Installation, Operation, and Maintenance Manual

IOM 1264-3

Group: **Chiller**

Part Number: **IOM1264-3**

Date: **February 2022**

Navigator®
Water-cooled Screw Chillers

Model WWV
120 to 300 Tons (527 to 1055 kW)
HFC-134a Refrigerant
50/60 Hz

Manufactured in an ISO 9001 & ISO 14001 certified facility

Pre-Start Checklist – Screw Chillers

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

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

Chilled Water and Condenser Water for Water-cooled Chiller	Yes	No	N/A	Initials
Piping complete				
Water strainer(s) installed in piping per manual requirements				
Water System – flushed, filled, and vented; Water treatment in place				
Cooling tower flushed, filled, vented; Water treatment in place (if applicable)				
Pumps installed and operational (rotation checked, strainers installed and cleaned)				
Controls operational (3-way valves, face/bypass dampers, bypass valves, etc.)				
Water system operated and tested; flow meets unit design requirements				
Flow switch(es) - installed, wired, and calibrated				
Vent installed on evaporator				
Glycol at design % (if applicable)				
Electrical	**Yes**	**No**	**N/A**	**Initials**
Building controls operational				
*Power leads connected to power block or optional disconnect				
Power leads have been checked for proper phasing and voltage				
All interlock wiring complete and compliant with Daikin specifications				
Power applied at least 24 hours before startup				
Oil heaters energized at least 24 hours before startup (not applicable for WWV models)				
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 (if applicable)				
Miscellaneous	**Yes**	**No**	**N/A**	**Initials**
Unit control switches all off				
Remote Evaporator Piping factory reviewed and approved (if applicable)				
All refrigerant components/piping leak tested, evacuated and charged				
Thermometers, wells, gauges, control, etc., installed				
Minimum system load of 80% capacity available for testing/adjusting controls				
Document Attached: Technical Data Sheet from Selection Software				
Document Attached: Final Order Acknowledgement				
Document Attached: Remote evaporator piping approval (if applicable)				

Notes: The most common problems delaying start-up and affecting unit reliability are:

1. Field installed compressor motor power supply leads too small. Questions: Contact the local Daikin sales representative*. State size, number and type of conductors and conduits installed:
   a. From Power supply to chiller _____

* Refer to NEC Article 430-22 (a)

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

Cut Here

Contractor Representative

Signed: _____

Name: _____

Company: _____

Date: _____

Phone/Email: _____

Daikin Applied Sales Representative

Signed: _____

Name: _____

Company: _____

Date: _____

Phone/Email: _____

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This manual provides installation, operation, and maintenance information for Daikin Navigator® model WWV screw chillers with the MicroTech® III controller.

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

⚠ DANGER

LOCKOUT/TAGOUT all power sources prior to service, pressurizing, de-pressuring, or powering down the Chiller. Failure to follow this warning exactly can result in serious injury or death. Be sure to read and understand the installation, operation, and service instructions within this manual.

⚠ WARNING

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

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with this instruction manual, it may cause interference with radio communications. Operation of this equipment in a residential area may cause harmful interference in which case the owner will be required to correct the interference at the owner's own expense.

Daikin Applied disclaims any liability resulting from any interference or for the correction thereof.

⚠ WARNING

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

HAZARD IDENTIFICATION INFORMATION

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

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

General Description

Daikin Navigator® model WWV chillers are complete, self-contained, automatically controlled, liquid-chilling units featuring variable speed screw compressors. All model WWV chillers are equipped with a single cooling circuit and single compressor. Navigator® chillers are designed for indoor installation only. The chillers use refrigerant HFC-134a, with no ozone depletion level.

The WWV is made up of a high efficiency, new variable volume ratio (VVR®) series single screw compressor, flooded shell and tube evaporator, and a shell and tube condenser. The compressor is designed to operate in a very wide operating range and ensure the best possible efficiency in each working condition. In this regard, a sophisticated device dynamically manages the VVR®. This system ensures the optimum position of the discharge ports as a function of the operating compression ratio, choosing one among the four available positions.

All the described components are managed by an innovative microprocessor control system that optimizes operations by monitoring all the machine operating parameters. A diagnostic system helps the operator in identifying alarm and fault causes.

Only normal field connections such as water piping, electric power, and control interlocks are required, thereby simplifying installation and increasing reliability. Necessary equipment protection and operating controls are included.

All Daikin Applied screw chillers must be commissioned by a Daikin Applied service technician or an authorized service provider. Failure to follow this startup procedure can affect the equipment warranty (see “Receiving and Handling” on page 7).

The standard limited warranty on this equipment covers parts that prove defective in material or workmanship. Specific details of this warranty can be found in the warranty statement at the back of this manual.

NOMENCLATURE

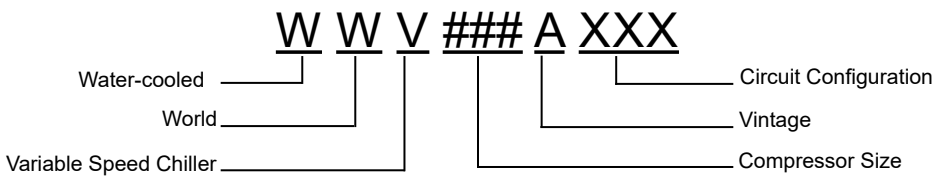


Table 1: Operating Limits for WWV Chillers

Maximum mechanical room ambient temperature	
During chiller operation	113°F (45°C)
During chiller storage - with maximum non-condensable relative humidity of 95%	122°F (50°C)
Evaporator outlet fluid temperature range	25.0°F (-3.9°C) to 68°F (20°C)
Evaporator outlet fluid temperature requiring glycol	< 40°F (4.4°C)
Maximum fluid temperature in evaporator for startup	109.4° F (43°C)
Condenser inlet fluid temperature range	60.8°F (16°C) to 122°F (50°C)
Range of evaporator and condenser fluid temperature change across vessels	7.2°F (4°C) to 14.4°F (8°C)

NOTE: Low fluid temperatures or high equipment room humidity may require optional double evaporator insulation. The system designer should determine its necessity.

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.
- Vessel nameplates are located on the evaporator and condenser. They have a National Board Number (NB) and a serial number, either of which identify the vessel (but not the entire unit).
- Compressor nameplate is located on each compressor and gives pertinent electrical information.

Receiving and Handling

The unit should be inspected immediately after receipt for possible damage. All Daikin Applied screw water-cooled chillers are shipped FOB factory and all claims for handling and shipping damage are the responsibility of the consignee.

Startup by a Daikin Applied service representative is included on all Navigator® units sold for installation within the U.S. and Canada and must be performed by them to initiate the standard Limited Product Warranty. Startup by any party other than a Daikin Applied service representative will void the Limited Product Warranty. Two-week prior notification of startup is required. The contractor should obtain a copy of the Startup Scheduled Request Form from the sales representative or from the nearest Daikin Applied service office. A pre-start checklist is located at the front of this manual.

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

⚠ CAUTION

Extreme care must be used when rigging the unit to prevent damage to the control panels and unit frame. See the certified dimension 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.

⚠ 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.

⚠ WARNING

Escaping refrigerant can displace air and cause suffocation. Immediately evacuate and ventilate the equipment area. If the unit is damaged, follow Environmental Protection Agency (EPA) requirements. Do not expose sparks, arcing equipment, open flame or other ignition source to the refrigerant.

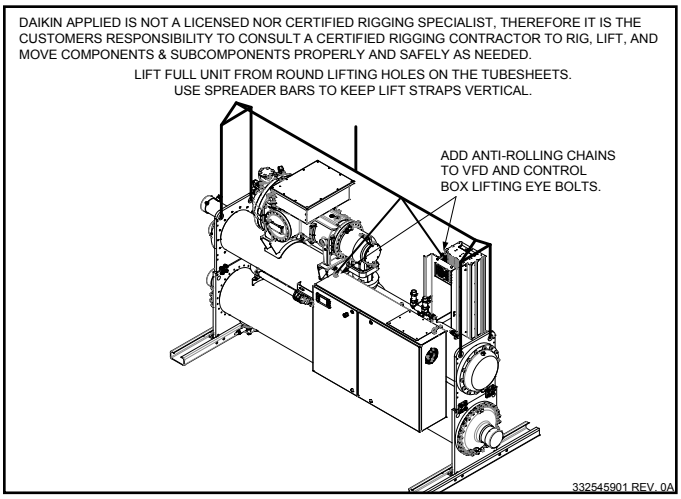
⚠ DANGER

Improper rigging, lifting, or moving of a unit can result in unit damage, property damage, severe personal injury or death. Follow rigging and moving instructions carefully.

Avoid rough handling shock due to impact or dropping the unit. Do not push or pull the unit; a forklift should not be used to directly lift the unit. Never allow any part of the unit to fall during unloading or moving as this can result in serious damage. Use extreme caution when handling the unit to prevent damage to the control panel and the refrigerant pipes.

The unit must be lifted by connecting rigging in each of the four corners, where the lifting holes are located on the vessel tube sheet (see lifting instructions). Spreader bars must be used along the line connecting the lifting holes to prevent damages to the electrical panel and the compressor terminal bo. Do not use any other point to lift the machine. (see Figure 1). Various lifting lugs and lifting holes are available on the unit to assist in servicing the unit or lifting components with the knockdown option. These component lugs should not be used for lifting the unit.

Figure 1: WWV Unit Rigging



NOTE: 1. Lengthwise spreader bars and anti-rolling chains must be used to avoid damage to unit. The spreader bars in Figure 1 are a representation only and may not reflect the appearance of the actual spreader bars needed.

2. The actual unit configuration may vary from this diagram. See the dimensional drawing section beginning on page 20 to identify the lifting point locations based on specific unit model.

Lifting instructions:

1. Rigging equipment, lifting accessories and handling procedures must comply with local regulations and legislation.
2. To lift the machine, use only the holes on the heat exchangers.
3. The rigging equipment and hooks used must have capacity suited to the load.

4. The installer must correctly select and use lifting equipment. It is recommend to use cables with minimum vertical capacity equal to the total machine weight.
5. The machine must be lifted slowly and well leveled. It is recommended to initially lift the unit to a low height to verify all rigging equipment is properly installed and unit is level. Adjust the lifting equipment, if necessary, to ensure the leveling and re-lift.
6. If not able to lift the unit directly into place and must go through a door for installation, a certified, licensed professional rigger must determine the lifting and rigging process as required by the site specific installation.

Unit Placement

The unit must be mounted on a level cement or steel base, suitable to support the overall weight of the complete machine in operation, and must be positioned so as to provide space for maintenance at one end of the unit, to allow the cleaning and/or the removal of the evaporator and the condenser tubes. The condenser and evaporator tubes are expanded inside the tube sheets to allow replacement, if necessary. Refer to Figure 2 below for clearance requirements.

The machine position should be designed to ensure access to all the safety and control devices. Never cover the safety devices (safety valves, pressure switches). The safety valves must be connected externally.

These units include the installation of safety valves for each exchanger, installed on an exchange tap, which always maintains an active valve. Thus, safety valves must be connected outside of the equipment room.

Mounting Hole Access

After positioning, the shipping rails should be removed and the machine must be firmly anchored to the ground or foreseen metal structure to support the machine. In this regard, 0.87 in (22 mm) diameter holes are included on the unit supports for securing mounting bolts, etc. Mounting location dimensions are given in Dimensional Drawings beginning on page 20. When mounted, the base of the unit must be level to within ± ½ inch (12.7 mm) across the length and width of the unit.

Service Access

The control panels are located on the front of the chiller and require a minimum of four feet of clearance in front of the panels.

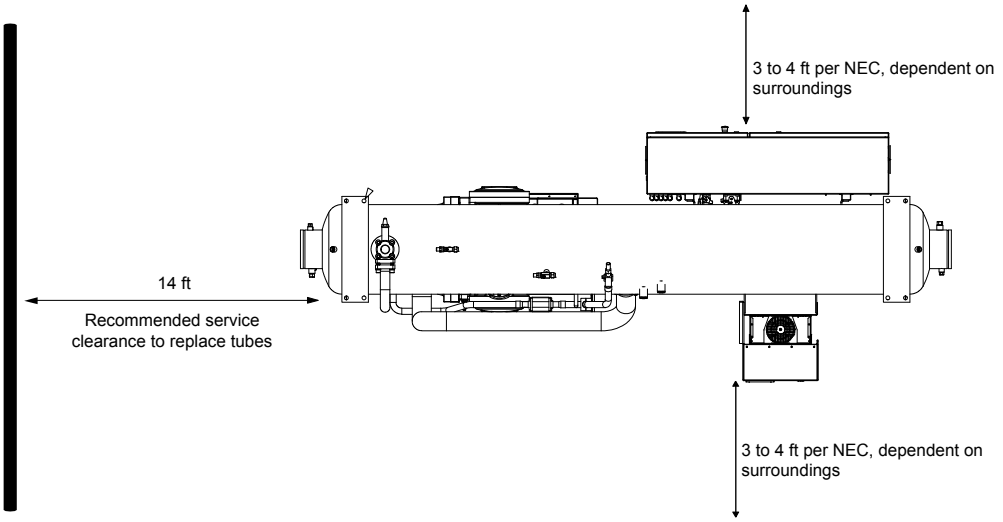
⚠ DANGER

Disconnect, lockout and tag all electrical power to the unit before servicing compressors and/or recovering refrigerant. Failure to do so can cause bodily injury or death.

Clearance Requirements

The unit must be placed in an area that allows for adequate clearance around the unit. See Figure 2 below for clearance requirements around the sides of the chiller. Doors and removable wall sections can be utilized to meet these clearance requirements. There must be a minimum of 3 to 4-feet clearance above the top of the chiller. The U.S. National Electric Code (NEC) or local codes can require more clearance in and around electrical components and must be checked for compliance.

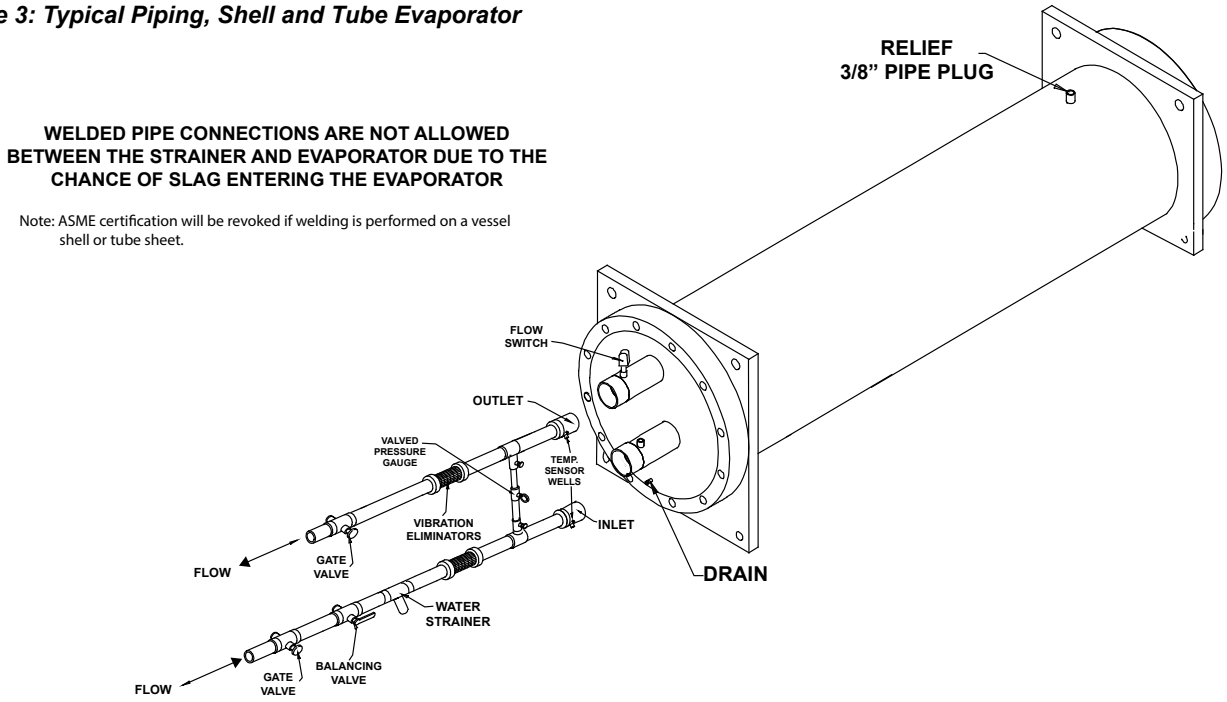
Figure 2: Service Clearance



NOTE: Electrical conduit and field installed electrical devices should not block service access to any chiller components.

Heat Exchanger Water Piping

Figure 3: Typical Piping, Shell and Tube Evaporator



Be sure that water inlet and outlet connections match certified drawings and nozzle markings.

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

- air vents at the high points.
- a cleanable water strainer upstream of the evaporator and condenser inlet connections.
- a flow proving device for both the evaporator and condenser to prevent freeze up. Flow switches, thermal dispersion switches, or Delta-P switches can be used. Note that thermal dispersion flow switches are factory installed as standard. Additional flow switches can be used only if they are connected in series with the ones already provided.
- sufficient shutoff valves to allow vessel isolation. The chiller must be capable of draining the water from the evaporator or condenser without draining the complete system.
- matching mechanical connections. All evaporators and condensers have OGS-type grooved water connections (adhering to Standard AWWA C606) or optional flange connections. **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 product. POE oil, if ever in contact with PVC/CPVC, will coat the inside wall of PVC/CPVC pipe causing environmental stress fractures. Although there is no PVC/CPVC piping in this product, please keep this in mind when selecting piping materials for your application, as system failure and property damage could result. Refer to the pipe manufacturer's recommendations to determine suitable applications of the pipe.

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

- temperature sensors at the inlet and outlet connections of both vessels.
- water pressure gauge connection taps and gauges at the inlet and outlet connections of both vessels for measuring water pressure drop.

⚠ CAUTION

When common piping is used for both building heating and cooling modes, care must be taken to provide that water flowing through the evaporator cannot exceed 110°F. Water this hot can damage controls or cause the relief valve to discharge refrigerant.

Piping must be supported to eliminate weight and strain on the fittings and connections. Chilled water piping must be adequately insulated.

System Water Volume

All chilled water systems need adequate time to recognize a load change, respond to that load change and stabilize, without undesirable short cycling of the compressors or loss of 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.

A storage tank may have to be added to the system to reach

the recommended system volume. Refer to AG 31-003 for method of calculating “Minimum Chilled Water Volume”.

