note 5)		X		
Clean epoxy coated condenser coils (Note 5)			X	
Check fan blades for tightness on shaft (Note 6)				X
Check fans for loose rivets and cracks				X
Check coil fins for damage			X	
Inspect and clean transformer filter (non-460V units only)			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 Megohm motors while they are in a vacuum to avoid damage to the motor.
5. Coil rinsing and cleaning can be required more frequently in areas with a high level of airborne particles.
6. When cleaning condenser coils, be sure fan motors are electrically locked out.

POE Lubricants

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:

- Danfoss POE lubricant 1855L

⚠ WARNING

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

⚠ WARNING

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

Procedure Notes

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

Control and Alarm Settings

The software that controls the operation of the unit is factory-set for operation with R-32.

Refrigerant Charging

⚠ CAUTION

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

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

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

Charging procedure

The units are factory-charged with R-32. Use the following procedure if recharging in the field is necessary.

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.

Evaporator waterflow MUST be established while charging the unit.

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

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

If the unit is at steady full load operation and bubbles are visible in the sight glass, then check liquid subcooling. The AGZ units have a condenser coil design with approximately 15% of the coil tubes located in a subcooler section of the coil to achieve liquid cooling to within 15 to 20°F (8.3 to11.1°C) of the outdoor air temperature when all condenser fans are operating. Subcooling should be checked at full load with 70°F (21.1°C) ambient temperature or higher, stable conditions, and all fans running. Liquid line subcooling at the liquid shut-off valve should be between 15 and 20°F at full load.

If subcooling is low, add charge to clear the sight glass. Once the subcooler is filled, extra charge will not lower the liquid temperature and does not help system capacity or efficiency.

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

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

Service

Special tools will be required due to higher refrigerant pressures with R-32. Oil-less/hp recovery units, hp recovery cylinders (DOT approved w/525# relief), gauge manifold 30”-250 psi low/0-800 psi high, hoses w/800 psi working & 4,000 psi burst.

All filter driers and replacement components must be rated for POE oils and for the refrigerant pressure

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-32 pressures and smaller molecule size make workmanship more critical.

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

Refrigerant Guidelines

⚠ WARNING

A2L

This unit contains R-32, a class A2L refrigerant that is flammable. This unit should only be installed, serviced, repaired, and disposed of by qualified personnel licensed or certified in their jurisdiction to work with R-32 refrigerant. Installation and maintenance must be done in accordance with this manual. Improper handling of this equipment can cause equipment damage or personal injury.

For installation only in locations not accessible to the general public.

Be aware that R-32 refrigerant may not contain an odor. Place in a well ventilated area to prevent accumulation of refrigerant.

Do not pierce or burn this unit.

Never use an open flame during service or repair. Never store in a room with continuously operating ignition sources (for example: open flames, an operating gas appliance, or an operating electric heater.), where there is ignitable dust suspension in the air, or where volatile flammables such as thinner or gasoline are handled.

Only use pipes, nuts, and tools intended for exclusive use with R-32 refrigerant in compliance with national codes (ASHRAE15 or IRC).

Do not mix air or gas other than R-32 in the refrigerant system. If air enters the refrigerant system, an excessively high pressure results, which may cause equipment damage or injury.

Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.

Lubrication

R-32 should be used only with polyolester (POE) oil. The HFC refrigerant components in R-32 will not be compatible with mineral oil or alkylbenzene lubricants. R-32 systems will be charged with the OEM recommended lubricant, ready for use with R-32.

Competence of Personnel

⚠ WARNING

Service on this equipment is to be performed by qualified refrigeration personnel familiar with equipment operation, maintenance, correct servicing procedures, and the safety hazards inherent in this work. Causes for repeated tripping of equipment protection controls must be investigated and corrected. Disconnect all power before doing any service inside the unit. If refrigerant leaks from the unit, there is a potential danger of suffocation since refrigerant will displace the air in the immediate area. Servicing this equipment must comply with the requirements of all applicable industry related published standards and local, state and federal, statutes, regulations and codes in regards to refrigerant reclamation and venting. Avoid exposing refrigerant to an open flame or other ignition source.

Information of procedures additional to usual information for refrigerating equipment installation, repair, maintenance and decommission procedures is required when equipment with flammable refrigerants is affected.

The training of these procedures is carried out by national training organizations or manufacturers that are accredited to teach the relevant national competency standards that may be set in legislation. The achieved competence should be documented by a certificate.

Maintaining and servicing R-32 refrigerant should only be performed as recommended by this manual and by personnel licensed or certified in their jurisdiction to handle A2L refrigerants. Dismantling the unit and treatment of the refrigerant, oil, and additional parts must be done in accordance with the relevant local, state, and national regulations.

Only use tools meant for use on R-32 refrigerant, such as a gauge manifold, charge hose, gas leak detector, reverse flow check valve, refrigerant charge base, vacuum gauge, or refrigerant recovery equipment.

The following guidelines align with UL Standard 60335-2-40.

Maintenance and Repair

- Portable equipment shall be repaired outside or in a workshop specially equipped for servicing units with FLAMMABLE REFRIGERANTS.
- Ensure sufficient ventilation at the repair place.
- Be aware that malfunction of the equipment may be caused by refrigerant loss and a refrigerant leak is possible.
- Discharge capacitors in a way that won’t cause any spark. The standard procedure to short circuit the capacitor terminals usually creates sparks.
- When brazing is required, the following procedures shall be carried out in the right order:
    - — Remove the refrigerant. If the recovery is not required by national regulations, drain the refrigerant to the outside. Take care that the drained refrigerant will not cause any danger. In doubt, one person should guard the outlet. Take special care that drained refrigerant will not float back into the building.
    - — Evacuate the refrigerant circuit.
    - — Remove parts to be replaced by cutting, not by flame.
    - — Purge the braze point with nitrogen during the brazing procedure.
    - — Carry out a leak test before charging with refrigerant.
- Reassemble sealed enclosures accurately. If seals are worn, replace them.
- Check safety equipment before putting into service.

Checks to the refrigerating equipment

Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times the manufacturer’s maintenance and service guidelines shall be followed. If in doubt, consult the manufacturer’s technical department for assistance.

The following checks shall be applied to installations using FLAMMABLE REFRIGERANTS:

- if an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant;
- marking to the equipment continues to be visible and legible. Markings that are illegible shall be corrected;
- refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

Checks to electrical devices

Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment so all parties are advised.

Initial safety checks shall include:

- that capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking;
- that no live electrical components and wiring are exposed while charging, recovering or purging the system;
- that there is continuity of earth bonding.

Repairs to sealed components

- During repairs to sealed components, all electrical supplies shall be disconnected from the equipment being worked upon prior to any removal of sealed covers, etc. If it is absolutely necessary to have an electrical supply to equipment during servicing, then a permanently operating form of leak detection shall be located at the most critical point to warn of a potentially hazardous situation.
- Particular attention shall be paid to the following to ensure that by working on electrical components, the casing is not altered in such a way that the level of protection is affected. This shall include damage to cables, excessive number of connections, terminals not made to original specification, damage to seals, incorrect fitting of glands, etc.
- Ensure that the apparatus is mounted securely.
- Ensure that seals or sealing materials have not degraded to the point that they no longer serve the purpose of preventing the ingress of flammable atmospheres. Replacement parts shall be in accordance with the manufacturer's specifications.

Repair to intrinsically safe components

- Do not apply any permanent inductive or capacitance loads to the circuit without ensuring that this will not exceed the permissible voltage and current permitted for the equipment in use.
- Intrinsically safe components are the only types that can be worked on while live in the presence of a flammable atmosphere. The test apparatus shall be at the correct rating.
- Replace components only with parts specified by the manufacturer. Other parts may result in the ignition of refrigerant in the atmosphere from a leak.

NOTICE
The use of silicon sealant can inhibit the effectiveness of some types of leak detection equipment. Intrinsically safe components do not have to be isolated prior to working on them.

Cabling

- Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.

Leak Detection

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. NEVER use the following when attempting to detect flammable refrigerant leaks:

- A halide torch (or any other detector using a naked flame)
- Substances containing chlorine

Detection of flammable refrigerants

The following leak detection methods are deemed acceptable for all refrigerant systems:

- Electronic leak detectors may be used to detect refrigerant leaks. For FLAMMABLE REFRIGERANTS, the sensitivity of electronic leak detectors may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25 % maximum) is confirmed.
- Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.Examples of leak detection fluids are:
  - — bubble method; or
  - — fluorescent method agents
- If a leak is suspected, all open flames shall be removed/ extinguished.
- If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. Removal of refrigerant shall be according to instructions in "Pressure Testing and Refrigerant Evacuation".