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

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

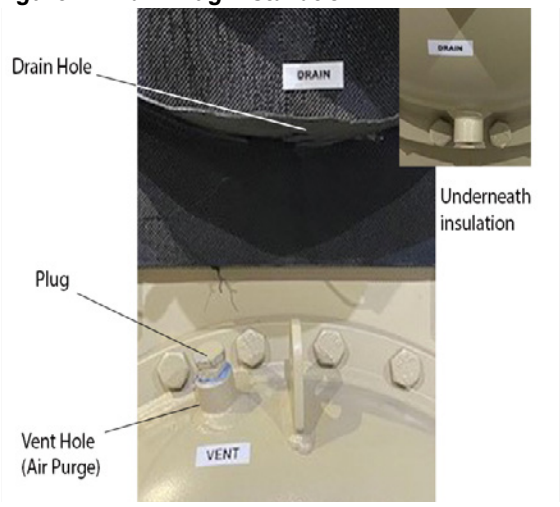
⚠ CAUTION

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

Vessel Drains at Startup

The unit is drained of water at the factory. Drain plugs for each vessel head are shipped separately in the control box. Units are shipped with the drain plug in the top water box vent hole and no plug in the bottom drain hole. Install the bottom drain plugs prior to filling the vessel with fluid. See Figure 4.

Figure 4: Drain Plug Installation



Flow Switch

A flow switch must be included in the chilled water system to prove that there is adequate water flow to the evaporator before the unit can start or to shut down the unit if water flow is interrupted. A solid state, thermal dispersion flow switch that is factory-wired is standard and is mounted in the chiller leaving water nozzle.

Temperature sensors and pressure gages are recommended on the water pipes near the heat exchangers connections. Furthermore, air vents must also be installed at the highest points on the pipe.

Should water pump noise be excessive, we recommend using flexible connectors at both pump or chiller inlet and outlet.

Variable Speed Pumping

Reducing evaporator flow in proportion to load can reduce system power consumption. Daikin Applied chillers are designed for variable water flow duty provided that the rate of change is less than 10 percent of the design flow per minute, and the minimum and maximum flow rates for the evaporator are not exceeded. If flow drops below the minimum allowable, large reductions in heat transfer can occur. If the flow exceeds the maximum rate, excessive pressure drop and tube erosion can occur. 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.

Glycol Solutions

Test coolant with a clean, accurate glycol solution hydrometer or refractometer to determine the freezing point. On glycol applications, the supplier normally recommends that a minimum of 25% solution by weight be used for protection against corrosion or that additional inhibitors should be employed.

The use of glycol may impact system performance depending on its concentration and should be considered during initial system design.

⚠ CAUTION

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

Ice Mode

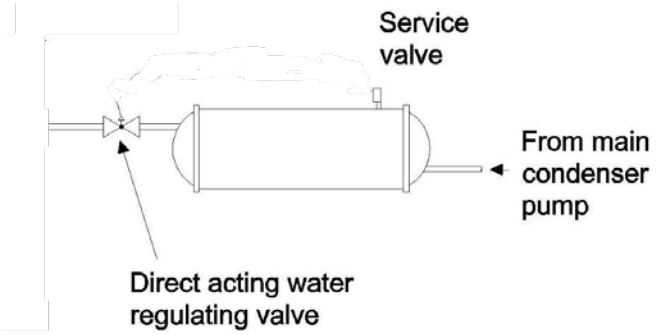
Ice making chillers will run very cold fluid during off hours, when energy is least expensive, to build a tank of ice. In ice building mode, the unit will operate at full load until the shutoff temperature setpoint is reached. Optional double evaporator insulation is recommended for ice mode operation. The standard controller software will require “ice” setpoint changes and a digital signal into the controller is required to change to the ice mode and back to standard cooling. Set points related to ice mode can be found in See Unit Level Set Points on page 22 and wiring connection points are shown in Figure 11 on page 14.

Condenser Water Control

The minimum condenser inlet water temperature should not be less than 60°F (15.6°C). If the water temperature is lower, a method of condenser water temperature control will be required. Cooling tower control is discussed beginning on page 30.

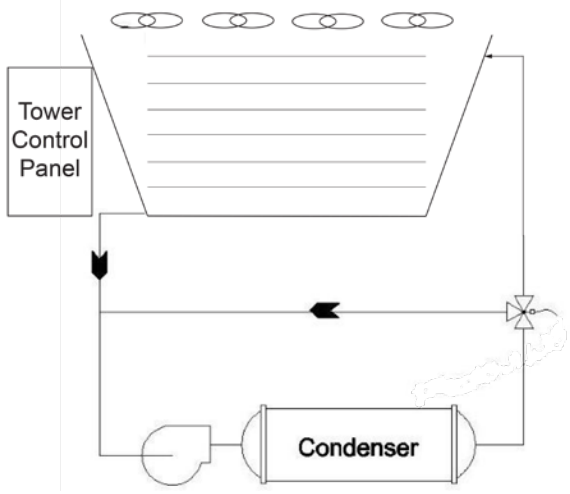
Two-Way Bypass Valve Operation: A two-way regulating control valve can control flow to ensure adequated condenser water temperature. The unit controller can send a 0-10Vdc signal to the valve to modulate its position.

Figure 5: Water Tower Connections - 2-Way Valve



Three-Way Bypass Valve Operation: To modulate the water temperature in the condenser, install a three-way by-pass valve. Figure 6 shows how the three-way valve is applied in the condenser water system. The three-way valve position can be modulated by a 0-10Vdc signal from the unit controller to regulates proper water temperature.

Figure 6: Water Tower Connections - 3-Way Valve



VFD Operating with a Condenser Water Pump: In place of a valve, use a circulation pump controlled by an inverter.

The VFD speed may be controlled by an analog 0-10 Vdc signal issued by the controller according to the water temperature entering the condenser.

Relief Valves

As a safety precaution and to meet code requirements, each chiller is equipped with pressure relief valves located on the condenser and evaporator for the purpose of relieving excessive refrigerant pressure (caused by equipment malfunction, fire, etc.) to the atmosphere.

Table 2: Three-Way Relief Valve Data

Chiller	WWV	
Relief Valve	Evaporator	Condenser
Location	Top of vessel	Top of vessel
Pressure Setting (psi)	225	300
Discharge Cap.(lb/min air)	84.4	111
Qty	1 set	1 set
Connection Size	1.0-inch female NPT	1.0-inch female NPT

Building codes require that relief valves be vented to the outside of a building. Relief piping connections to the relief valves must have flexible connectors.

Remove plastic shipping plugs (if installed) from the inside of the valves prior to making pipe connections. Whenever vent piping is installed, the lines must be in accordance with local code requirements and ANSI/ASHRAE Standard 15 code recommendations must be followed.

In order to ensure proper installation, it is important to know how the three-way relief valve functions. One valve remains active at all times and the second valve acts as a standby. When the stem of the three-way valve is turned into the valve completely, the valve is in “Front Seated Position” and all refrigerant will flow through the back outlet port, as shown in Figure 8. When the stem of the three-way valve is turned back completely, the valve is in “Back Seated Position” and all refrigerant will flow through the front outlet port as shown in Figure 9.

Figure 7: Three-Way Relief Valve

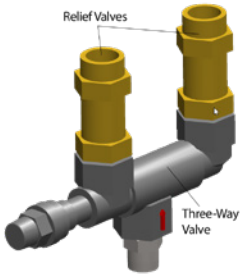


Figure 8: Three-Way Valve, Front Seated Position

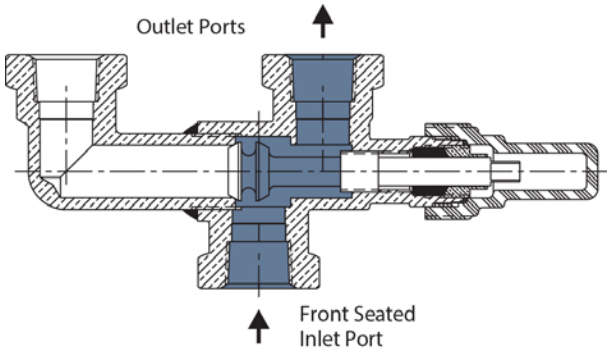
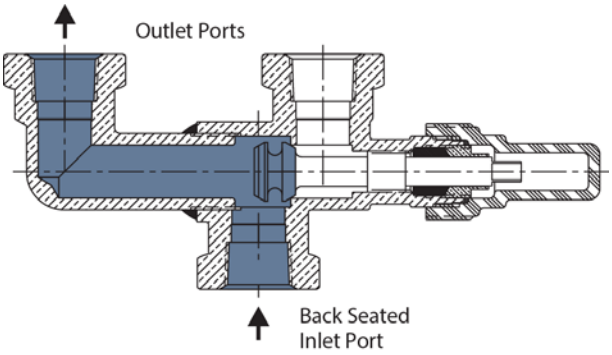


Figure 9: Three-Way Valve, Back Seated Position

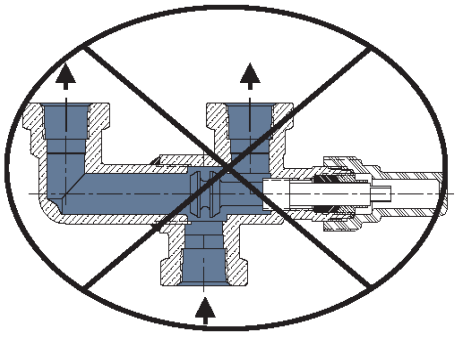


When the valve stem is not turned forward or turned back completely, the valve is in "Mid Position," as shown in Figure 10.

⚠ CAUTION

Do not operate the system with the three-way valve stem in the Mid Position.

Figure 10: Three-Way Valve, Mid Position



Electrical Connections

Power wiring connections to the chiller may be done with either copper or aluminum wiring. Wire should be sized and installed per NEC and/or local codes. Wire sizing and wire count must fit in the power connection lug sizing listed in chiller submittals. All wiring within the unit is sized in accordance with the U.S.A National Electrical Code. Refer to the unit nameplate and the submittals for the correct electrical ratings.

⚠ DANGER

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

The field power wiring required varies depending on unit model. See page 14 for wiring information. These wiring diagrams are also provided with the chiller.

NOTE: Wiring, fuse, and wire size must be in accordance with the National Electric 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 NEMA MG-1 Standard, it is most important that the unbalance between phases be kept at a minimum.

⚠ CAUTION

Do not use power factor correction capacitors with WWV chillers. Doing so can cause harmful electrical resonance in the system. Correction capacitors are not necessary since VFDs inherently maintain high power factors.

Control panels are rated for the amount of current that can be passed through it and still contain the damage within the enclosure; this value is known as the short circuit panel rating as shown in Table 3 and is standard on all WWV models.

Table 3: Short Circuit Current Ratings (kAmps)

Voltage/Hz	High Short Circuit Panel Rating
460/60	65kA
380/60	
400/50	
575/60	25kA

Field-supplied disconnect switches are required if not factory-supplied with the unit. Disconnecting means are addressed by Article 440 of the U.S.A. National Electrical Code (NEC), which requires "disconnecting means capable of disconnecting air conditioning and refrigerating equipment including motor-compressors, and controllers from the circuit feeder." Select and locate the disconnect switch per the NEC guidelines.

Control Circuit

The unit control circuit is powered at 120 Vac. Terminals are provided in the unit control panel for optional field hookup of the control circuit to a separate fused 115-volt power supply in lieu of the standard factory installed control transformer.

Water flow switch interlock terminals are included in the controller. See Field Wiring Diagram - Single Point Power on page 14 for the correct connections in the field. The purpose of the water flow switch interlock is to prevent the compressor from running while the evaporator and condenser water pumps

come online and provide the correct water flow.

It is best to leave pump control to the unit controller for better system management. If an external system independently manages pump starts, use the following guidelines:

- Turn on evaporator pump 2 minutes before enabling the machine
- Turn off evaporator pump 5 minutes after disabling the machine

Use with On-Site Generators

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

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.

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

1. Set the generator to always run five minutes longer than the unit start-to-start timer, which can be set from two to sixty minutes, while keeping the chiller powered by the generator until the fully Synchronized AutomaticTransfer Switch properly hands over chiller power from the site.
2. Configure the transfer switch provided with the generator to automatically shut down the chiller before transfer is made. The automatic shut-off function can be accomplished through a BAS interface or with “remote on/off” wiring connection shown in “Figure 11: Field Wiring Diagram - Single Point Power” on page 14.

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

Long Term Storage

This information applies to new units being stored waiting for startup or to existing units that may be inoperative for an extended period of time.

The chiller must be stored in a dry location and protected from any damage or sources of corrosion. A Daikin Applied service representative must perform an inspection and leak test of the unit on 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 or for repairs to the unit during the period of storage, 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.

Should it be necessary to store the unit prior to installation, it is necessary to observe some precautions.

- Do not remove the protective plastic
- Do not leave the unit exposed to the elements
- Do not expose the unit to direct sunlight
- Do not use the machine near a heat source and/or open flame
- Keep in places where room temperature is between + 41°F (5°C) to 130°F (54.4°C) (room temperature over the maximum limit may trigger the relief valve resulting in loss of refrigerant).

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

Figure 11: Field Wiring Diagram - Single Point Power

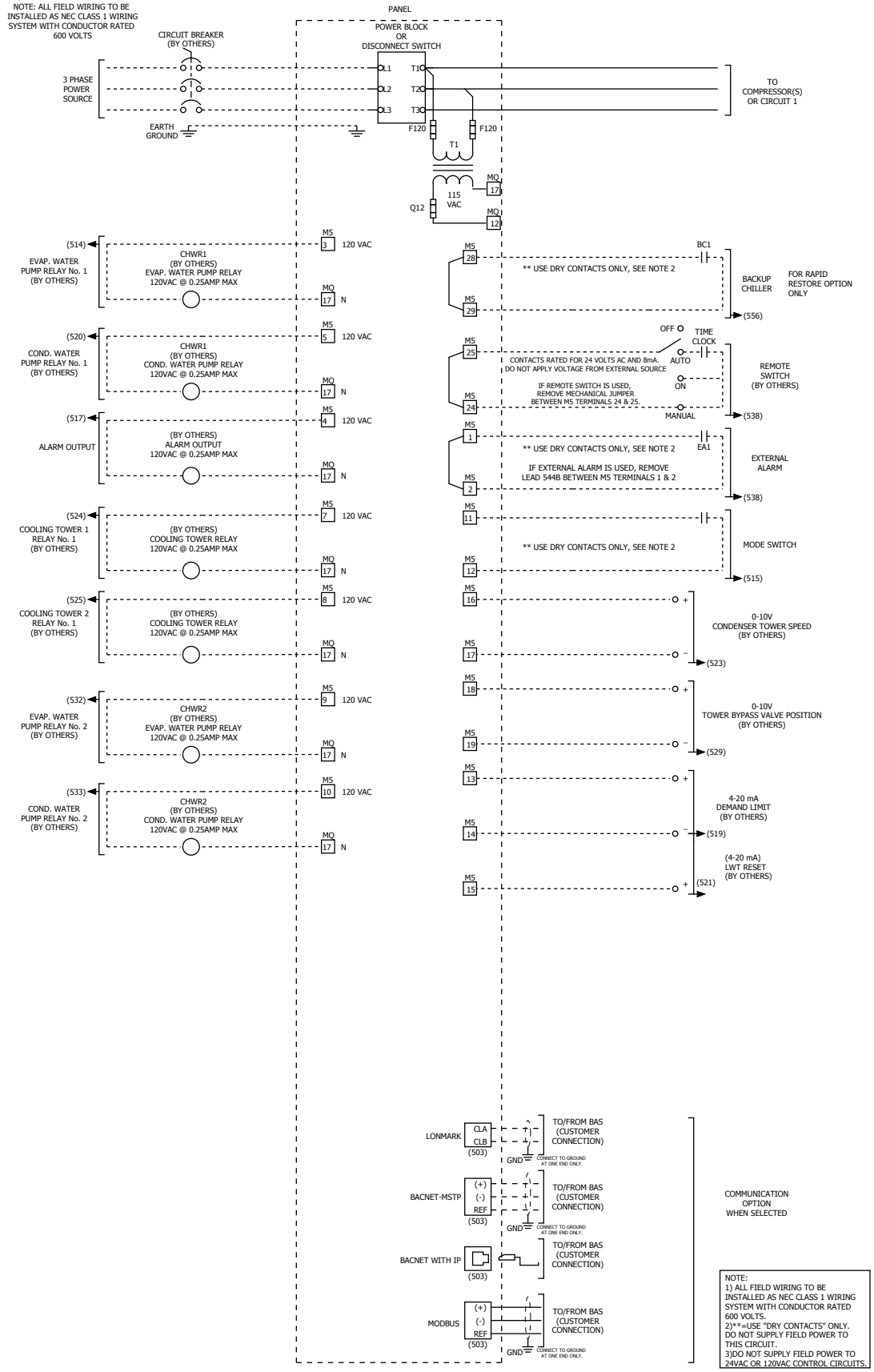


Figure 12: Typical Refrigerant Piping Diagram

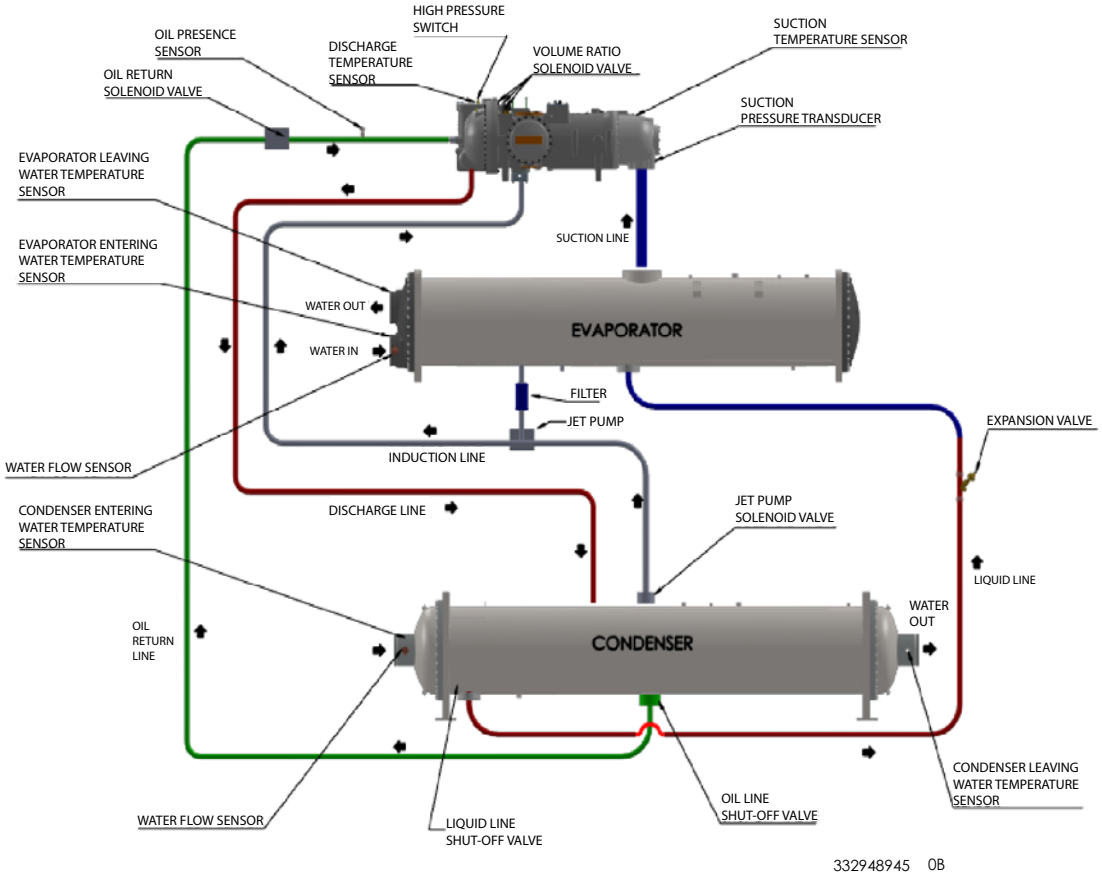
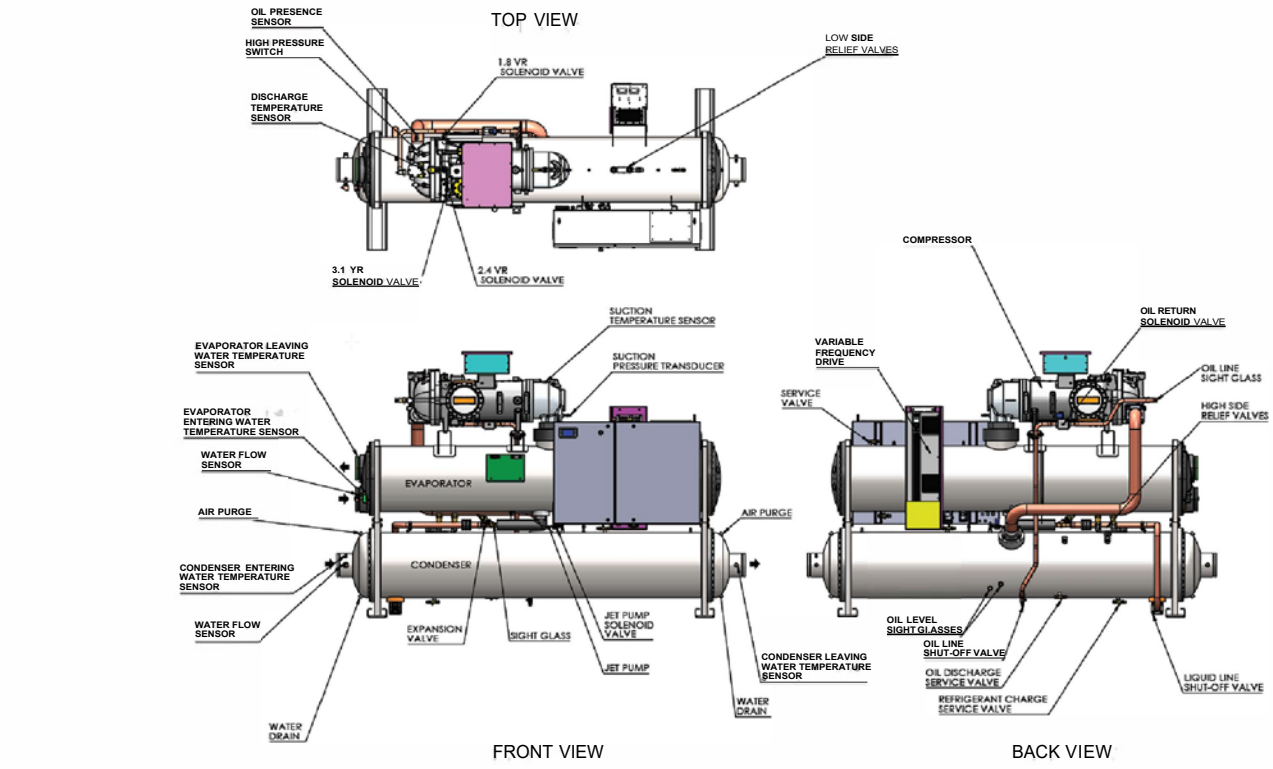


Figure 13: Unit Layout Overview



Retrofit Knockdown

It is estimated that fifty percent of retrofit applications require partial or complete disassembly of the chiller. WWV chillers are relatively easy to disassemble due to the small compressor size and simplified refrigerant piping. Two knockdown arrangements, Type A and Type B, are available as options. All major components (evaporator, condenser, compressor, unit control panel and compressor) are designed with lifting holes or eyebolts that should be utilized in moving these pieces individually.

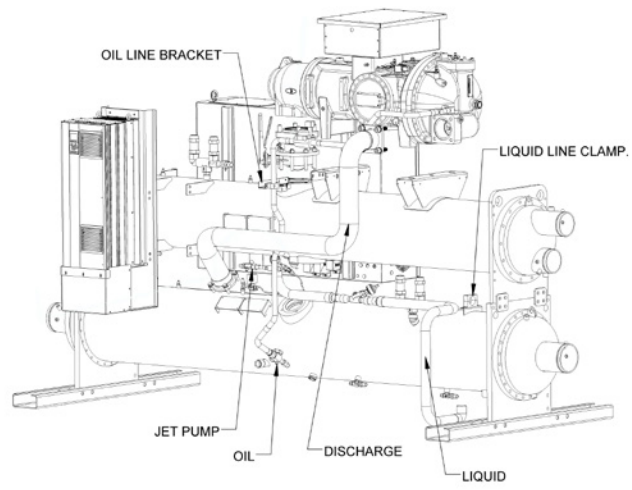
Type A Knockdown, "Bolt-Together Construction"

Chillers are built and shipped completely assembled with bolt-together construction on major components for field disassembly and reassembly on the job site.

Type A Scope:

- Chiller components are manufactured with bolt-together construction designed for field disassembly and reassembly on-site.
- Suction and discharge lines have bolt-on flanges.
- Unit ships with vessel and/or head insulation.
- Unit ships with full factory refrigerant charge in the chiller.
- Unit ships with replacement refrigerant gaskets and O-rings, stick-on wire ties, and touch-up paint.Unit is fully tested at the factory prior to shipment.
- Site disassembly and reassembly must be supervised or completed by Daikin Applied service personnel.
- Blockoff plates are required to cover any refrigerant connection left open for extended periods of time. Contact Daikin Applied service to obtain these parts.
- Ideal for retrofit applications where site diassembly is needed due to installation clearances.

Figure 14: Knockdown Piping Connections - Exploded View



Type B Knockdown, "Bolted Construction, Shipped as Parts"

Compressor(s), power boxes and control box are removed at the factory and shipped on separate skids; combined vessel stack is shipped together as a sub-assembly.

Type B Scope:

- All associated piping and wiring remain attached, if possible.
- All free piping ends are capped.
- Unit ships with vessel and/or head insulation, if ordered.
- Refrigerant will not be shipped with the chiller and must be procured by others.
- Compressor(s) and vessels receive an inert gas holding charge.
- Unit ships with replacement refrigerant gaskets and O-rings, stick-on wire ties, and touch-up paint.
- Unit is fully tested at the factory prior to shipment.
- Site reassembly must be supervised or completed by Daikin Applied service personnel. Cost for unit resassembly and supervision by Daikin Applied service is not included in the purchase price of the equipment. Contact Daikin Applied service for pricing.
- Ideal for retrofit applications where it is desired that the compressor(s), power box, and control box be removed at the factory, prior to shipment, and where refrigerant may be secured by others.

Compressor Dimensions

The compressor dimension on WWV models are shown in Figure 15 and detailed in Table 4.

Figure 15: WWV Compressor Dimension Schematic

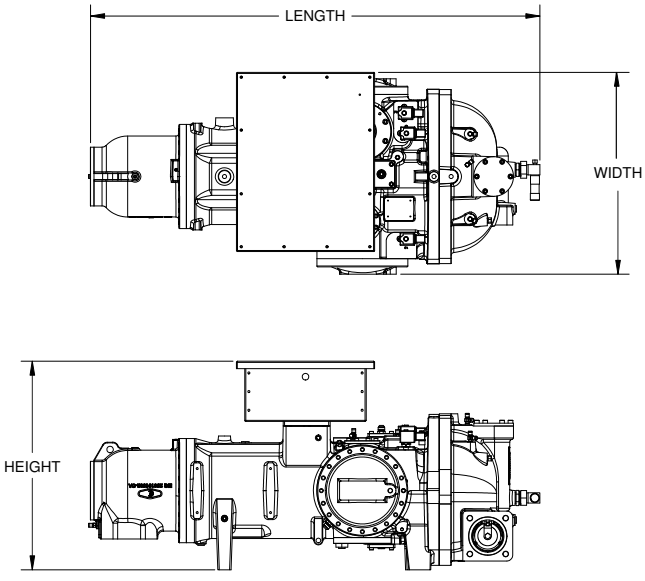


Table 4: Compressor Dimensions and Weights

Compressor Model	Dimensions			Weight (lbs)
	Length (in)	Width (in)	Height (in)	
JNNS	60.5	27.1	28.0	1534
MNNS	61.6	28.0	29.1	1925
RNNS	64.6	30.5	31.4	2778

Unit Knockdown Dimensions

Figure 16: Unit Dimensional Diagram for Typical WWV Knockdown

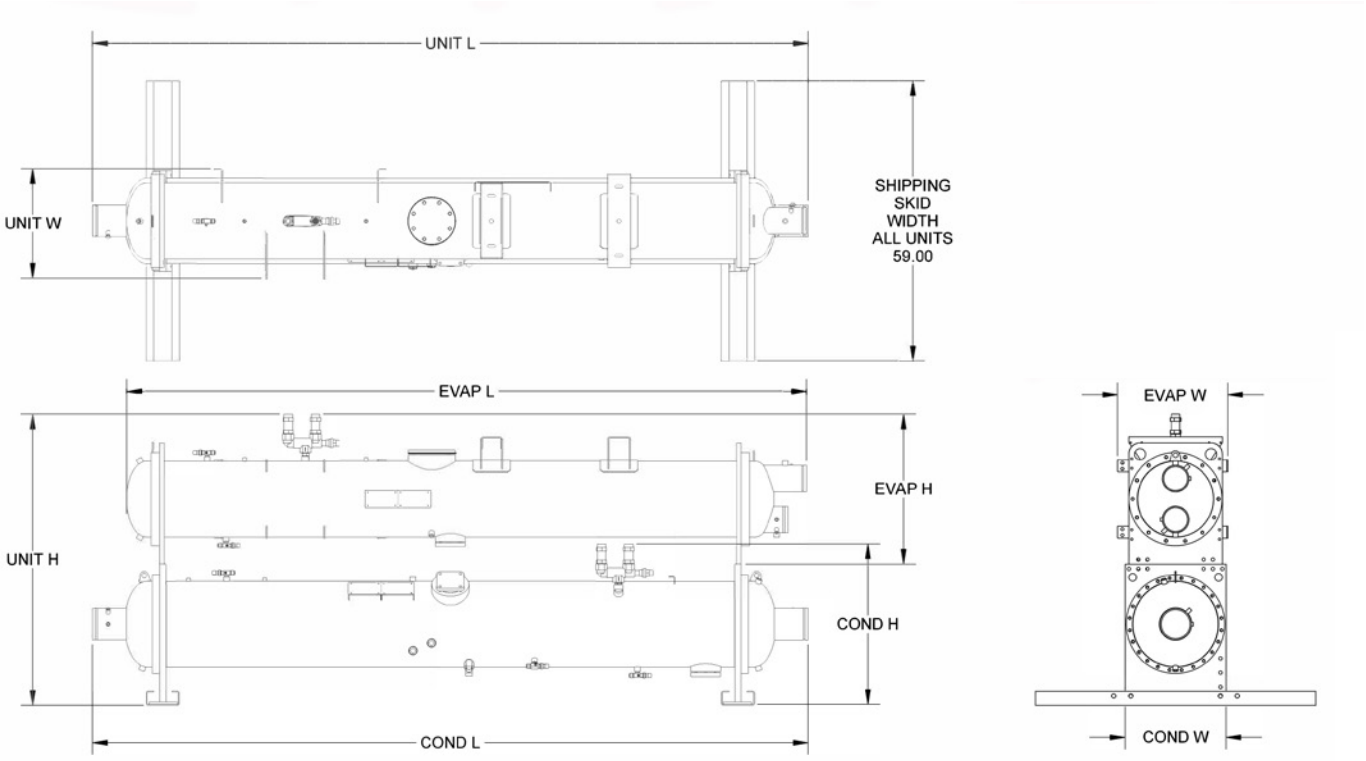


Table 5: WWV Knockdown Dimensions

	Combined Unit Configurations			
	E16/C18	E16/C20	E20/C20	E24/C24
Length (in)	150.7	149.7	149.8	152
Width (in)	23.2	23.2	25.2	30.4
Height (in)	61.2	61.2	65.4	73.3

	Separated Evaporator			Separated Condenser		
	E16	E20	E24	C18	C20	C24
Length (in)	143.2	144.3	142.7	150.7	149.3	151.5
Width (in)	23.2	25.2	30.4	21.3	23.7	28.4
Height (in)	31.7	35.9	38.5	33.8	34.6	38.1
Weight (lb)	1783	2579	3646	2398	2999	4371

NOTE: Weight based on maximum tube configuration and heaviest waterbox combination.

Type A Knockdown Disassembly

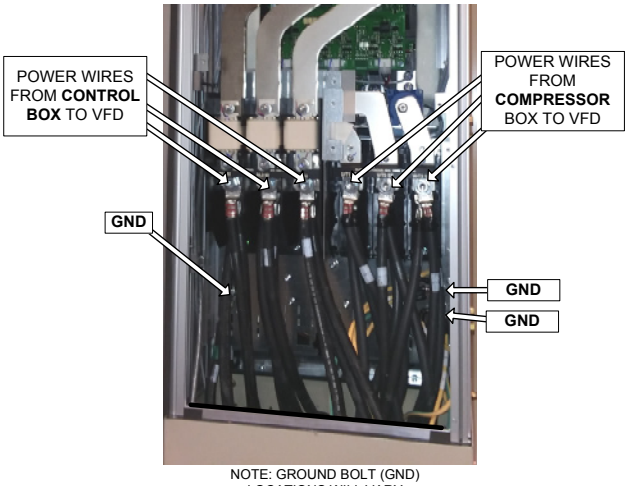
Removal of specific components only may be necessary for job site installation. Steps outlined below illustrate knockdown of compressor, all refrigerant lines and electrical items. Additional knockdown details will be shipped with the unit in the control panel. During disassembly, save gaskets for block offs and bolts, washers, and nuts for use later to install block off plates.

⚠ CAUTION

Standard torque specs must be followed when re-installing bolts, unless otherwise stated for specific components. Contact Daikin Applied service for this information.

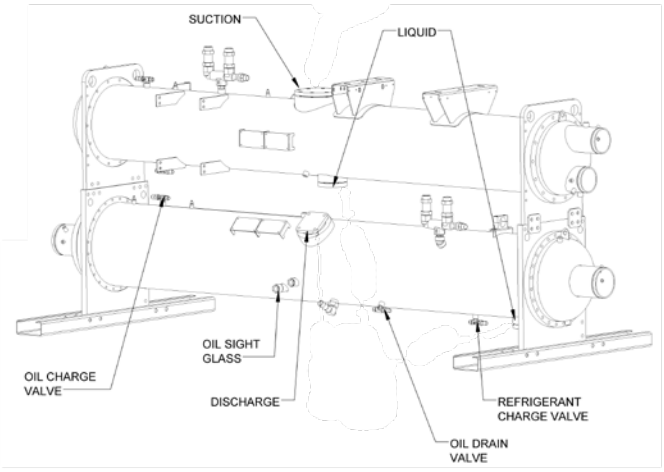
1. Recover refrigerant charge from the unit.
2. Remove discharge line at compressor and condenser connections.
3. Remove liquid line at evaporator and condenser connections, leaving the liquid line clamp on the top of the condenser.
4. Remove jet pump line at shutoff valve on condneser and evaporator. Reassemble the clamp attached to the compressor bracket after copper jet pump line is removed.
5. Remove oil line at Rotolock connection on compressor and condenser connection. Remove support bracket attached to compressor mounting foot. Leave the clamp and bracket attached to the oil line.
6. Remove power wire harness assemblies from the bottom of the VFD to the unit control box and to compressor terminal box but leave the bus bars, electrical barrier, ground strap, and fittings installed.
7. Disconnect the thermister wires from the compressor terminal box and coil them inside the VFD - do not disconnect from the VFD terminal block. Unbolt VFD from mounting brackets and use lifting lugs to remove the panel.
8. Disconnect the high pressure switch from the control box end only and leave connected to the compressor.
9. Remove compressor using lifting lugs and install blockoffs on the discharge and suction connections; then remove suction line.
10. Disconnect all solenoids from the chiller but leave connected to the control box; the jet pump solenoid harness should include the solenoid coil.
11. Disconnect the multi-cable connectors from the back side of the control box. Leave all transducers and flow sensors installed on the chiller, just remove the cables. Unmount the control box and use lifting lugs to remove. the control panel.
12. Ensure vessel blockoffs are installed at suction, discharge, and liquid connections as shown in Figure 18. Refer to detailed knockdown instructions included in the chiller control panel for discharge line bolt torque specifications.
13. Vessels can be further separated at tubesheet braces if needed, leaving relief valves attached. Use lifting holes in the tubesheets to properly move vessels.

Figure 17: Power Wiring Inside VFD



NOTE: GROUND BOLT (GND) LOCATIONS WILL VARY DEPENDING ON VFD SIZE.