Pressure Testing and Refrigerant Evacuation

- Make sure that air or any matter other than R-32 refrigerant does not get into the refrigeration cycle.
- If refrigerant gas leaks occur, ventilate the area as soon as possible.
- R-32 should always be recovered and never released directly into the environment.
- Only use tools meant for use on R-32 refrigerant (such as a gauge manifold, charging hose, or vacuum pump adapter).

Removal and evacuation

When breaking into the refrigerant circuit to make repairs, or for any other purpose, conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration.

- The following procedure shall be adhered to:
  - i. safely remove refrigerant following local and national regulations - see “Recovery” section;
  - ii. purge the circuit with inert gas;
  - iii. evacuate;
  - iv. purge with inert gas;
  - v. open the circuit by cutting (if flammable refrigerant).
- The refrigerant charge shall be recovered into the correct recovery cylinders according to local and national codes. For equipment containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the equipment safe for flammable refrigerants. This process might need to be repeated several times.
- Compressed air or oxygen shall not be used for purging refrigerant systems.
- For equipment containing flammable refrigerants, refrigerants purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum.
- When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.
- Ensure that the outlet for the vacuum pump is not close to any potential ignition sources and that ventilation is available.

Handling and Storage

Conditions for Safe Storage

- Requirements to be met by storerooms and receptacles:
  - — Store only in unopened original receptacles
  - — Store in a cool and dry location
- Further information about storage conditions:
  - — Keep container tightly sealed
  - — Store in cool, dry conditions in well sealed receptacle
  - — Protect from heat and direct sunlight
- Maximum storage temperature: 40°C (104°F)

Fire and Explosion Protection Information

Open and handle refrigerant receptacle with care. Keep ignition sources away. Do not smoke. Protect against electrostatic charges. Waste air is to be released into the atmosphere only via suitable separators.

Commissioning

- Ensure that the floor area is sufficient for the refrigerant charge.
- Connect the pipes and carry out a leak test before charging with refrigerant.
- Check safety equipment before putting into service.

Charging procedures

In addition to conventional charging procedures and specific unit charging guidelines on page 94, the following requirements shall be followed.

- Ensure that contamination of different refrigerants does not occur when using charging equipment.
- Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders shall be kept in an appropriate position according to the instructions.
- Ensure that the refrigerating system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the refrigerating system.
- Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

Decommissioning

- If the safety is affected when the equipment is put out of service, the refrigerant charge shall be removed before decommissioning.
- Ensure sufficient ventilation at the equipment location.
- Be aware that malfunction of the equipment may be caused by refrigerant loss and a refrigerant leak is possible.
- Discharge capacitors in a way that won’t cause any spark.
- Remove the refrigerant according to details in “Recovery” section. If recovery is not required by national regulations, drain the refrigerant to the outside. Take care that the drained refrigerant will not cause any danger. In doubt, one person should guard the outlet. Take special care that drained refrigerant will not float back into the building.
- Ensure all isolation valves on the equipment are closed off.

Labeling

Equipment shall be labelled stating that it has been de-commissioned and emptied of refrigerant. The label shall be dated and signed. For equipment containing FLAMMABLE REFRIGERANTS, ensure that there are labels on the equipment stating the equipment contains FLAMMABLE REFRIGERANT.

Recovery

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely. When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant (i. e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of all appropriate refrigerants including, when applicable, FLAMMABLE REFRIGERANTS. If in doubt, the manufacturer should be consulted. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition. Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release. Consult manufacturer if in doubt.

The recovered refrigerant shall be returned to the refrigerant supplier in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that FLAMMABLE REFRIGERANT does not remain within the lubricant. The evacuation process shall be carried out prior to returning the compressor to the suppliers. Only electric heating to the compressor body shall be employed to accelerate this process. When oil is drained from a system, it shall be carried out safely.

Recovery Procedure

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail.It is recommended good practice that all refrigerants are recovered safely.

Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant.

It is essential that electrical power is available before the task is commenced.

1. Become familiar with the equipment and its operation.
2. Isolate system electrically.
3. Before attempting the procedure, ensure that
   - mechanical handling equipment is available, if required, for handling refrigerant cylinders;
   - all personal protective equipment is available and being used correctly;
   - the recovery process is supervised at all times by a competent person;
   - recovery equipment and cylinders conform to the appropriate standards.
4. Pump down refrigerant system, if possible.
5. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
6. Make sure that cylinder is situated on the scale before recovery takes place.
7. Start the recovery machine and operate in accordance with instructions.
8. Do not overfill cylinders (no more than 80 % volume liquid charge.
9. Do not exceed the maximum working pressure of the cylinder, even temporarily.
10. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.