Figure 18: Vessel Blockoff Locations



Type B Knockdown Disassembly

Type B knockdown units are shipped disassembled except for the vessel stack ("Figure 18: Vessel Blockoff Locations" on page 18) and are shipped without refrigerant. If the stack size or weight dictates further disassembly, the vessels can be separated by disconnecting any interconnecting wiring and tubing and then unbolting the tube sheet braces while ensuring the vessel weights are safely supported. Vessels have holes designed into each tubesheet for lifting purposes.The vessels and compressors have an inert gas holding charge that must be released prior to attempting to open any connection.

⚠ WARNING

Remove compressor, piping, or vessel holding charge through the Schrader valve in the block off plates before attempting to loosen any fittings on them. Failure to do so can cause severe bodily injury.

Reassembly

1. Reassemble the vessel stack, if dissassembled, and reconnect any wiring and tubing.
2. Mount the compressor on the stack. Be careful to avoid damaging lines already mounted on the unit. Mounting bolts, washers, and nuts are shipped loose. Leave the mounting bolts loose until the suction and discharge lines are installed and aligned.

   During assembly, bolts holding block off plates are used for reassembly of the component.
3. Do not remove block offs until ready to install piping. The compressor and vessels have a Schrader valve on their block off plates to be used for relieveing the inert gas holding charge.
4. Install the suction, discharge, and liquid line piping. For Type B knockdown, the piping is shipped in crates and on pallets. Tighten bolts after each line has been installed and aligned, referring to detailed knockdown instructions included in the chiller control panel for discharge line bolt torque specifications. Insulate the suction line with the insulation and glue provided.
5. Install the control panel and reattach wiring to the unit.
6. Install VFD on the mounting brackets and reconnect wiring to the unit control panel and compressor terminal box. Refer to detailed knockdown instructions included in the chiller control panel to properly place the wires.
7. Pressure (leak) test, evacuate, and charge with field-supplied HFC-134a using stanard refrigeration practices.

Figure 19: WWV Single Compressor Unit

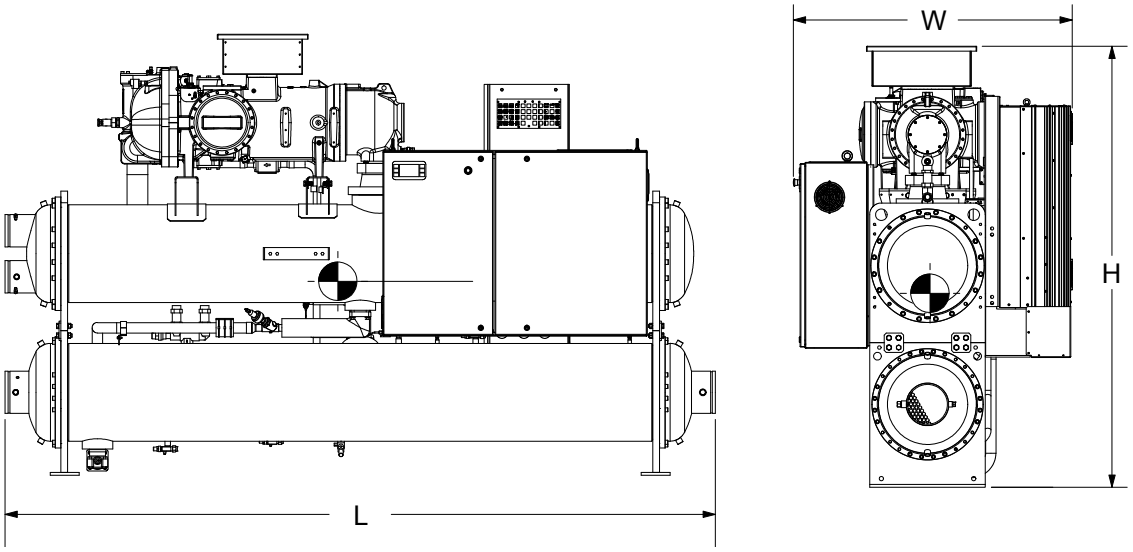


Figure 20: WWV Single Compressor Unit - Same End Condenser Connection

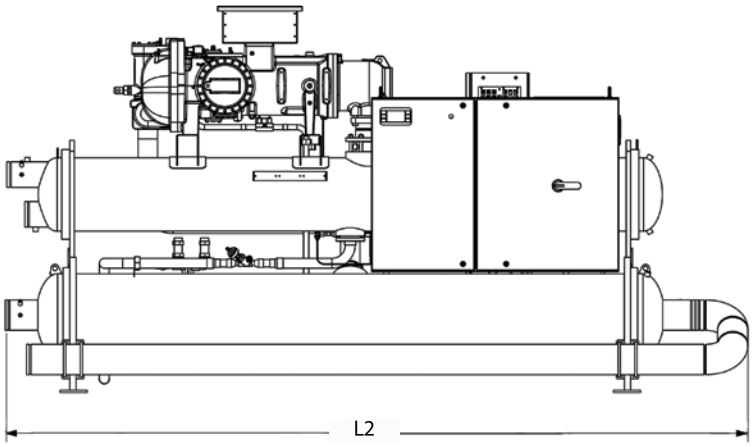


Table 6: WWV Single Dimensions

Compressor	Evaporator	Condenser	L	L2 same end connection		
(in)	Size	Size	Length (in)	Length (in)	Width (in)	Height (in)
J	E1610	C1810	150.7	162.2	55.1	84.3
J	E1610	C2010	149.3	163.8	55.1	84.3
M	E1610	C1810	150.7	162.2	55.1	85.3
M	E1610	C2010	149.3	163.8	55.1	85.3
M	E2010	C2010	149.3	163.8	57.1	89.7
M	E2410	C2410	151.4	166.0	61.6	97.4
R	E2010	C2010	149.3	163.8	57.1	92.0
R	E2410	C2410	151.4	166.0	61.6	99.6

NOTE: See certified drawings for additional dimensional data

Operator Responsibilities

It is important that the operator become familiar with the equipment and the system before attempting operation. During the initial startup of the chiller, the Daikin Applied service technician will be available to answer any questions and instruct the proper operating procedures. It is recommended that the operator maintain an operating log for each individual chiller unit. In addition, a separate maintenance log should be kept of the periodic maintenance and servicing activities.

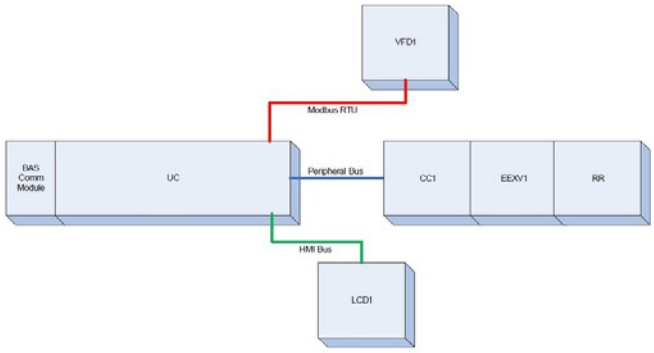
Operator Schools

Training courses for Navigator® Water-cooled Screw Maintenance and Operation are held throughout the year at the Daikin Learning Institute in Verona, Virginia. The class includes instruction on basic refrigeration, MicroTech® III controllers, enhancing chiller efficiency and reliability, MicroTech® III troubleshooting, system components, and other related subjects. For more information, refer to the back cover of this document for Training contact information.

Control System Architecture

Figure 21 shows an overview of the control system including all possible components, some of which will only be used if the chiller is equipped with a particular option or certain hardware.

Figure 21: WWV Control System Overview



MicroTech® III Unit Controller Inputs/Outputs

Table 7: Analog Inputs

#	Description	Signal Source
AI1	Evap Entering Water Temp	NTC 10KThermister
AI2	Condenser Entering Water Temp	NTC 10KThermister
X3	Demand Limit	4-20 mA Current
X4	LWT Reset	4-20 mA Current
X6	Evap Leaving Water Temp	NTC 10KThermister

Table 8: Analog Outputs

#	Description	Output Signal
X5	Cooling Tower VFD Speed	0-10VDC
X7	Cooling Tower Bypass Valve Position	0-10VDC

Table 9: Digital Inputs

#	Description	Signal Off	Signal On
DI1	Unit Ground Fault Relay	Fault	No Fault
DI2	Evaporator Flow Switch	No Flow	Flow
DI3	Oil Presence Sensor	Oil Not Present	Oil Present
DI4	Remote Switch	Unit disable	Unit enable
DI5	Unit Switch	Unit disable	Unit enable
DI6	External Alarm	Unit disable	Unit enable
X1	Emergency Stop	Unit off	Unit enable
X2	Mode Switch	Cool Mode	Ice Mode
X8	Condenser Flow Switch	No Flow	Flow

Table 10: Digital Outputs

#	Description	Output OFF	Output ON
DO1	Evaporator Water Pump 1	Pump Off	Pump On
DO2	Alarm Relay	Alarm not Active	Alarm Active
DO3	Condenser Water Pump 1	Pump Off	Pump On
DO5	Cooling Tower Fan 1	Off	On
DO6	Cooling Tower Fan 2	Off	On
DO9	Evaporator Water Pump 2	Pump Off	Pump On
DO10	Condenser Water Pump 2	Pump Off	Pump On

CC1 Module

Table 11: Analog Inputs

#	Description	Signal Source
X1	Discharge Temperature Circuit 1	NTC 10k Thermister
X2	Evaporator Pressure Circuit 1	Ratiometric 0.5-4.5 Vdc
X3	Oil Pressure Circuit 1	Ratiometric 0.5-4.5 Vdc
X4	Condenser Pressure Circuit 1	Ratiometric 0.5-4.5 Vdc
X6	Condenser Leaving Water Temp	NTC 10k Thermister

Table 12: Digital Outputs

#	Description	Output Off	Output On
DO1	Oil Return Solenoid Valve & Jet Pump Solenoid Valve Circuit 1	Solenoid Closed	Solenoid Open
DO3	VVR SV 1 Circuit 1	Solenoid Closed	Solenoid Open
DO4	VVR SV 2 Circuit 1	Solenoid Closed	Solenoid Open
DO5	VVR SV 3 Circuit 1	Solenoid Closed	Solenoid Open

Evaporator EXV1 Module

Table 13: Analog Inputs

#	Description	Signal Source
X2	Suction Temperature Circuit 1	NTC 10k Thermister
X3	Liquid Temperature Circuit 1	NTC 10k Thermister

RapidRestore® Module

Table 14: Digital Inputs

#	Description	Signal Off	Signal On
DI1	RapidRestore Enable	Disable	Enable

Compressor VFD1 Module

Table 15: Digital Inputs

#	Description	Signal Off	Signal On
37	Mech Hi Press Switch	Safe Torque Off	Normal Operation

Table 16: Analog Inputs

#	Description	Signal Source
54	Motor Temperature	PTC Thermister

Set Points

The following parameters are remembered during power off (permanent memory), are factory set to the Default value, and can be adjusted to any value in the Range column.

Unit Level Set Points

All basic unit configuration settings require the unit switch to be off in order to make a change. Modifying the Ground Fault Protection and Comm Module settings require rebooting the controller in order to apply a change.

Table 17: Set Point Default and Range

Description	Default	Range
Basic Unit Configuration		
Compressor Type	Not Set	Not Set, F3AL, F3BL, F4AL
Compressor Maximum Speed	51 Hz	51 to 78 Hz - dependant on compressor type
Compressor VFD Input RLA	100	1 to 1000 amps
Compressor VFD Parameter Set	No	No, Yes
Input Voltage	Not Set	Not Set, 380, 400, 460, 575
Ground Fault Protection Option	No	No, Yes
RapidRestore	No	No, Yes
Evaporator Glycol	No	No, Yes
Condenser Glycol	No	No, Yes
Available Mode	Cool	Cool, Cool/Ice, Ice (changeable if Evap Glycol = Yes)
Oil Presence Sensor	Yes	No, Yes
Comm Module 1	None	None, IP, LON, MSTP, Modbus
Comm Module 2	None	None, IP, LON, MSTP, Modbus
Comm Module 3	None	None, IP, LON, MSTP, Modbus
Unit Mode and Enabling		
Unit Enable	Enable	Disable, Enable
Control source	Local	Local, Network
Unit Test Mode	Off	Off,On
Staging and Capacity Control		
Cool LWT	44.6°F (7°C)	See below
Ice LWT	24.8°F (-4°C)	17.6 to 39.2°F (-8 to 4°C)
Start Up Delta T	4.9°F (2.7°C)	3 to 9°F (1.66 to 5°C)
Shut Down Delta T	2.7°F (1.5°C)	1.8 to 3.6°F (1 to 2°C)
Ice Cycle Delay	12	1-23 hours
Clear Ice Delay	No	No, Yes
RapidRestore Maximum Power Off Time	15 seconds	15 to 180 seconds
Pump Control		
Evaporator Pump Control Configuration	#1 Only	#1 Only, #2 Only, Auto, #1 Primary, #2 Primary
Evaporator Recirculation Time	90	15 to 300 seconds
Evaporator Pump 1 Run Hours	0	0 to 999999 hours
Evaporator Pump 2 Run Hours	0	0 to 999999 hours
Evaporator Pump 1 Starts	0	0 to 999999 starts
Evaporator Pump 2 Starts	0	0 to 999999 starts
Condenser Pump Control Configuration	#1 Only	#1 Only, #2 Only, Auto, #1 Primary, #2 Primary

Condenser Recirculation Time	30	10 to 300 seconds
Condenser Pump 1 Run Hours	0	0 to 999999 hours
Condenser Pump 2 Run Hours	0	0 to 999999 hours
Condenser Pump 1 Starts	0	0 to 999999 starts
Condenser Pump 2 Starts	0	0 to 999999 starts
Power Conservation and Limits		
LWT Reset Enable	Disable	Disable, Enable
Maximum Reset	9°F (5°C)	0 to 18°F (0 to 10°C)
Demand Limit Enable	Off	Off, On
Tower Control		
Tower Control	None	None, Condenser EWT, Condenser LWT
Number of Tower Fan Stages	1	1, 2
Tower Fan Stage 1 On Temperature	70°F (21.11°C)	66.2 to 120°F (19 to 48.89°C)
Tower Fan Stage 2 On Temperature	75°F (23.89°C)	66.2 to 120°F (19 to 48.89°C)
Tower Fan Stage Off Differential	3°F (1.67°C)	1 to 10.0°F (0.56 to 5.56°C)
Tower Fan Stage On Delay	2 minutes	1 to 60 minutes
Tower Fan Stage Off Delay	5 minutes	1 to 60 minutes
Tower Fan Stage On Position/Speed	80%	0 to 100%
Tower Fan Stage Off Position/Speed	30%	0 to 100%
Valve/VFD Control Configuration	None	None, Valve Set Point, Valve Stage, VFD Stage, Valve SP/VFD Stage
Valve Type	NC to Tower	NC to Tower, NO to Tower
Valve/VFD Set Point	65°F (18.33°C)	60 to 120°F (15.56 to 48.89°C)
Minimum Valve Position	10%	0 to 100%
Maximum Valve Position	90%	0 to 100%
Valve Start Minimum Position	0.0%	0 to 100%
Valve Start Maximum Position	100.0%	0 to 100%
Valve Start Minimum @ (Temperature)	60°F (15.56°C)	32 to 100°F (0 to 37.78°C)
Valve Start Maximum @ (Temperature)	90°F (32.22°C)	32 to 100°F (0 to 37.78°C)
Minimum VFD Speed	25%	0 to 100%
Maximum VFD Speed	100%	0 to 100%
Valve PID Proportional Factor	1.0	0 to 100
Valve PID Integral Time	2.0 minutes	0 to 100 minutes
VFD PID Proportional Factor	1.0	0 to 100
VFD PID Integral Time	2.0 minutes	0 to 100 minutes
Unit Sensor Offsets		
Evaporator LWT Senser Offset	0°F (0°C)	-9.0 to 9.0°F (-5.0 to 5.0°C)
Evaporator EWT Senser Offset	0°F (0°C)	-9.0 to 9.0°F (-5.0 to 5.0°C)
Condenser LWT Senser Offset	0°F (0°C)	-9.0 to 9.0°F (-5.0 to 5.0°C)
Condenser EWT Senser Offset	0°F (0°C)	-9.0 to 9.0°F (-5.0 to 5.0°C)
Circuit Configuration		
Start To Start Time Delay	15 min	15 to 60 minutes
Stop To Start Time Delay	3 min	3 to 20 minutes
Alarm and Limit Settings - Unit		
Evaporator Fluid Freeze	36°F (2.2°C)	See section below
Evaporator Flow Loss Delay	15 sec	5 to 15 sec
Evaporator Recirculate Timeout	3 min	1 to 10 min
Condenser Fluid Freeze	36°F (2.2°C)	See section below
Condenser Flow Loss Delay	15 sec	5 to 15 sec
Condenser Recirculate Timeout	3 min	1 to 10 min
Alarm and Limit Settings - Circuits		
Low Evap Pressure Unload	29.0 psi (200.0 kPa)	See below
Low Evap Pressure Hold Offset	2.2 psi (15 kPa)	1.5 to 7.3 psi (10 to 50 kPa)
High Oil Pressure Delay	30 sec	10-30 sec
High Oil Pressure Drop Minimum	36.3 psi (250 kPa)	0.0 to 60.2 psi (0.0 to 415.0 kPa)

High Discharge Temperature	230°F (110°C)	149 to 230°F (65 to 110°C)
High Condenser Pressure Hold Offset	2.7°F (1.5°C)	2.7 to 27°F (1.5 to 15°C) - Value forced to be at least 0.9°F (0.5°C) greater than the High Condenser Pressure Unload Offset setting.
High Condenser Pressure Unload Offset	1.8°F (1.0°C)	1.8 to 25.2°F (1.0 to 14°C)
High Condenser Pressure Delay	5 sec	0 to 5 sec
Low Pressure Ratio Delay	300 sec	30 to 300 sec
Low DSH Limit	10.8°F (6.0°C)	10.8 to 27.0°F (6.0°C to 15.0°C)
BAS Control Inputs		
Network Unit Enable	Disable	Disable, Enable
Network Cool Set Point	44.6°F (7.0°C)	See below section
Network Capacity Limit	100%	0% to 100%
Network Alarm Clear Command	Normal	Normal, ClearAlarm

Table 18: Unit Test Mode Set Points

Description	Default	Range
Test Unit Alarm Output	Off	Off, On
Test Evaporator Pump Output 1	Off	Off, On
Test Evaporator Pump Output 2	Off	Off, On
Test Condenser Pump Output 1	Off	Off, On
Test Condenser Pump Output 2	Off	Off, On
Test Cooling Tower Fan 1 Output	Off	Off, On
Test Cooling Tower Fan 2 Output	Off	Off, On
Test Cooling Tower VFD Speed	0.0%	0.0% to 100.0%
Test Cooling Tower Bypass Valve Position	0.0%	0.0% to 100.0%

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

Table 19: Administration and Service Support

Description	Default	Range
Unit G.O. Number	"Enter Data"	Alphanumeric string of up to 16 characters
Unit Serial Number	"Enter Data"	Alphanumeric string of up to 20 characters
Next Maintenance Month	January	January through December
Next Maintenance Year	2017	2009 - 2200
Service Support Reference	999-999-9999	Any 10 digit phone number
Controller Time	From Controller Timeclock	00:00:00 to 23:59:59
Controller Date	From Controller Timeclock	1/1/2000 to 12/31/2050
UTC Difference	-60 minutes	-3276 to 32767 minutes
Daylight Savings Time Enable	Yes	No, Yes
Daylight Savings Time Start Month	March	January through December
Daylight Savings Time Start Week	2nd Week	1st through 5th Week
Daylight Savings Time End Month	November	January through December
Daylight Savings Time End Week	1st Week	1st through 5th Week
Operator Password Disable	Off	Off, On
Apply Changes	No	No, Yes
Active Alarm Clear	Off	Off, On
Alarm Log Clear	No	No, Yes
Log Export to SD Card	No	No, Yes
Load Files from SD Card	No	No, Yes
Save Settings to SD Card	No	No, Yes
Restore Settings from SD Card	No	No, Yes
Restore Default Settings	No	No, Yes
Display Units	English	English, Metric

Saving and Restoring Settings

When the ‘Save Settings To SD Card’ setting is set to ‘Yes’, all the setting values should be saved into a file on the SD card. This operation requires that there is an SD Card in the slot on the controller and it is not write protected. When the operation completes, the setting should change back to ‘No’.

This operation is dependent on functionality built into the controller firmware so only some aspects of the behavior can be changed via the controller software. The settings will be saved on the SD Card in two files: PARAM.BIN and PARAM.UCF. Both files are standalone and contain all the setting values.

When the ‘Restore Settings From SD Card’ setting is set to ‘Yes’, the setting values should be changed to those found in the PARAM.BIN or PARAM.UCF file on the SD card. If both files are on the SD card, the controller will use the PARAM.BIN file. After the setting values are loaded from the SD card, the controller should automatically reboot in order to apply all the setting changes.

When the ‘Restore Defaults’ setting is set to ‘Yes’, the setting values should all change back to the original values in the software.

Dynamic Set Point Ranges

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

Table 20: Cool LWT and Network Cool Set Point

Evaporator Glycol Selection	Range
No	40 to 68°F (4.44 to 20.0°C)
Yes	25 to 68°F (-3.89 to 20.0°C)

Table 21: Evaporator and Condenser Fluid Freeze

Glycol Selection	Range
No	35.6 to 42.8°F (2 to 6°C)
Yes	-0.4 to 42.8°F (-18 to 6°C)

Table 22: Low Evaporator Pressure Hold and Unload

Evaporator Glycol Selection	Range
No	27.8 to 45 psi (191.6 to 310 kPa)
Yes	0 to 45 psi (0 to 310 kPa)

Glycol Factors

WWV chillers are designed to operate with leaving anti-freeze solution temperatures per software range limits. Consult the local Daikin Applied sales office for performance outside these temperatures. Leaving chilled fluid temperatures below 40°F (4.4°C) result in evaporating temperatures at or below the freezing point of water and a glycol solution is required. MicroTech® III control inhibits compressor unloading at leaving fluid temperatures below 25°F (-3.9°C).

Circuit Level Set Points

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

Table 23: Set Points for Individual Circuits

Description	Default	Range
Mode, Enabling, Configuration		
Capacity Control	Auto	Auto, Manual
Manual Speed	See below	See below
VR Control	Auto	Auto, Manual
Manual VR	See below	1.6, 1.8, 2.4, 3.1
The Manual Speed setting value will follow the target speed while Capacity Control = Auto. When Capacity Control is set to ManSpd, the Manual Speed set point can be set to the desired value. The minimum will be the same minimum speed calculated for automatic control. The maximum value is equal to the Compressor Maximum Speed setting. The Manual VR setting value will follow the target capacity while VR Control = Auto. When VR Control is set to Manual, the Manual VR set point can be set to the desired value.		
Sensor Offsets		
Evaporator Pressure Offset	0 psi (0 kPa)	-14.5 to 14.5 psi (-100 to 100 kPa)
Condenser Pressure Offset	0 psi (0 kPa)	-14.5 to 14.5 psi (-100 to 100 kPa)
Oil Pressure Offset	0 psi (0 kPa)	-14.5 to 14.5 psi (-100 to 100 kPa)
Suction Temperature Offset	0°F (0°C)	-9.0 to 9.0°F (-5.0 to 5.0°C)
Discharge Temperature Offset	0°F (0°C)	-9.0 to 9.0°F (-5.0 to 5.0°C)
Liquid Temperature Offset	0°F (0°C)	-9.0 to 9.0°F (-5.0 to 5.0°C)
Administrative and Service Support		
Clear Cycle Timers	Off	Off, On
Compressor Run Hours	0	0 to 999999 hours
Compressor Starts	0	0 to 65535

Circuit Test Mode Set Points

Circuit test mode set points can be changed when either the unit mode is Test, or the circuit mode is Test. When neither the unit nor the circuit are in Test mode, all the circuit test mode set points for the circuit are automatically changed back to their 'off' values.

Description	Default	Range
Test Oil Return and Jet Pump Output	Off	Off, On
Test VR 1.8 Output	Off	Off, On
Test VR 2.4 Output	Off	Off, On
Test VR 3.1 Output	Off	Off, On
Test EXV Position	0.0%	0.0 to 100.0%

Calculations

Evaporator

Error

LWT Error = Evaporator LWT - Active LWT Set Point

Slope

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

Unit Enable

Enabling and disabling the chiller is accomplished using set points and inputs to the chiller. The Unit Switch, Remote Switch Input, and Unit Enable Set Point all are required to be On/Enable for the unit to be enabled when the control source is set to Local. The same is true if the control source is set to Network, with the additional requirement that the BAS Enable set point be Enable.

Table 24: Enable Combinations

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

All of the methods for disabling the chiller, discussed in this section, will cause a normal shutdown of any running circuits.

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. This set point also determines whether the unit is configured for glycol use. The Control Source Set Point determines where a command to change modes will come from.

The Available Modes Set Point must only be changed when the unit switch is off. This is to avoid changing modes of operation inadvertently while the chiller is running. Unit Mode is set according to the following table.

Table 25: Unit Mode Combinations

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

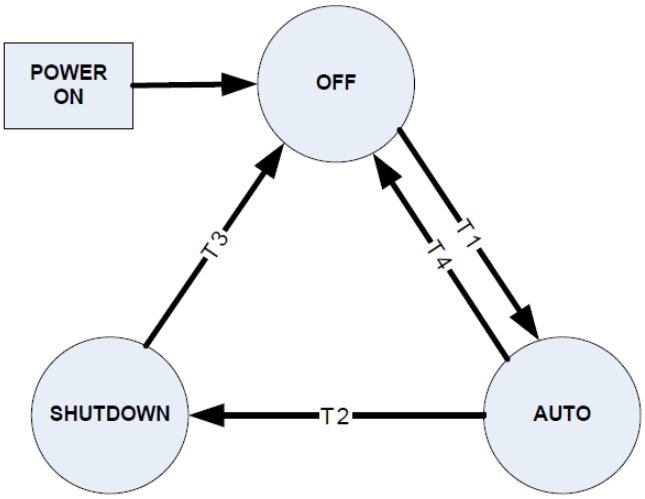
Glycol Configuration

If the Evaporator Glycol Set Point is set to a value ‘Yes’, then glycol limits should be enabled for the unit. This means that various pressure and temperature settings can be set to lower values as a result of the glycol limits being enabled. Once glycol limits are enabled, they should only be disabled when the Evaporator Glycol Set Point is set to ‘No.’

Unit Control States

The unit will always be in one of three states:

1. Off – Unit is not enabled to run.
2. Auto – Unit is enabled to run.
3. Shutdown – Unit is doing a normal shutdown.



T1 - Off to Auto. All of the following are required:

- Unit is enabled
- No unit alarm requiring shutdown is active
- Circuit is available to start
- Unit configuration is valid

T2 - Auto to Shutdown. Any of the following are required:

- Unit is disabled
- Unit alram requiring normal shutdown is active

T3 - Shutdown to Off. Any of the following are required:

- Unit alarm requiring rapid shutdown is active
- Circuit is in the Off state

T4 - Auto to Off. Any of the following are required:

- Unit alram requiring normal shutdown is active
- Circuit disabled and unit in Off state

Unit Status

Unit Status is displayed to indicate the general 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.

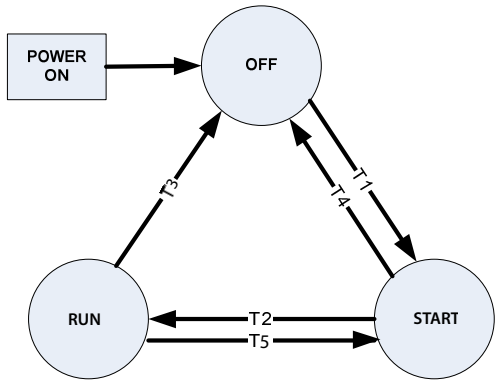
Table 26: Unit Status Conditions

#	Status	Conditions
0	AUTO	Unit State = Auto
1	OFF: Ice Mode Timer	Unit State = Off, Unit Mode = Ice, and Ice Deay = Active
2	OFF:All Cir Disabled	Unit State = Off and all circuits unavailable to start (temporary conditions are not considered to be a cause of a circuit being unavailable)
3	OFF: Unit Alarm	Unit State = Off and manual reset Unit Alarm active
4	OFF: Keypad Disable	Unit State = Off and Unit Enable Set Point = Disable
5	OFF: Remote Switch	Unit State = Off and Remote Switch input is Off
6	OFF: BAS Disable	Unit State = Off, Control Source = Network, and BAS Enable = false
7	OFF: Unit Switch	Unit State = Off and Unit Switch input is Off
8	OFF: Test Mode	Unit State = Off and Unit Mode = Test
9	AUTO: Wait For Load	Unit State = Auto, no circuits running, and LWT is less than the active set point + startup delta
10/11	AUTO: Evap Recirc or Cond Recirc	Unit State = Auto and Evaporator State = Start or Condenser State = Start
12/13	AUTO: Wait Cond Flow or Wait Evap Flow	Unit State = Auto, Evaporator State = Start and Flow Switch input is off, or Condenser State = Start and Flow Switch input is off
14	Shutting Down	Unit State = Shutdown
15	AUTO: Max Pulldn Rate	Unit State = Auto, unit capacity limited by the evap EWT pulldown rate
16	AUTO: Unit Cap Limit	Unit State = Auto, unit capacity limit has been met or exceeded
17	AUTO: RapidRestore	Unit State = Auto, unit is performing RapidRestore operation
18	OFF: Cfg Chg Rst Ctrl	A configuration change requiring a reboot has occurred but controller has not been rebooted yet.
19	OFF: Invalid Config	The unit configuration is not complete.
20	OFF: Sending VFD Config	Controller is configuring the compressor VFD via Modbus communication

Evaporator Pump Control

Three evaporator pump control states for control of the evaporator pumps.

1. Off - No pump on.
2. Start – Pump is on, water loop is being recirculated.
3. Run – Pump is on, water loop has been recirculated, and circuits can start if needed.



T1 - Off to Start - Requires either of the following to be true:

- Unit state = Auto
- Freeze protection started

T2 - Start to Run - Requires the following to be true for time longer than evaporator recurculate time set point:

- Evap state = Start
- Evaporator flow switch input is on

T3 - Run to Off - Requires all of the following to be true:

- Unit state = Off
- Freeze protection is not active

T4 - Start to Off. - Requires all of the following to be true:

- Unit state = Off
- Freeze protection is not active

T5 - Run to Start. - Requires the following to be true for longer than the Evaporator Flow Loss Delay set point:

- Evap State = Run
- Evaporator flow switch input is off.

Evaporator Freeze Protection

To protect the evaporator from freezing, the evaporator pump will start if the manual reset flow loss alarm is not active and either of the following are true:

- LWT equal to or less than the Evap Freeze set point for at least three seconds AND LWT sensor fault isn't active
- EWT equal to or less than the Evap Freeze set point for at least three seconds AND EWT sensor fault isn't active

Freeze protection will end when manual reset flow loss alarm is active or all of the following are true:

- LWT is at least 2°F (1.11°C) above the Evap Freeze set point or LWT sensor fault is active
- EWT is at least 2°F (1.11°C) above the Evap Freeze set point or EWT sensor fault is active
- Pump has been running for at least 15 minutes

Evaporator Pump Selection

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

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

Primary/Standby Pump Staging

The pump designated as primary will start first. If the evaporator state is Start for a time greater than the evaporator 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 Evaporator 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.

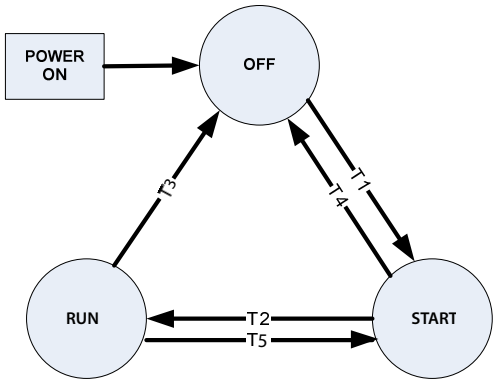
Auto Control

If auto pump control is selected, the primary/standby logic above is still used. When the evaporator is not in the Run state, the run hours of the pumps will be compared. The pump with the least hours will be designated as the primary at this time. Counters for both starts and run hours should be maintained for each pump. These should be displayed and should be changeable.

Condenser Pump Control

For control of the condenser pumps, three condenser pump control states are used:

1. Off - No pump on.
2. Start – Pump is on, water loop is being recirculated.
3. Run – Pump is on, water loop has been recirculated and circuits can start if needed.



T1 – Off to Start - Transition should also occur if Freeze Protection starts or RapidRestore® is active. Requires all of the following

- Evap State = Run
- Unit State = Auto
- Evap LWT Error > Start Delta T

T2 – Start to Run - Requires the following to be true for time longer than condenser recurculate time set point:

- Cond State = Start
- Condenser flow seitch input is on

T3 – Run to Off - Requires all of the following to be true:

- Unit State = Off or Evap LWT Error < Start Delta T - 0.556°C
- Freeze Protection is not active
- RapidRestore® is not active
- Compressor is not running

T4 – Start to Off - Requires all of the followingto be true:

- Unit State = Off or Evap LWT Error < Start Delta T - 0.556°C
- Freeze Protection is not active
- RapidRestore® is not active
- Compressor is not running

T5 – Run to Start - Requires the following to be true for longer than the Evaporator Flow Loss Delay set point:

- Cond State = Run
- Condenser flow switch input is off.

Condenser Freeze Protection

To protect the condenser from freezing, the condenser pump will start if the manual reset flow loss alarm is not active and either of the following are true:

- LWT is equal to or less than the Cond Freeze set point for at least three seconds AND LWT sensor fault isn't active
- EWT is equal to or less than the Cond Freeze set point minus 0.6°C for at least three seconds AND EWT sensor fault isn't active

Freeze protection will end when manual reset flow loss alarm is active or all of the following are true:

- LWT is at least 1.11°C (2°F) above the Cond Freeze set point or LWT sensor fault is active
- EWT is at least 1.11°C (2°F) above the Cond Freeze set point or EWT sensor fault is active
- Pump has been running for at least 15 minutes

Condenser Pump Selection

Condenser pump selection, staging, auto control, starts and run hours function in the same way as for the evaporator section beginning on page 29.

Cooling Tower Control

WWV cooling tower control includes the capability to control 1 or 2 fan stages, a bypass valve, and a fan VFD.

Cooling Tower Fan Staging

Tower fan staging is enabled when the Tower Control set point is set to a CP (controlled parameter) of either Condenser EWT or Condenser LWT based on the Tower Control set point. A stage timer should start when the condenser pump starts or when the fan stage is changed.

The first stage should turn on when the following conditions are met:

- Stage timer > Tower Fan Stage On Delay set point
- CP > Stage 1 On Temperature set point
- Bypass valve position > Stage On Position/Speed set point (if Valve/VFD Control Configuration = Valve Stage)
- VFD Speed > Stage On Position/Speed set point (if Valve/VFD Control Configuration = VFD Stage or Valve SP/VFD Stage)

The second fan stage can turn on when the following conditions are met:

- Number of Tower Fan Stages = 2
- Stage timer > Stage On Delay set point
- CP > Stage 2 On Temperature set point
- Bypass valve position > Stage On Position/Speed set point (if Valve/VFD Control Configuration = Valve Stage)
- VFD Speed > Stage On Position/Speed set point (if Valve/VFD Control Configuration = VFD Stage or Valve SP/VFD Stage)

The second fan stage should turn off when the following conditions are met:

- Stage timer > Tower Fan Stage Off Delay set point
- CP < Stage 2 On Temperature set point – Stage Off Differential set point
- Bypass valve position < Stage Off Position/Speed set point (if Valve/VFD Control Configuration = Valve Stage)
- VFD Speed < Stage Off Position/Speed set point (if Valve/VFD Control Configuration = VFD Stage OR Valve SP/VFD Stage)

The first fan stage should turn off when the following conditions are met:

- Stage timer > Tower Fan Stage Off Delay set point
- CP < Stage 1 On Temperature set point – Stage Off Differential set point
- Bypass valve position < Stage Off Position/Speed set point (if Valve/VFD Control Configuration = Valve Stage)
- VFD Speed < Stage Off Position/Speed set point (if Valve/VFD Control Configuration = VFD Stage OR Valve SP/VFD Stage)

The fan stage should also be set to 0 when condenser pump state is not Run.

Cooling Tower Bypass Valve

When the Valve/VFD Control Configuration set point is set to None or VFD Stage, bypass valve position should always be set to 0%.

If the Valve/VFD Control Configuration set point is set to Valve Set Point, Valve SP/VFD Stage, or Valve Stage, the bypass valve should be controlled as described in the following mode sections.