Disposal

- Waste treatment method recommendation:
  - Must be specially treated adhering to official regulations
  - Incineration in an adequate incinerator is recommended
  - Uncleaned packaging disposal must be made according to official regulations
- Ensure sufficient ventilation at the working place

The following procedure shall be adhered to:

i. safely remove refrigerant following local and national regulations - see “Recovery” section
ii. evacuate the refrigerant circuit
iii. purge the refrigerant circuit with nitrogen gas for 5 minutes
iv. evacuate again

If compressors are to be removed, cut out the compressor and drain the oil.

Troubleshooting

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
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/Light Loads	6. Evaluate BAS sequence and settings. Evaluate need for HGBP or thermal inertia

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
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

Appendix

Pre-Start Checklist

Must be completed, signed, and provided to Daikin Applied sales office 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 Piping and Condenser Water Piping for Water-cooled Chiller	Yes	No	N/A	Initials
Piping Complete				
Water strainer(s) installed in piping per IOM requirements				
Chilled Water System – flushed, filled, and vented; Water treatment in place				
Condenser Water System (incl. cooling tower) - flushed, filled, vented; Water treatment in place (applicable for water-cooled systems)				
Pumps installed and operational (rotation checked, strainers cleaned)				
Water system operated and tested; flow meets unit design requirements				
Flow switch(es) - installed, wired, and ready for calibration during startup				
Air vent installed on evaporator chilled water inlet piping				
Glycol at design % (if applicable)				
Electrical	**Yes**	**No**	**N/A**	**Initials**
Building controls operational (3-way valves, face/bypass dampers, bypass valves, etc.)				
*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 Applied specifications				
Power applied at least 24 hours before startup				
Crankcase heaters must operate for 24+ hours before startup to maximize separation				
Chiller components (EXV Sensors Transducers) installed and wired properly				
*Wiring complies with National Electrical Code and local codes (See Notes)				
Remote EXV wired with shielded cable				
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				
SiteLine™ cloud-connected controls included and needs to be commissioned				
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 Aplied sales representative*. State size, number and type of conductors and conduits installed:
   a. From Power supply to chiller ______________________________

* Refer to NFPA 70-2017, Article 440.35

2. Remote Evaporator piping incomplete or incorrect. Provide approved piping diagrams.
3. Items on this list incorrectly acknowledged resulting in delayed start and possible extra expenses incurred by return trips.

Contractor Representative

Signed: ______________________

Name: ______________________

Company: ______________________

Date: ______________________

Phone/Email: ______________________

Daikin Applied Sales Representative

Signed: ______________________

Name: ______________________

Company: ______________________

Date: ______________________

Phone/Email: ______________________

Warranty Registration Form

New Chiller Start-Up Form - Warranty Registration
AGZ Scroll Compressor Chillers

This form must be completely filled out and returned to Daikin Applied (Warranty Department) within ten (10) days of start-up in order to comply with the terms of the Daikin Applied Limited Product Warranty.
Complete and email to: CHLWarrantyStartup@daikinapplied.com

JOB INFORMATION

Job Name:

Daikin Applied G.O.:

Startup Date:

No. of Units at Site:

Daikin Applied S.O.:

Installation Notes:

Purchasing Contractor Information:

UNIT INFORMATION

Unit Model No.:

Serial No.:

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

Benshaw/DRC Control Box M/M#:

Benshaw/DRC Control Box S/N#:

Before beginning, confirm that items on the Pre-Start Checklist have been completed and initial:

Note Discrepancies here or on Page 6:

PRE START-UP CHECKLIST

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

Is the unit free of visible shipping damage, corrosion, or paint problems?	Yes	No	N/A
Is unit level and isolators installed?	Yes	No	N/A
Does the unit meet all location, installation and service clearances per IOM Bulletin?	Yes	No	N/A
Are all fan fastener nuts on the fans tights?	Yes	No	N/A
Does electrical service correspond to unit nameplate?	Yes	No	N/A

Nameplate: Volts: ______ Hertz: ______ Phase: ______

Has electrical service been checked for proper phasing at each circuit power terminal block?	Yes	No	N/A
Has unit been properly grounded and all field wiring confirmed to unit electrical specifications?	Yes	No	N/A
Has a fused disconnect and fuses or breaker been sized per product manual and installed per local code?	Yes	No	N/A

Number of Conduits: ______ Number of Wires: ______ Wire Size: ______

Are all electrical power connections tight?	Yes	No	N/A
Has power been applied for 24 hours prior to start-up?	Yes	No	N/A
Does all field wiring conform to unit electrical specifications?	Yes	No	N/A
Are all service and liquid line valves per the IOMM in correct position?	Yes	No	N/A
Water Strainer installed? Brazed Plate Evaporator 0.063" (1.6mm) or smaller perforations	Yes	No	N/A
Has a flow switch been installed per the IOM manual?	Yes	No	N/A
Has the chilled water circuit been cleaned, flushed, and water treatment confirmed?	Yes	No	N/A
Does the chiller water piping conform to the IOM manual?	Yes	No	N/A
Are fans properly aligned and turn freely?	Yes	No	N/A
Is wind impingement against the air-cooled condenser a consideration?	Yes	No	N/A
Are the condenser coils coated?	Yes	No	N/A

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

REFRIGERANT PIPING FOR REMOTE EVAPORATOR APPLICATIONS

Reviewed and confirmed piping is per the approved SF-99006 form submitted to the factory?	Yes	No	N/A
Has all field piping been leak tested? (R-410a at 150 psig [1034 kPA], R-32 at 300 psig [2068 kPa])	Yes	No	N/A
Has system been properly evacuated and charged?	Yes	No	N/A

Refrigerant: ______ Circuit 1: ______ lbs. Circuit 2: ______ lbs.

Is a liquid line filter-drier installed in each circuit?	Yes	No	N/A
Is a liquid line solenoid installed correctly in each circuit?	Yes	No	N/A
Is the suction temperature sensor properly installed?	Yes	No	N/A

DESIGN CONTROLS

CHILLER

Water Pressure Drop: ______ psig (kPa) ______ Ft. (kPa) ______ gpm (lps)

Water Temperatures: Entering: ______ °F (°C) Leaving: ______ °F (°C)

CONDENSER

Design Ambient Temperatures: Entering: ______ °F (°C) Leaving: ______ °F (°C)

Minimum Ambient Temperatures: Entering: ______ °F (°C) Leaving: ______ °F (°C)

START-UP

Does unit start and perform per sequence of operation as stated in the IOM Manual?	Yes	No
Do condenser fans rotate in the proper directions?	Yes	No

HMI STATUS CHECK

Each Reading Must be Verified with Field Provided Instruments of Known Accuracy

Water Temperatures	HMI	Verification
Leaving Evaporator:	°F (°C)	°F (°C)
Entering Evaporator:	°F (°C)	°F (°C)
Circuit #1 Refrigerant Pressures		
Evaporator:	psig (kPa)	psig (kPa)
Liquid Lines Pressure:		psig (kPa)
Condenser Pressure:	psig (kPa)	psig (kPa)
Circuit #2 Refrigerant Pressures		
Evaporator:	psig (kPa)	psig (kPa)
Liquid Lines Pressure:		psig (kPa)
Condenser Pressure:	psig (kPa)	psig (kPa)
Circuit #1 Refrigerant Temperatures		
Saturated Evaporator Temperature:	°F (°C)	°F (°C)
Suction Line Temperature:	°F (°C)	°F (°C)
Suction Superheat:	°F (°C)	°F (°C)
Saturated Condenser Temperature:	°F (°C)	°F (°C)
Liquid Line Temperature:		°F (°C)
Subcooling:		°F (°C)
Discharge Temperature:		°F (°C)
Circuit #2 Refrigerant Temperatures:		
Saturated Evaporator Temperature:	°F (°C)	°F (°C)
Suction Line Temperature:	°F (°C)	°F (°C)
Suction Superheat:	°F (°C)	°F (°C)
Saturated Condenser Temperature:	°F (°C)	°F (°C)
Liquid Line Temperature:		°F (°C)
Subcooling:		°F (°C)
Discharge Temperature:		°F (°C)
Ambient Air Temperature:	°F (°C)	°F (°C)

NON-MICROTECH READINGS

Water Pressure Drop: ______ (ft) ______ (psig) ______ (gpm)*

NOTE: Actual DP ft ÷ Design DP ft = √ x Design GPM = Actual GPM

Does the system contain glycol? ☐ Yes ☐ No

Percentage by weight: ______ or by volume: ______ Glycol Type: ______

If the chilled water system include glycol, have the freeze protection, low pressure devices and settings been adjusted for the actual job requirements? Detail these settings on page 8 - Remarks section ☐ Yes ☐ No