As the calculated position varies from 0 to 100%, the voltage signal for the Bypass Valve Position output should vary based on the Valve Type set point:

- If 'NC to tower' then 0 to 100% = 0 to 10 VDC
- If 'NO to tower' then 0 to 100% = 10 to 0 VDC

For both valve control modes, when active a valve position is calculated and limited to a range from the Minimum Valve Position set point to the Maximum Valve Position set point.

Valve Set Point Mode

This mode is enabled when the Valve/VFD Control set point is set to Valve Setpoint or Valve SP/VFD Stage. When the condenser state becomes Run, the valve position will be controlled to a position limited to a range from the Minimum Valve Position set point to the Maximum Valve Position set point. In this mode the valve position is calculated by a PID loop to control the condenser EWT or LWT (as selected by the Tower Control set point) to the Valve/VFD Set Point.

Valve Stage Mode

This mode is enabled when the Valve/VFD Control set point is set to Valve Stage. When the condenser state becomes Run, the valve position will be controlled to a position limited to a

range from the Valve Minimum Position set point to the Valve Maximum Position set point.

In this mode the valve position is calculated by a PID loop to control the condenser EWT or LWT (as selected by the Tower Control set point) to the active set point. The active set point is selected based on the fan stage as shown below:

Tower Fan Stage	Active Set Point
0	Valve/VFD Set Point
1	Tower Fan Stage 1 On Temperature
2	Tower Fan Stage 2 On Temperature

Cooling Tower Fan VFD

When the Valve/VFD Control set point is set to None, Valve Setpoint, or Valve Stage, cooling tower fan VFD control should not be operational and the speed should always be set to 0%.

If the Valve/VFD Control Configuration set point is set to VFD Stage or Valve SP/VFD Stage then VFD speed will be controlled as described below.

When active a VFD speed is calculated and limited to a range defined by the VFD Minimum Speed set point and the VFD Maximum Speed set point.

The VFD speed should always be 0% when the fan stage is 0. When one or both fan stages are on, the VFD speed should be calculated using a PID loop to control the condenser EWT or LWT (as selected by the Tower Control set point) to the active set point. The active set point is selected based on the fan stage as shown below.

Tower Fan Stage	Active Set Point
0	N/A
1	Tower Fan Stage 1 On Temperature
2	Tower Fan Stage 2 On Temperature

As the calculated speed varies from 0 to 100%, the voltage signal for the Tower VFD Speed output should vary from 0 to 10 VDC.

Leaving Water Temp (LWT) Target

The LWT Target varies based on settings and inputs. The base LWT Target is selected as shown inTable 27.

Table 27: LWT Targets Control Source

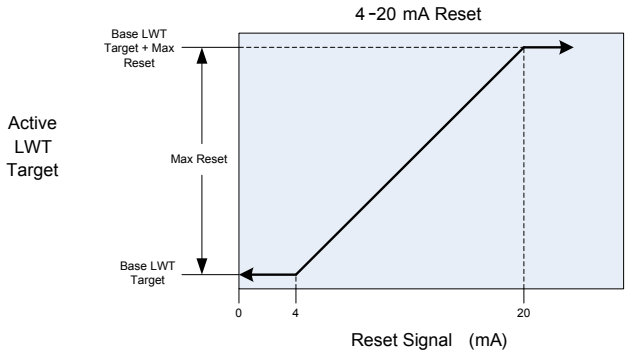
Available Modes Set Point	Control Source Set Point	Mode Input	BAS Request	Base LWT Target
COOL	Local	-	-	Cool Set Point
	Network	-	-	BAS Cool Set Point
Cool/Ice	Local	Off	-	Cool Set Point
		On	-	Ice Set Point
	Network	-	Cool	BAS Cool Set Point
		-	Ice	BAS Ice Set Point
Ice	Local	-	-	Ice Set Point
	Network	-	-	BAS Ice Set Point

LWT Reset

The base LWT target may be reset to a higher value if the unit is in Cool mode and LWT Reset Enable is enabled.

When the reset is active, it will be 0 if the reset signal is less than or equal to 4 mA. Reset is equal to the Max Reset set point 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.

Figure 22: 4-20mA Reset



When the active reset increases, the Active LWT Target is changed at a rate of 0.1 °C (0.18 °F) every 10 seconds. When the active reset decreases, the Active LWT Target is changed all at once.

After reset is applied, the LWT target can never exceed a value of 20.0°C (68°F). Since the Cool LWT set point can be set as high as 20.0°C, the amount of reset may be limited in order to meet this requirement to clamp the active LWT target to 20.0°C.

Unit Capacity Control

Unit capacity control will be performed as described in this section. Loading and unloading the refrigerant circuit is used to control the overall unit capacity.

Cool Mode Operation

LWT error and EWT pulldown rate are the primary factors in unit capacity adjustments. This section details all the logic for unit capacity control in Cool Mode.

Staging On

Unit capacity control will command the circuit to start if all of the following are true:

- Unit State = Auto
- Evaporator Pump State = Run
- LWT error > Startup Delta T set point

Staging Off

Unit capacity control logic will command the circuit to shut down if either of the following conditions are true:

- LWT error < -(Shut Down Delta T set point)
- LWT < LWT Target AND EWT < LWT Target

Ice Mode Operation

In Ice mode, the compressor will load up at the maximum possible rate that allows for stable operation of the refrigerant circuit. The unit should start when LWT error is greater than the Startup Delta T set point. The unit should shut down when LWT error is 0 or less.

Unit Capacity Limits

Unit capacity limits are 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 and network limit use a deadband around the actual limit value, such that unit capacity increase is not allowed within this deadband. If unit capacity is above the deadband, capacity is decreased until it is back within the deadband which is 7%.

The unit capacity will be adjusted as needed to meet the lowest active limit, but the circuit cannot be turned off to meet a limit lower than the minimum unit capacity.

Demand Limit

The maximum unit capacity can be limited by a 4-20 mA signal on the Demand Limit analog input at the unit controller. This function is only enabled if the Demand Limit set point is set to On. As the signal varies from 4 mA up to 20 mA, the limit changes linearly from 100% to 0%.

Network Limit

The maximum unit capacity can be limited by a network command. This function is only enabled if the unit control source is set to network. The signal will be received through the BAS interface on the unit controller. This network limit command directly sets a max unit capacity from 0% to 100%.

RapidRestore® Option

RapidRestore® is an option that can be added to WWV chillers. The general purpose of the option is to allow the capability to restart more quickly and to load faster than normal when power is lost and restored.

Enabling

The RapidRestore® option is enabled via the RapidRestore® set point on the unit configuration screen. Changing the setting to ‘enable’ will require the following to be true:

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

If either of the above conditions are no longer true for at least five seconds, then the RapidRestore® set point will be changed to ‘disable’, effectively disabling the RapidRestore® option in the chiller.

Operation Following Power Cycle

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

- RapidRestore® is enabled
- Power failure lasts less than the value of the Max Power Failure Time set point
- Power failure lasts at least one second (shorter power loss may result in unpredictable operation)
- Unit is enabled
- LWT error is at least 1°C

RapidRestore® will end if any of the following conditions occur:

- LWT error is less than 1°C
- Unit capacity = 100%
- Unit becomes disabled for any reason
- 10 minutes have passed since unit powered up

Unit Level Changes

Evaporator Recirculation Time

With a goal of starting the chiller within 30 seconds after power is restored, the evaporator recirculation time must be trimmed to account for the controller boot time. When RapidRestore® is triggered, the time value used for the evaporator recirculation time will be 10 seconds. Note that the evaporator recirculation time set point is not changed as a result of this.

Condenser Recirculation Time

Similar to the evaporator, the condenser recirculation time will be trimmed to 10 seconds for RapidRestore®. The condenser recirculation time set point is not changes as a result.

Unit Capacity Control

The evaporator LWT error does not have to be more than the start delta t value. If RapidRestore® is active, that is considered adequate for starting the chiller.

Circuit Level Changes

When RapidRestore® is triggered, all compressor cycle timers are cleared to allow for starting more quickly. The limitation of four starts per hour is still in effect though, and will not be cleared by the RapidRestore® operation. Compressor speed increments will be 2Hz (normally 1Hz).

Circuit Functions

Components controlled at the circuit level include:

- Compressor VFD
- Compressor VR Solenoid Valves
- Oil Return Solenoid Valve
- Jet Pump Solenoid Valve
- Evaporator EXV

Approach Values

Evaporator Approach = LWT – Evap Saturated Temp

Condenser Approach = Cond Saturated Temp - LWT

Superheat Values

Suction superheat = Suction Temp – Evap Saturated Temp

Discharge superheat = MAX{0, Discharge Temp – Cond Saturated Temp}

Subcooling = Cond Saturated Temp – Liquid Line Temp

Differential Pressure Values

Oil Pressure Drop = Cond Pressure - Oil Pressure

Pressure Ratio

Pressure Ratio = (Cond Press +101.3) ÷ (Evap Press + 101.3)

Actual Capacity

Actual capacity is a representation of capacity as a percentage of full capacity based on feedback regarding the actual speed of the compressor.

Compressors vary capacity via changes to the speed. The actual compressor speed is read from the VFD. Feedback capacity for a compressor with a VFD is:

Actual Compressor Speed x 100 ÷ Maximum Speed

Circuit Availability

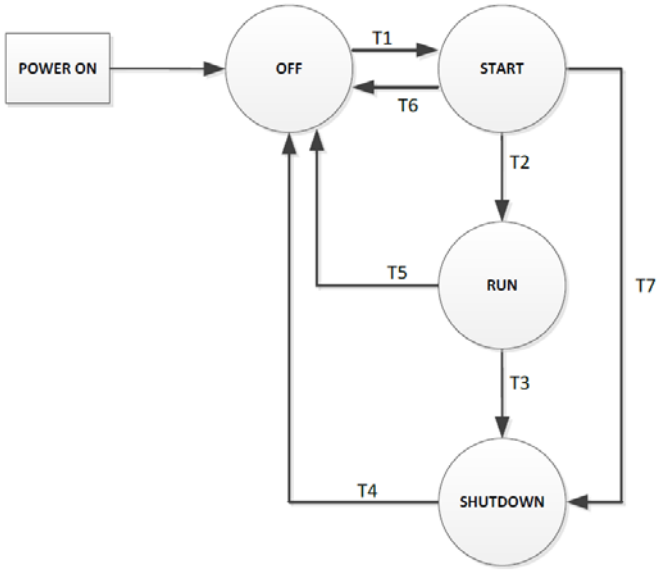
A circuit is available to start if the following conditions are true:

- No manual reset circuit fault alarms are active
- Circuit Mode set point is set to Enable
- BAS Circuit Mode set point is set to Auto if Control Source = Network
- No cycle timers are active (including the max starts per hour limit)

Circuit States

There are four distinct states of control for the circuit as shown.

Figure 23: Circuit State Transitions



T1 – Off to Start - All of the following must be true:

- Circuit is available to start per the previous section
- Adequate pressure in the evaporator and condenser (see No Pressure At Start Alarm)
- Unit capacity control logic requires the circuit to start
- BAS Circuit Mode set point is set to Auto if Control Source = Network
- No cycle timers are active (including max starts per hour)
- Evaporator State = Run
- Condenser State = Run
- Circuit state has been Off for at least 15 seconds

T2 – Start to Run - All of the following are required:

- Circuit has been in the Start state for 20 seconds
- Evap Pressure ≥ Low Pressure Unload set point

T3 – Run to Shutdown - Any of the following are required:

- Unit capacity control logic requires this circuit to stop
- Unit state is Shutdown
- A normal shutdown alarm occurs on the circuit
- Control Source = Network and BAS Circuit Mode = Off

T4 – Shutdown to Off - Any of the following are required:

- Unit state is Off
- Rapid stop alarm occurs on the circuit
- Evaporator State is not Run
- Condenser State is not Run
- Compressor speed ≤ 20 Hz
- Circuit State = Shutdown for more than 30 seconds

T5 – Run to Off - Any of the following are required:

- Unit state is Off
- Rapid stop alarm occurs on the circuit
- Evaporator State is not Run
- Condenser State is not Run

T6 – Start to Off - Any of the following are required:

- Unit state is Off
- Rapid stop alarm occurs on the circuit
- Evaporator State is not Run
- Condenser State is not Run

T7 – Start to Shutdown - Any of the following are required:

- Unit capacity control logic requires this circuit to stop
- Unit state is shutdown
- A normal shutdown alarm occurs on the circuit
- Control Source = Network and BAS Circuit Mode = Off

Circuit Status

Circuit Status is displayed to indicate the general condition of the circuit. The following table lists the text displayed for each circuit 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 28: Circuit Status

#	Status	Conditions
0	Off: Ready	Circuit is ready to start when needed.
1	Off: Cycle Timer	Circuit is off and cannot start due to active cycle timer.
2	Off: Max Starts Per Hour	Circuit is off and cannot start due to compressor reaching max starts per hour.
3	Off: BAS Disable	Circuit is off and cannot start due to BAS Circuit Mode input being set to Off.
4	Off: Alarm	Circuit is off and cannot start due to active circuit alarm.
5	Shutting Down	Circuit is in shutdown state.
6	Run: Normal	Circuit is in start or run state and running normally.
7	Run: DSH Low	Circuit is in start or run state and cannot load due to low discharge superheat.
8	Run: Evap Press Low	Circuit is in start or run state and cannot load due to low evaporator pressure.
9	Run: Cond Press High	Circuit is in start or run state and cannot load due to high condenser pressure.
10	Run: VFD Input Current High	Circuit is in start or run state and cannot load due to high VFD input current.
11	Run: VFD Out Current High	Circuit is in start or run state and cannot load due to high VFD output current.
12	Run: VFD Temp High	Circuit is in start or run state and cannot load due to high VFD temperature..
13	Run: High LWT Limit	Circuit is in start or run state and cannot load due to the evaporator LWT exceeding the limit for allowing full capacity.

Compressor Control

The compressor is controlled via:

- commands to the VFD via Modbus to start/stop the compressor
- a speed command to the VFD via Modbus to control the compressor speed
- a digital output to control the oil return solenoid valve and jet pump solenoid valve
- digital outputs for compressor VR solenoids to control VR

Cycle Timers

A minimum time must pass between starts of each compressor. When the compressor starts, a timer starts which will run for a time determined by the Start-Start Timer set point.

A minimum time must pass between the stop and start of each compressor as well. When the compressor stops, a timer starts which will run for a time determined by the Stop-Start Timer set point.

While either timer is running the compressor cannot start. Both cycle timers will be enforced even through cycling of power to the chiller. These timers may be cleared via the Clear Cycle Timers set point.

Starts Per Hour Limit

In addition to the cycle timers, a limit of four starts per hour is enforced. A buffer of start times for the last four starts is maintained. If the current time is an hour or less after the first timestamp in the buffer, the next start will be delayed. This limit is cleared if the Clear Cycle Timers set point is set to Yes.

Capacity Control

The compressor will vary capacity via changes to the motor speed (frequency). The speed is controlled via writing to a specific modbus register in the VFD. The VFD should initiate the compressor to run when the circuit state is Start, Run, or Shutdown.

Auto Capacity Control

The minimum running speed is set to 14 Hz and the normal speed change is 1hz for all compressor configurations.

Circuit State = Off - Speed command is 0 Hz.

Circuit State = Start - Immediately after starting, the compressor speed will be set to a frequency at least equal to the calculated Compressor Minimum Frequency, which minimum is 14 Hz.

Circuit State = Run - After the circuit enters the Run state for 30 seconds, changes to the speed are performed based on load and unload commands coming from the unit capacity control logic. The speed is constrained to a range from the minimum based on the configuration up to the Compressor Maximum Speed set point.

When a capacity increase occurs a time delay starts and when a capacity decrease occurs a separate time delay starts. While either of these delays is active, no normal capacity changes will occur. The load and unload delay times are calculated values.

Whenever the speed command is less than the Compressor Minimum Frequency value, the speed command should be increased at the same rate allowed for normal capacity increases until it reaches that value. If there is an unload command from the unit capacity control logic, the speed command should not decrease if it is less than or equal to the Compressor Minimum Frequency value.

Circuit State = Shutdown - Speed will be ramped down to 20 Hz. The ramp rate will be 1 Hz/second, but the maximum ramp time should be 30 seconds so the ramp rate will adjust up as needed to complete the speed ramp within 30 seconds.

Manual Speed Control

The speed of the compressor may be controlled manually. Manual speed control is enabled via a set point with choices of Auto and Manual. With manual control speed can be set in 0.1 Hz increments, in a range from 14 Hz to the Compressor Maximum Speed set point.

When setting a manual speed, the compressor speed will generally be stepped up or down using 1 Hz speed changes. If the change required to reach the manually set speed command is less than 1 Hz, the compressor speed will change directly to the manually set speed command. Changes to the speed will be made as fast as allowed by the calculated load and unload delays. Capacity control may be set to Manual only when circuit state is Run.

Capacity control shall revert back to automatic control if either::

- the circuit state changes from Run to another state
- capacity control has been set to manual for four hours

VR Solenoid Valve Control

There are three solenoid valves for changing volume ratio (VR) of the compressor:

- 100% solenoid valve
- 50% solenoid valve
- 75% solenoid valve

Note: The VR position % does not equal the % capacity load of the compressor.

Automatic VR Control

The compressor should start with all three solenoid valves off. After compressor has been running for at least 20 seconds, the control logic will “stage” the solenoid valves. The table below shows which VR solenoid valves are on at each stage as well as stage up and stage down conditions. The staging conditions must be active for 30 seconds to trigger each stage up or down.

Stage	VR	50 VR SV	75 VR SV	100 VR SV
0	1.6	Off	Off	Off
1	1.8	On	Off	Off
2	2.4	Off	On	Off
3	3.1	On	On	On

Whenever the VR of the compressor needs to be reduced, all three solenoid valves must first be turned off for 15 seconds. After that, the necessary solenoid valve can be turned on.

When the circuit state becomes Shutdown or Off, all VR solenoids should be turned off.

Manual VR Control

VR can be controlled manually using settings on the variable VR screen. VR control can be changed to Manual only when the circuit state is Run. When VR Control is set to Manual, the VR can be selected with choices of 1.6, 1.8, 2.4, 3.1. The solenoid valve outputs will be set according to the table in the previous section on automatic control. However, there will not be any time delays or special operation for staging the VR down as in automatic control.

Evaporator EXV Control

The Evaporator EXV is installed in the liquid line feeding the evaporator and the chiller controls use specific logic to set the position.

EXV will normally be positioned to control suction superheat (SSH) with a PI loop. In some conditions, the evap EXV will be positioned to control evaporator pressure to keep the compressor within its operating envelope.