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

Unit Voltage Across Each Phase: L1-L2: ______ V L2-L3: ______ V L1-L3: ______ V

Unit Current Per Phase: L1 amps: ______ V L2 amps: ______ V L3 amps: ______ V

Compressor Current Per Phase:

Compressor #1: ______ V	L1 amps: ______ V	L2 amps: ______ V	L3 amps: ______ V
Compressor #2: ______ V	L1 amps: ______ V	L2 amps: ______ V	L3 amps: ______ V
Compressor #3: ______ V	L1 amps: ______ V	L2 amps: ______ V	L3 amps: ______ V
Compressor #4: ______ V	L1 amps: ______ V	L2 amps: ______ V	L3 amps: ______ V
Compressor #5: ______ V	L1 amps: ______ V	L2 amps: ______ V	L3 amps: ______ V
Compressor #6: ______ V	L1 amps: ______ V	L2 amps: ______ V	L3 amps: ______ V

MICROTECH SETPOINTS

ALARM SETPOINTS MUST BE VERIFIED WITH INSTRUMENTS OF KNOWN ACCURACY

Leaving Evaporator:	______ °F (°C)	Low Pressure Hold:	______ psig (kPa)
Reset Leaving:	______ °F (°C)	Low Pressure Unload:	______ psig (kPa)
Reset Signal:	______ ma	Evaporator Water Freeze:	______ psig (kPa)
Reset Option:	______	High Pressure Cut-Out:	______ psig (kPa)
Maximum Chilled Water Reset:	______ °F (°C)	Unit Type:	______
Return Setpoint:	______ °F (°C)	Number of Compressors:	______
Maximum Pulldown:	______ °F (°C)	Number of Stages:	______
Evaporator Full Load Delta T:	______ °F (°C)	Number of Fab Stages:	______
Evap Recirc Timer:	______ sec.	Software Version:	______
Start-to-stop Delay:	______ min.		
Stop-to-stop Delay:	______ min.		
Stage Up Delay:	______ sec.		
Stage Down Delay:	______ sec.		

SITELINE (IF APPLICABLE)

Gateway Serial Number(s): ______ MAC Address: ______

ICCID: ______ Confirm ethernet cable connection: Yes No N/A

Confirm hardware is installed and wired:

Connected from two antennas to CELL MAIN and CELL DIV ports on gateway (Cellular installation) or one antenna to WiFi/BT port on gateway (Wi-Fi installation) or LAN switch to Eth0 port on gateway (LAN installation) Yes No N/A

Confirm Ethernet cable connected between Eth1 port on gateway and Equipment unit controller (TIP port on MT3) Yes No N/A

Configure Wi-Fi or LAN Settings (if applicable) (Refer IM1332 Appendix A):

Wi-Fi settings configured in gateway Yes No N/A

LAN settings configured in gateway Yes No N/A

Record Signal Strength from Gateway User Interface (should be in Good or Excellent range): ______

Confirm cloud connectivity:

Call Controls Technical Response Center (TRC) at (866) 462-7829 to confirm data transfer: Yes No N/A

Submit Commissioning Procedure in SiteLine User Interface Yes No N/A

Has SiteLine been explained to end user? Yes No N/A

Have operator instructions been provided to end user? Yes No N/A

Hours of training: ______

If the answer to any of the above is "no," explain:

SUMMARY & SIGNATURES

Are all control lines secure to prevent excess vibration and wear? Yes No

Are all gauges shut off, valve caps, and packings tight after startup? Yes No

Has the chiller been leak tested? Detail refrigerant leaks and repairs below Yes No

Refrigerant Leaks:

Repairs Made:

Items not installed per IOM Manual and/or recommended corrective actions:

	Print Name	Signature	Date:
Mechanical Contractor Signature:			Date:
Electrical Contractor Signature:			Date:
Customer Signature:			Date:
Technician Signature:			Date:
Daikin Applied Service Manager Review:			Date:

IVS SENSORLESS PUMP COMMISSIONING CHECK SHEET
FOR PUMP PACKAGE UNITS ONLY

Project Name:			
Building Address:			
Contractor Name:			
Site Contact Name:		Site Contact Number:	
Your Company:		Your Name:	
Pump Model:		Pump Tag Number:	
Pump Serial:		Sales Order Number:	

NOTE: For independent sensorless operation, go to Section 1. For independent external sensor operation, go to Section 2. For external controller, go to Section 3.