EXV States

The control of the EXV follows a sequence of states. The transitions from one state to another is based on the running conditions of the circuit. The states are as follows:

- Closed –EXV fully closed.
- Startup – The pressure target ramps up to bring the liquid level up in the evaporator.
- Superheat – EXV controls to a calculated pressure target in order to maintain evaporator liquid refrigerant level at an optimal level.

Oil Return Solenoid Valve

The oil return solenoid valve output should be on whenever the compressor is being commanded to run. This output activates the oil return solenoid valve as well as the jet pump solenoid valve.

Circuit Capacity Overrides

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

High Water Temperature Capacity Limit

If the evaporator LWT reaches 25°C (77°F) or higher, then high evaporator loop temperature capacity limits will be in effect.

When high evaporator loop temperature capacity limits are in effect and the capacity is 80% or higher, the circuit will not increase in capacity.

When high evaporator loop temperature capacity limits are in effect and the capacity is higher than 85%, the circuit capacity will be reduced until it is at 85% or less.

High evaporator loop temperature capacity limits will no longer be in effect when evaporator LWT is less than 25°C (77°F) for at least a minute.

Low Discharge Superheat Capacity Limit

If DSH < Minimum DSH set point, unit mode is Cool, and the compressor speed = 35 Hz, the compressor will not be allowed to increase speed.

If DSH < Minimum DSH set point, unit mode is Cool, and the compressor speed > 35 Hz the compressor speed will be reduced until it is at 35 Hz or lower.

The above limits will no longer be in effect when DSH ≥ Minimum DSH set point for at least a minute or the unit mode is no longer Cool.

Alarms

Situations may arise that require some action from the chiller, or that should be logged for future reference. 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 circuit from running are active
On	An alarm is preventing the chiller from running

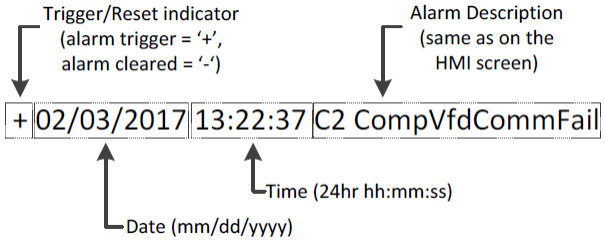
There are alarms that do not cause the chiller to shut down or prevent it from running. Those alars should not cause the alarm digital output to be turned on.

Alarm Logging

All alarms appear in the active alarm list while active and can contain up to 50 total entries.. All alarms are added to the alarm log when triggered and when cleared. Entries in the log representing the occurrence of an alarm will be preceded by '+' while entries representing the clearing of an alarm will be preceded by '-'.

When an alarm occurs, the alarm date, time, and description are stored in the active alarm buffer corresponding to that alarm (viewed on the Alarm Active screens) also in the alarm history buffer (viewed on the Alarm Log screens). The active alarm buffers hold a record of all current alarms.

Figure 24: Alarm Format



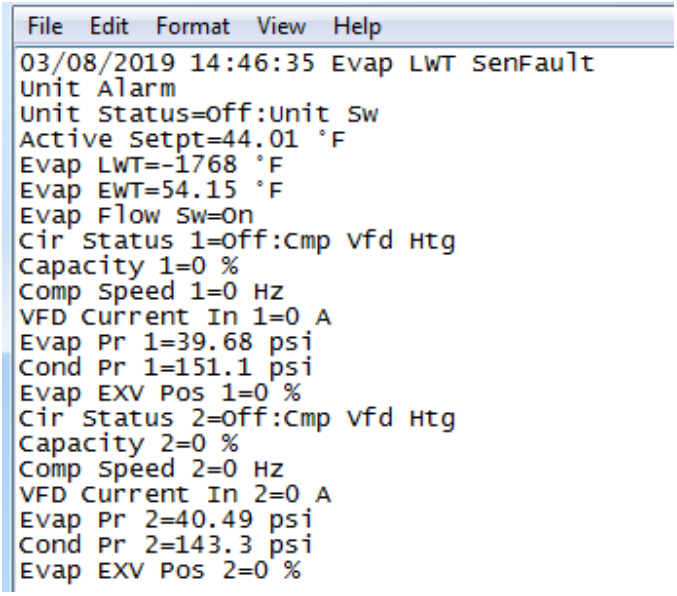
Alarm Snapshot Log

When alarms designated as 'Fault' category are triggered they should also be stored in the Alarm Snapshot Log. 'Problem' and 'Warning' category alarms should not be stored in the alarm snapshot log. See the alarm details section for information about the category assigned to each alarm.

This log will store the alarm, time and date it was triggered, and a list of values from the program cycle just before the alarm was triggered.

Like the alarm log, this functionality relies on features built into the controller firmware. The snapshot log should be implemented with 'sets' of logged parameters defined for unit alarms and circuit alarms. Each set should be configured such that older entries will be pushed out as new entries are added when the set is full. Each of the sets can have 50 alarm instances stored based on the available storage and the number of sets configured. All sets are viewed in the same alarm snapshot log, and the log should show the entries in order from newest to oldest.

Figure 25: Alarm Snapshot Log Example



Note that the alarm snapshot log will be erased if a configuration setting on the unit configuration screen is changed and the controller rebooted. This is a behavior that cannot be changed since it is part of the alarm snapshot feature built into the firmware.

Event Log

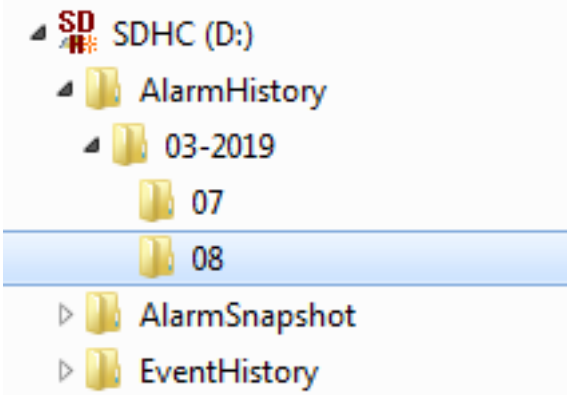
The event log should be set up and behave in a way similar to the alarm log. Note that this is a functionality that is part of the firmware so some of the characteristics and behavior are not changeable with the application software. This log stores up to 50 entries with the oldest entries being pushed out as new entries need to be added if the log is full.

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 and when cleared. Entries in the log representing the occurrence of an event will be preceded by '+' while entries representing the clearing of an alarm will be preceded by '-'.

Export to SD Card

The alarm log can be exported to an SD card in the controller. A setting called 'Log Export to SD' will be used to initiate this when set to 'Yes'. The exported log will be saved in a text file on the SD card with Alarm, Snapshot, and Event logs each getting their own folder on the root level of the card. Within each log folder, the logs are organized by 'month-year' folders, and then by 'day' subfolders as shown in the example below:

Figure 26: SD Card Folder Structure



Signaling Alarms

The following actions will signal that an alarm has occurred:

- The unit or a circuit will execute a rapid or normal shutdown.
- An alarm bell icon will be displayed in the upper right-hand corner of all controller screens including the optional remote user interface panel's screens.
- An optional field supplied and wired remote alarm device will be activated.

Clearing Alarms/Faults

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

To use the unit controller HMI, follow the Alarm links to the Alarms screen, which will show Active Alarms and Alarm Log. Select Active Alarm and press the wheel to view the Alarm List (list of current active alarms). They are in order of occurrence with the most recent on top. The second line on the screen shows Alm Cnt (number of alarms currently active) and the status of the alarm clear function. An active password is not necessary to clear alarms.

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

Description of Alarms

Details for each alarm are listed as shown below.

Displayed Text:	Text to be displayed on HMI in the alarm lists.
Trigger:	Conditions required to trigger the alarm.
Action Taken:	Actions should be taken when alarm triggers.
Reset:	Method by which the alarm can be cleared and conditions required for doing so, if any.

Unit Alarms

Evaporator Flow Loss

Displayed Text:	Evap Water Flow Loss
Trigger:	1: Evap Pump State = Run AND Evap Flow Digital Input = No Flow for time > Flow Loss Delay set point AND at least one circuit is not in the Off state 2: Evap Pump State = Start for time greater than Recirculate Timeout set point and all pumps have been tried and Evap Flow Digital Input = No Flow
Action Taken:	Rapid shutdown all circuits and: - if an auto reset occurrence has triggered, keep unit enabled and allow the evaporator recirculation sequence to proceed - if a manual reset occurrence has been triggered, lock out unit from running.
Reset:	This alarm can be cleared at any time manually via the keypad or via the BAS clear alarm command. If active via trigger condition 1: When the alarm occurs due to this trigger, it can auto reset the first two times each day, with the third occurrence being manual reset. When the auto reset occurrences are triggered the unit will remain enabled to run (rather than going to an off state). For the auto reset occurrences, the alarm will reset automatically when the evaporator state is Run again. This means the alarm stays active while the unit waits for flow, then it goes through the recirculation process after flow is detected. Once the recirculation is complete, the evaporator goes to the Run state which will clear the alarm. After three occurrences, the count of occurrences is reset and the cycle starts over if the manual reset flow loss alarm is cleared. If active via trigger condition 2: If the flow loss alarm has occurred due to this trigger, it is always a manual reset alarm.

Condenser Flow Loss

Displayed Text:	Cond Water Flow Loss
Trigger:	1: Condenser Pump State = Run AND Condenser Flow Digital Input = No Flow for time > Flow Loss Delay set point AND at least one circuit is not in the Off state 2: Condenser Pump State = Start for time greater than Recirculate Timeout set point and all pumps have been tried and Evaporator Flow Digital Input = No Flow
Action Taken:	Rapid shutdown all circuits and: -if an auto reset occurrence has triggered, keep unit enabled and allow the evaporator recirculation sequence to proceed -if a manual reset occurrence has been triggered, lock out unit from running
Reset:	This alarm can be cleared at any time manually via the keypad or via the BAS clear alarm command. If active via trigger condition 1: When the alarm occurs due to this trigger, it can auto reset the first two times each day, with the third occurrence being manual reset. When the auto reset occurrences are triggered the unit will remain enabled to run (rather than going to an off state). For the auto reset occurrences, the alarm will reset automatically when the evaporator state is Run again. This means the alarm stays active while the unit waits for flow, then it goes through the recirculation process after flow is detected. Once the recirculation is complete, the evaporator goes to the Run state which will clear the alarm. After three occurrences, the count of occurrences is reset and the cycle starts over if the manual reset flow loss alarm is cleared. If active via trigger condition 2: If the flow loss alarm has occurred due to this trigger, it is always a manual reset alarm.

Evaporator/Condenser Water Freeze Protect

Displayed Text:	Evap Water Freeze Cond Water Freeze
Trigger:	LWT or EWT equal to or less than Freeze Protect set point for a time at least as long as the evaporator recirculation time. If the sensor fault is active for either LWT or EWT, then that sensor value cannot trigger the alarm.
Action Taken:	Rapid shutdown unit and lock out unit from running
Reset:	This alarm can be cleared manually via the unit controller HMI, but only if specific LWT and EWT are both above the specified Freeze Protect set point or have a sensor fault (meaning the temperature reading is not valid).

Evaporator Water Temperatures Inverted

Displayed Text:	EvapWaterTempInverted
Trigger:	All of the following are true for at least 90 seconds: • Unit is in Run state • Evap EWT < Evap LWT – 1°C • EWT sensor fault not active • LWT sensor fault not active
Action Taken:	Normal shutdown unit and lock out unit from running
Reset:	This alarm can be cleared manually via the unit controller HMI or via BAS command.

Evaporator/Condenser LWT Sensor Fault

Displayed Text:	Evap LWT SenFault/ Cond LWT SenFault
Trigger:	If any of the following occur: • Resistance value is < 340 Ω • Resistance value is > 300k Ω • Reliability value reported for input is anything other than ‘NoFault’
Action Taken:	Rapid shutdown unit and lock out unit from running
Reset:	This alarm can be cleared manually via the unit controller HMI or BAS command if the following are true: • Resistance value is from 340 Ω to 300k Ω • Reliability value reported for input is ‘NoFault

Evaporator/Condenser EWT Sensor Fault

Displayed Text:	Evap EWT SenFault/ Cond EWT SenFault
Trigger:	If any of the following occur: • Resistance value is < 340 Ω • Resistance value is > 300k Ω • Reliability value reported for input is anything other than ‘NoFault’
Action Taken:	Normal shutdown unit and lock out unit from running
Reset:	This alarm can be cleared manually via the unit controller HMI or BAS command if the following are true for at least five seconds: • Resistance value is from 340 Ω to 300k Ω • Reliability value reported for input is ‘NoFault’

External Alarm

Displayed Text:	External Alarm
Trigger:	Emergency Stop input has been on for at least 3 seconds, then external alarm input is off for at least 1 second.
Action Taken:	Rapid shutdown unit and lock out unit from running
Reset:	Auto clear when external input is on for 5 seconds.

Emergency Stop

Displayed Text:	Emergency Stop Switch
Trigger:	Emergency Stop input is off for at least 1 second.
Action Taken:	Rapid shutdown unit and lock out unit from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or via BAS command if the emergency switch input is on for 5 seconds.

Unit Ground Fault Protection

Displayed Text:	Unit Ground Fault
Trigger:	All of the following are true: • Ground Fault Protection Option set point = Yes • Ground Fault Relay input is off for 1 second
Action Taken:	Rapid shutdown unit and lock out unit from running
Reset:	Auto reset when Ground Fault Relay input is on for 5 seconds

Compressor Controller (CC1) Module Comm Failure

Displayed Text:	CC1 Mod Comm Fail
Trigger:	Communication with the CC1 module has failed. This means the reliability value reported for the module is anything other than 0 for at least 3 seconds
Action Taken:	Rapid shutdown unit and lock out unit from running
Reset:	This alarm can be cleared manually via the unit controller HMI or BAS command after reliability value reported for the module is 0 for at least 5 seconds.

Evaporator EXV Module Comm Failure

Displayed Text:	EEXV1 Mod Comm Fail
Trigger:	Communication with the EEXV1 module has failed. This means the reliability value reported for the module is anything other than 0 for at least 3 seconds
Action Taken:	Rapid shutdown unit and lock out unit from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or BAS command after reliability value reported for the module is 0 for at least 5 seconds.

Evaporator/Condenser Pump #1 or #2 Failure

Displayed Text:	Evap Pump1(or 2)Fault/Cond Pump1(or 2) Fault
Trigger:	Unit is configured with primary and backup pumps, pump #1 (or #2) is running, and the pump control logic switches to pump #2 and vice versa.
Action Taken:	Backup pump is used
Reset:	This alarm can be cleared manually via the unit controller HMI or BAS command

Bad Demand Limit Input

Displayed Text:	Bad Demand Lim Input
Trigger:	Demand limit input out of range and Demand Limit set point is set to Enable. 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 ignored
Reset:	Auto clear when Demand Limit set point is set to Disable or demand limit input back in range for 5 seconds.

Bad LWT Reset Input

Displayed Text:	Bad LWT Reset Input
Trigger:	LWT Reset set point is Enable and LWT reset input is 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 reset function ignored
Reset:	Auto clear when LWT Reset set point is Disable or LWT Reset input back in range for 5 seconds.

RapidRestore Module Comm Failure

Displayed Text:	RR Module Comm Fail
Trigger:	RapidRestore set point is set to 'Yes' and communication with the RapidRestore module has failed. This means the reliability value reported for the module is anything other than 0 for at least 3 seconds
Action Taken:	RapidRestore functionality will be disabled while the module is not communicating since an input on the module is required in order to enable the functionality.
Reset:	This alarm will automatically clear after communication is restored for at least 5 sec.

Circuit Alarms

Low Evaporator Pressure

Text:	C1 EvapPressLow
Trigger:	Trigger 1 - This alarm will trigger when Freeze time is exceeded and Circuit State = Start or Run. 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 = 70 – 0.906 x freeze error, limited to a range of 20-70 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 freeze time has not been exceeded, the timer will reset. Trigger 2 - The alarm will trigger if Evaporator Press is less than 0 kPa (0 psi) for longer than one second while the circuit state is Run. Trigger 3 - The alarm will trigger if Evap Press is less than 0 kPa (0 psi) for longer than 5 seconds while the circuit state is anything other than Run. For any trigger condition, the alarm cannot trigger if the evaporator pressure sensor fault is active or the CC1 module communication is not working.
Action:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI if evap press is above 0 kPa (0 psi).

High Condenser Pressure

Text:	C1 CondPressHigh
Trigger:	Saturated Condenser Temp > Max Saturated Condenser Value for time longer than High Condenser Pressure Delay set point. Cannot trigger if CC1 module commination is not working.
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the unit controller HMI if Saturated Condenser Temp ≤ Max Saturated Condenser Value.

Mechanical High Pressure Switch

Displayed Text:	C1 MHP Switch
Trigger:	At least 12 seconds elapsed since controller booted and compressor VFD reports Safe Stop alarm or warning. The alarm is bit 30 in the Alarm word and the warning is bit 30 in the Warning word from the VFD..
Action Taken:	Rapid shutdown of unit and lock out from running.
Reset:	This alarm can be cleared manually via the Unit Controller HMI. When alarm is cleared, command to reset alarms should be sent to VFD.

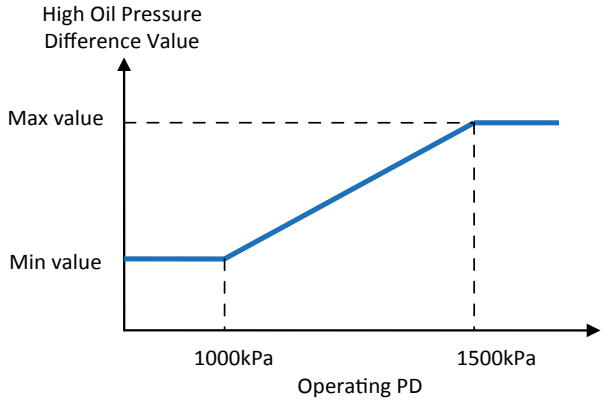
High Discharge Temperature

Displayed Text:	C1 DiscTempHigh
Trigger:	The following are true for one second: • Circuit state is Start, Run, or Shutdown • Discharge Temperature > High Discharge Temperature set point • discharge temperature sensor fault is not active
Action Taken:	Normal shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or via BAS command.