SECTION 1 - SENSORLESS STARTUP PROCEDURE

Complete

1. Open up and bleed pump seal flush line to verify no air has travelled into seal / seal lines
2. Change parameter 0-20 (default value is option 1601 – "Reference [Unit]") to option 1850 "Sensorless Readout" to display Sensorless flow readout on the top left corner of screen
3. Change parameter 0-22 (default value is option 1610 – "Power [kW]") to option 1654 "Feedback 1 [Unit]" to display Sensorless pressure readout on the top right corner of screen
4. Open the discharge valve and set the pump to the design duty speed and record the VFD Sensorless pressure and flow readout (include units). This is what the actual system flow and head are.

   SENSORLESS PRESSURE =

   SENSORLESS FLOW =
5. Ramp the pump up or down to achieve the design flow. Record the VFD sensorless flow and pressure –this will be your new setpoint.

   SENSORLESS PRESSURE =

   SENSORLESS FLOW =
6. Set parameter 20-21 to the Sensorless Pressure readout taken in previous step
7. Set parameter 22-89 to the Sensorless Flow readout taken in previous step
8. Set parameter 22-87 to a value that is 40% of the value in 20-21. You have now readjusted the quadratic control curve to match actual site conditions.
9. Change parameter 0-20 back to the default value of option 1601 – "Reference [Unit]"
10. Change parameter 0-22 back to the default value of option 1610 – "Power [kW]"
11. Put the VFD into AUTO mode. The pump will ramp up to get to the setpoint pressure and as the demand in the system decreases, the setpoint will also decrease to ride the control curve down to the minimum pressure set in parameter 22-87. As demand increases, it will ride back up the control curve to full design setpoint.

SECTION 2- EXTERNAL SENSOR STARTUP PROCEDURE

Complete

1. Open up and bleed pump seal flush line to verify no air has travelled into seal / seal lines 2a. If your sensor provides a voltage (V) signal, go to step 3
2. a. If your sensor provides a voltage (V) signal, go to step 3.
   b. your sensor provides a milliamp (mA) signal, make sure switch S202 for A54 (located behind the keypad) is pushed to the ON position (to the right) and go to step 5.
3. Change parameter 6-20 to match the low end of voltage signal from the sensor (eg: if your sensor provides a 0-10V signal, enter 0). Go to step 4.
4. Change parameter 6-21 to match the high end of voltage signal from the sensor (eg: if your sensor provides a 0-10V signal, enter 10). Go to step 7.
5. Change parameter 6-22 to match the high end of current signal from the sensor (eg: if your sensor provides a 4-20mA signal, enter 4). Go to step 6.
6. Change parameter 6-23 to match the high end of current signal from the sensor (eg: if your sensor provides a 4-20mA signal, enter 20). Go to step 7.
7. Change parameter 20-00 (default value is option 105 – "Sensorless Pressure") to option 2 "Analog input 54" to make drive look at sensor reading for feedback value
8. Change parameter 20-12 to the unit that matches your sensor measurement units (eg: if you have a pressure sensor, it will be in units of pressure like psi)
9. Change parameter 20-13 to the value that matches the bottom end of your sensor measurement scale (eg: if your pressure sensor measures from 2-100psi, you enter a value of 2)
10. Change parameter 20-14 to the value that matches the high end of your sensor measurement scale (eg: if your pressure sensor measures from 2-100psi, you enter a value of 100)
11. Set parameter 20-21 the setpoint you want the pump to maintain
12. Change parameter 22-80 (default value is 1 "Enabled") to option 0 "Disabled"
13. Put the VFD into AUTO mode – it will now display the sensor reading in the center of the screen and the target setpoint on the top left of the screen. It will ramp up / down to meet the setpoint based on the sensor reading.

SECTION 3 – EXTERNAL CONTROLLER (BAS) STARTUP PROCEDURE

Complete

1. Open up and bleed pump seal flush line to verify no air has travelled into seal / seal lines
2. Change parameter 0-20 to option 1602 "Reference %" to show the percent speed signal on top left corner
3. Change parameter 1-00 to option 0 "Open Loop" (drive will 'listen' for external speed reference)
4. Change parameter 3-02 to "0" (this is the minimum speed signal)
5. Change parameter 3-03 to "60" (this is the maximum speed signal)
6. Change parameter 3-15 to option 1 "Analog Input 53"
7. Put the VFD into AUTO mode – the VFD will now ramp up / down based on the analog speed signal it receives on terminal 53. You can check what the drive is seeing on the input by going to parameter 16-62.

Limited Product Warranty

DAIKIN APPLIED AMERICAS INC.
LIMITED PRODUCT WARRANTY
(**United States and Canada**)

WARRANTY

Daikin Applied Americas Inc. dba Daikin Applied ("Company") warrants to contractor, purchaser and any owner of the product (collectively "Owner") that, subject to the exclusions set forth below Company, at its option, will repair or replace defective parts in the event any product manufactured by Company, including products sold under the brand name Daikin and used in the United States or Canada, proves defective in material or workmanship within twelve (12) months from initial startup or eighteen (18) months from the date shipped by Company, whichever occurs first. Authorized replacement parts are warranted for the remainder of the original warranty. All shipments of such parts will be made FOB factory, freight prepaid and allowed. Company reserves the right to select carrier and method of shipment. In addition, Company provides labor to repair or replace warranty parts during Company normal working hours on products with rotary screw compressors or centrifugal compressors. Warranty labor is not provided for any other products.

Company must receive the Registration and Startup Forms for products containing motor compressors and/or furnaces within ten (10) days of original product startup, or the ship date and the startup date will be deemed the same for determining the commencement of the warranty period and this warranty shall expire twelve (12) months from that date. For additional consideration, Company will provide an extended warranty(ies) on certain products or components thereof. The terms of the extended warranty(ies) are shown on a separate extended warranty statement.

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

EXCLUSIONS

1. If free warranty labor is available as set forth above, such free labor does not include diagnostic visits, inspections, travel time and related expenses, or unusual access time or costs required by product location.
2. Refrigerants, fluids, oils and expendable items such as filters are not covered by this warranty.
3. This warranty shall not apply to products or parts : (a) that have been opened, disassembled, repaired, or altered, in each case by anyone other than Company or its authorized service representative; (b) that have been subjected to misuse, abuse, negligence, accidents, damage, or abnormal use or service; (c) that have not been properly maintained; (d) that have been operated or installed, or have had startup performed, in each case in a manner contrary to Company's printed instructions; (e) that have been exposed, directly or indirectly, to a corrosive atmosphere or material such as, but not limited to, chlorine, fluorine, fertilizers, waste water, urine, rust, salt, sulfur, ozone, or other chemicals, contaminants, minerals, or corrosive agents; (f) that were manufactured or furnished by others and/or are not an integral part of a product manufactured by Company; or (g) for which Company has not been paid in full.
4. This warranty shall not apply to products with rotary screw compressors or centrifugal compressors if such products have not been started, or if such startup has not been performed, by a Daikin Applied or Company authorized service representative.

SOLE REMEDY AND LIMITATION OF LIABILITY

THIS WARRANTY CONSTITUTES THE SOLE WARRANTY MADE BY COMPANY. COMPANY'S LIABILITY TO OWNER AND OWNER'S SOLE REMEDY UNDER THIS WARRANTY SHALL NOT EXCEED THE LESSER OF: (i) THE COST OF REPAIRING OR REPLACING DEFECTIVE PRODUCTS; AND (ii) THE ORIGINAL PURCHASE PRICE ACTUALLY PAID FOR THE PRODUCTS. COMPANY MAKES NO REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, REGARDING PREVENTION OF MOLD/MOULD, FUNGUS, BACTERIA, MICROBIAL GROWTH, OR ANY OTHER CONTAMINATES. THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT, WHICH ARE HEREBY DISCLAIMED. IN NO EVENT AND UNDER NO CIRCUMSTANCE SHALL COMPANY BE LIABLE TO OWNER OR ANY THIRD PARTY FOR INCIDENTAL, INDIRECT, SPECIAL, CONTINGENT, CONSEQUENTIAL, DELAY OR LIQUIDATED DAMAGES FOR ANY REASON, ARISING FROM ANY CAUSE WHATSOEVER, WHETHER THE THEORY FOR RECOVERY IS BASED IN LAW OR IN EQUITY, OR IS UNDER A THEORY OF BREACH CONTRACT OR WARRANTY, NEGLIGENCE, STRICT LIABILITY, OR OTHERWISE. THE TERM "CONSEQUENTIAL DAMAGE" INCLUDES, WITHOUT LIMITATION, THOSE DAMAGES ARISING FROM BUSINESS INTERRUPTION OR ECONOMIC LOSS, SUCH AS LOSS OF ANTICIPATED PROFITS, REVENUE, PRODUCTION, USE, REPUTATION, DATA OR CROPS.

ASSISTANCE

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

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