High Oil Pressure Difference

Displayed Text:	C1 Oil PD High
Trigger:	Circuit is in the Run state and Oil Pressure Difference > High Oil Pressure Difference value for a time longer than High Oil Pressure Difference Delay set point. High Oil Pressure Difference value is calculated as shown Figure 27. *Operating PD = Condenser Pressure – Evaporator Pressure* *Minimum for High Oil Pressure Difference = High Oil Pressure Difference set point* *Maximum for High Oil Pressure Difference = High Oil Pressure Difference set point + 100kPa*
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller unit controller HMI or via BAS command.

Figure 27: High Oil Pressure Difference Values



Oil Feed Loss

Displayed Text:	C1 Oil Feed Loss
Trigger:	The following are true for 20 second: • Oil Presence Sensor setting is 'Yes' • Compressor is running • Oil Presence Sensor input is off
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI.

High Motor Temperature

Displayed Text:	C1 Motor Temp High
Trigger:	Compressor VFD reports motor overheat alarm, which is bit 7 in the Alarm word from the VFD.
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller unit controller HMI when compressor has been off for at least 5 minutes. When the alarm is cleared in the unit controller, the command to clear the fault in the VFD will be sent.

No Pressure Change At Start

Displayed Text:	C1 No Press Chg Start
Trigger:	After start of compressor, at least a 7 kPa drop in evaporator pressure or 25 kPa increase in condenser pressure has not occurred within 40 seconds.
Action Taken:	Rapid shutdown of unit and lock out from running.
Reset:	This alarm can be cleared manually via the Unit Controller unit controller HMI or BAS command.

No Pressure At Start

Displayed Text:	C1 No Press At Start
Trigger:	All of the following must be true to trigger: • Circuit start requested • Either Evaporator Pressure or Condenser Pressure are less than 35 kPa (5.1 psi)
Action Taken:	Abort start of circuit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller unit controller HMI or BAS command.

Low Discharge Superheat

Displayed Text:	C1 Disc SH Low
Trigger:	If both of the following are true for at least 30 minutes, the alarm is triggered: • Circuit state is not Off • DSH < Low DSH Limit set point
Action Taken:	Normal shutdown of unit and lock out from running on the third occurrence.
Reset:	This alarm can be cleared manually via the Unit Controller HMI or via BAS command.

Low Pressure Ratio

Displayed Text:	C1 Low Pr Ratio
Trigger:	Circuit state is Run and pressure ratio < 1.3 for a time > Low Pressure Ratio Delay set point. This alarm is actually triggered on the third occurrence of the above conditions within 2 hours. Prior occurrences are events.
Action Taken:	Rapid shutdown of unit and lock out from running on the third occurrence.
Reset:	This alarm can be cleared manually via the Unit Controller HMI or via BAS command.

High Compressor VFD Output Current

Displayed Text:	C1 CmpVfd Curr OutHigh
Trigger:	This alarm will trigger when all of the following are true: • compressor is running • Motor Current > Max Motor Current x 1.1 for at least 2 seconds
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or via BAS command.

High Compressor VFD Input Current

Displayed Text:	C1 CmpVfd Curr In High
Trigger:	This alarm will trigger when all of the following are true for at least 5 seconds: • unit mode is Ice • compressor is running • VFD Input Current > VFD Primary RLA set point x 1.05 VFD Primary RLA set point is part of the unit configuration.
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or via BAS command.

Compressor VFD Comm Failure

Displayed Text:	C1 CompVfd CommFail
Trigger:	Communication with the compressor VFD has failed. This means that either a modbus configuration error has occurred, or a modbus command has failed in 10 consecutive loops of the modbus commands for this node address.
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or via BAS command if communication has been restored for 5 seconds.

Compressor VFD Fault

Displayed Text:	C1 Comp Vfd Fault
Trigger:	Trip flag from VFD is set and alarm flags for the following VFD alarms are NOT set: • Earth fault • High control card temperature • Control word timeout • High Motor Temp • DC link undervoltage • DC link overvoltage • Mains Phase Loss • Motor Phase Loss • Safe Stop The above conditions are required for one second to trigger the alarm.
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or via BAS command. When alarm is cleared, command to reset alarms should be sent to VFD.

Compressor VFD Over Voltage

Displayed Text:	C1 VfdOverVoltage
Trigger:	DC link over voltage alarm flag is set in compressor VFD for at least one second.
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm will automatically reset when ‘DC link over voltage’ alarm flag is not set for at least 5 seconds.

Compressor VFD Under Voltage

Displayed Text:	C1 VfdUnderVoltage
Trigger:	DC link under voltage alarm flag is set in compressor VFD.
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm will automatically reset when ‘DC link under voltage’ alarm flag is not set for at least 5 seconds.

Compressor Motor Phase Loss

Displayed Text:	C1 Motor Phase Loss
Trigger:	Any of the following Compressor VFD alarm flags is set: • Motor phase U is missing • Motor phase V is missing • Motor phase W is missing
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm will automatically reset when none of the motor phase loss alarm flags are set for at least 5 seconds.

Mains Phase Loss

Displayed Text:	C1 CmpVfd Phase Loss
Trigger:	Compressor VFD sets the ‘Mains Phase Loss’ alarm flag for at least one second or the ‘Mains Failure’ warning flag for at least 2.5 seconds.
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or BAS command if none of the trigger condition are true.

Motor Earth Leakage

Displayed Text:	C1 Motor Earth Lkg
Trigger:	Compressor VFD sets the ‘Earth Fault’ alarm flag .
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm will automatically reset when the Earth Fault flag is not set for at least 5 seconds..

Compressor VFD Control Card Temp High

Displayed Text:	C1 VfdCtrlCardTmpHi
Trigger:	Compressor is running and VFD sets the Ctrl Card Temp alarm flag.
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or BAS command if 'Ctrl Card Temp' alarm flag is not set for at least one minute.

Compressor Multiple Start Failure

Displayed Text:	Cn CompMultiStartFail
Trigger:	This alarm is actually triggered on the third occurrence of the below conditions within 2 hours. Prior occurrences are events. All of the following must be true to trigger: • Compressor Run command is on • Compressor VFD Communication Failure is not active • Either VFD Actual Speed = 0 for more than 15 seconds OR VFD Actual Speed < 14hz for more than 30 seconds
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or BAS command

Evaporator Pressure Sensor Fault

Displayed Text:	C1 EvapPressSenFault
Trigger:	Trigger if all of the following are true: • UC communication with CC1 module is OK • sensor input voltage is less than 400mv and, for at least 1 second • sensor input voltage is more than 4600mv for at least one second and compressor running for at least 90 seconds
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or BAS command if sensor input voltage is 400mv to 4600mv for at least 5 seconds.

Condenser Pressure Sensor Fault

Displayed Text:	C1 CondPressSenFault
Trigger:	Trigger if all of the following are true: • UC communication with CC1 module is OK • sensor input voltage is less than 400mv or more than 4600mv for at least 1 second.
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or BAS command if sensor input voltage is 400mv to 4600mv for at least 5 seconds.

Oil Pressure Sensor Fault

Displayed Text:	C1Cmp1 OffOilFeedPSen
Trigger:	Trigger any time sensor input voltage is less than 400mv or more than 4600mv and UC communication with CC1 module is OK, for at least 1 second.
Action Taken:	Normal shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or BAS command if sensor input voltage is 400mv to 4600mv for at least 5 seconds.

Suction Temp Sensor Fault

Displayed Text:	C1 SuctTempSenFault
Trigger:	Trigger if UC communication with EEXV1 module is OK and any of the following are true for at least 1 second: • Sensor input value < 340 Ω • Sensor input value > 300 kΩ • Sensor reliability reported by control system ≠ 'No Fault'
Action Taken:	Rapid shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or BAS command if sensor input value is 340 Ω to 300 kΩ and sensor reliability = 'No Fault' for at least 5 seconds.

Discharge Temp Sensor Fault

Displayed Text:	C1 DiscTempSenFault
Trigger:	Trigger if UC communication with CC1 module is OK and any of the following are true for at least 1 second: • Sensor input value < 340 Ω • Sensor input value > 300 kΩ • Sensor reliability reported by control system ≠ 'No Fault'
Action Taken:	Normal shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or BAS command if sensor input value is 340 Ω to 300 kΩ and sensor reliability = 'No Fault' for at least 5 seconds.

Liquid Line Temperature Sensor Fault

Displayed Text:	C1 LiqTempSenFault
Trigger:	Trigger if UC communication with EEXV1 module is OK and any of the following are true for at least 1 second: • Sensor input value < 340 Ω • Sensor input value > 300 kΩ • Sensor reliability reported by control system ≠ 'No Fault'
Action Taken:	Normal shutdown of unit and lock out from running
Reset:	This alarm can be cleared manually via the Unit Controller HMI or BAS command if sensor input value is 340 Ω to 300 kΩ and sensor reliability = 'No Fault' for at least 5 seconds.

Power Loss While Running

Displayed Text:	C1 PwrLossWhileRun
Trigger:	Circuit is running when controller loses power
Action Taken:	None
Reset:	N/A

Events

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

Unit Power Restore

Trigger:	This event will trigger when the controller restarts and the last reset cause was 'power'. The reset cause is a system parameter available to be read in the controller.
Action Taken:	None
Reset:	N/A

Low Evaporator Pressure - Hold

Trigger:	This event will trigger when the unit mode is Cool, circuit state is Run, and evaporator pressure drops below the low evaporator pressure hold value. Low evaporator pressure hold value = Low Evaporator Pressure Unload set point + Low Evaporator Pressure Hold Offset set point
Action Taken:	Circuit will not be able to increase in capacity.
Reset:	This event is reset when the evaporator pressure rises at least 14 kPa (2.03 psi) above the Low Evaporator Pressure Hold set point. It is also reset if the circuit is no longer in the run state or the unit operating mode is changed to Ice.

Low Evaporator Pressure - Unload

Trigger:	This event will trigger when the unit mode is Cool, the circuit state is Run, and evaporator pressure drops below the Low Evaporator Pressure Unload set point.
Action Taken:	Compressor speed will decrease 1Hz every second until evaporator pressure rises up to at least the Low Evaporator Pressure Unload set point.
Reset:	This event is reset when the evaporator pressure rises at least 14 kPa (2.03 psi) above the Low Evaporator Pressure Hold set point. It is also reset if the circuit is no longer in the run state or the unit operating mode is changed to Ice.

High Condenser Pressure - Hold

Trigger:	This event will trigger when the unit mode is Cool, the circuit state is Run, and saturated condenser temperature rises above the high saturated condenser hold value.
Action Taken:	Circuit will not be able to increase in capacity.
Reset:	This event is reset when the saturated condenser temperature drops at least 0.5°C below the high saturated condenser hold value. It is also reset if the circuit is no longer in the run state or the unit operating mode is changed to Ice.

High Condenser Pressure - Unload

Trigger:	This event will trigger when the unit mode is Cool, the circuit state is Run, and saturated condenser temperature rises above the high saturated condenser unload value.
Action Taken:	Compressor speed will decrease 1Hz every second until saturated condenser temperature drops below the high saturated condenser unload value.
Reset:	This event is reset when saturated condenser temperature drops at least 0.2°C below the high saturated condenser unload value. It is also reset if the circuit is no longer in the run state or the unit operating mode is changed to Ice.

High VFD Output Current Hold

Trigger:	This event will trigger when all of the following are true: • Unit mode = Cool • compressor is running • Motor Current > Max Motor Current x 0.95
Action Taken:	Circuit will not be able to increase in capacity.
Reset:	This event is reset when Motor Current < Max Motor Current x 0.95 for at least 60 seconds. It is also reset when the compressor is no longer running or the unit operating mode is changed to Ice.

High VFD Output Current Unload

Trigger:	This event will trigger when compressor is running, Unit mode = Cool, and either of the following occur: • Motor Current > Max Motor Current • Motor Current > Max Motor Current x 0.97 for 5 seconds
Action Taken:	Compressor speed will decrease 1Hz every two seconds until the event reset condition is met.
Reset:	This event is reset when Motor Current < Max Motor Current x 0.97 for at least 3 seconds. It is also reset when the compressor is no longer running or the unit operating mode is changed to Ice.

High VFD Input Current Hold

Trigger:	This event will trigger when all of the following are true for at least 5 seconds: • Unit mode = Cool • compressor is running • VFD Line Current > VFD Primary RLA set point VFD Primary RLA set point is part of the unit configuration.
Action Taken:	Circuit will not be able to increase in capacity.
Reset:	This event is reset when VFD Line Current < VFD Primary RLA set point x 0.99 for at least 3 minutes. It is also reset when the compressor is no longer running or the unit operating mode is changed to Ice.

High VFD Input Current Unload

Trigger:	This event will trigger when all of the following are true for at least 5 seconds: • Unit mode = Cool • compressor is running • VFD Line Current > VFD Primary RLA set point x 1.05 VFD Primary RLA set point is part of the unit configuration.
Action Taken:	Compressor speed will decrease 1Hz every 2 seconds until the event reset condition is met.
Reset:	This event is reset when VFD Line Current ≤ VFD Primary RLA set point x 1.05. It is also reset when the compressor is no longer running or the unit operating mode is changed to Ice.

High VFD Temperature Hold

Trigger:	This event will trigger when all of the following are true for at least 5 seconds: • Unit mode = Cool • compressor is running • VFD Heat Sink > 84°C
Action Taken:	Compressor will not be able to increase in speed or capacity.
Reset:	This event is reset when VFD Heatsink Temp < 84°C for at least 60 seconds. It is alsow reset when the compressor is not running or the unit operating mode is changed to Ice.

High VFD Temperature Unload

Trigger:	This event will trigger when all of the following are true for at least 5 seconds: • Unit mode = Cool • compressor is running • VFD Heat Sink > 87°C
Action Taken:	Compressor speed will decrease at a rate equivalent to 1Hz every 10 seconds.
Reset:	This event is reset when VFD Heatsink Temp ≤ 87°C. It is alsow reset when the compressor is not running or the unit operating mode is changed to Ice.

Low Pressure Ratio Shutdown

Trigger:	This event will trigger on the first and second occurrence of the below conditions within 2 hours. A third occurrence within a 2 hour window triggers the alarm. Circuit state is Run and pressure ratio < 1.3 for a time > Low Pressure Ratio Delay set point.
Action Taken:	Rapid shutdown of unit
Reset:	This event resets immediately after triggering.

Compressor Start Failure

Trigger:	This event will trigger on the first and second occurrence of the below conditions within 2 hours. A third occurrence within a 2 hour window triggers the alarm. All of the following must be true to trigger: • Compressor Run command is on • Compressor VFD Communication Failure is not active • Either VFD Actual Speed = 0 for more than 15 seconds OR VFD Actual Speed < 14Hz for more than 30 seconds
Action Taken:	Rapid shutdown of unit
Reset:	This event resets immediately after triggering.

Unit Controller Operation

Figure 28: Unit Controller

The unit controller HMI/display is an 8-line display with 6 buttons (keys). The right side buttons are used for navigation of the menus with up, down, and check/enter. The Up and Down buttons move the cursor up and down the screen. If the selected line links to another screen, there will be an arrowhead on the right end of the line. To navigate to the linked screen, the Enter button is pressed.

The three, left side buttons for Home, Alarm, and Back/Cancel have LED indicator lights.

- When the Home button is pressed, the Main Menu screen is displayed.
- When the Alarm button is pressed, the Alarm Log screen is displayed. If there are active alarms and the alarm button is pressed repeatedly, the HMI will cycle between the Alarm Log screen, the Active Alarms screen, and the Alarm Detail screen for the active alarm.
- When the Back button is pressed, the previously displayed screen is displayed. This button can be pressed repeatedly until the Main Menu screen is displayed.

Changing Parameter Values

When a setting or changeable field is selected on the screen, the Enter button is pressed to enter edit mode. Once in edit mode, the Up and Down buttons are used to adjust the value. The Enter button is pressed to set the parameter to the selected value. If the user wants to cancel any changes to the parameter, the Back button can be pressed. When the Enter or Back button are pressed, the interface returns to navigation mode.

Figure 29: Example Menu Screen

Menu Details

Three types of lines exist:

- Menu title, displayed in the first line as in Figure 29.
- Link (also called Jump) having an arrow (>) in the right of the line and used to link to the next menu.
- Parameters with a value or adjustable set point.

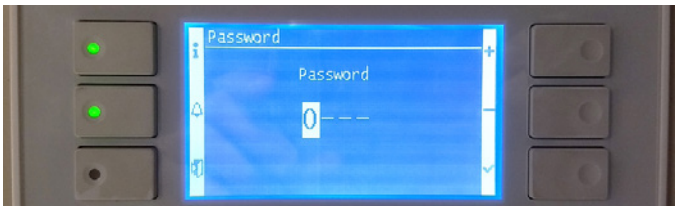
The first line visible on each display includes the menu title and the line number indicating which menu number you are on and the total number of menus. In the above menu screen, the title is Cir 1 Data and it is menu 1 of 22.

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

Each line on a screen can contain status-only information or include changeable data fields (set points) and becomes highlighted when the cursor is on that line. A line in a menu may also be a link to further menus. An arrow is displayed to the far right of the line to indicate it is a “jump” line, meaning pushing the bottom right checkmark button will cause a “jump” to a new menu.

Passwords

Figure 30: Password screen



When the HMI is first accessed or if the HMI has been idle for longer than the Password Timeout (default 30 minutes), the display will show a “startup” page where a password is entered or continue without entering a password. Once a valid password is entered or if continuing without a password, the display changes to the Main Menu. There are 4 levels of access for the user interface:

- No password
- Operator level - 5321
- Technician/Manager level - Provided at startup
- Daikin Applied service technician level

Read/write access to unit setpoints is dependent upon the entered password level. Continuing without a password allows access only to the Main Menu with read only capability to basic status items. The Operator password allows access to more status information as well as read/write access to basic set points required to set up the unit for “normal” operation. TheTechnician/Manager password allows similar access to Operator with the addition of more advanced status and commissioning set points. The Daikin Applied service technician has the highest level of access.

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

⚠ DANGER

LOCKOUT/TAGOUT all power sources prior to starting, pressurizing, de-pressuring, or powering down the Chiller. 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.

Pre-Startup

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

NOTICE

Daikin Applied service personnel or factory authorized service agency must perform initial startup in order to activate warranty. Return the "WWV Screw Compressor Equipment Warranty Form" within 10 working days to Daikin Applied as instructed on the form to obtain full warranty benefits.

⚠ CAUTION

Most relays and terminals in unit control center are powered when S1 is closed and control circuit disconnect is on. Therefore, do not close S1 until ready for startup or unit may start unintentionally and possibly cause equipment damage.

Before powering the machine and thus starting the compressors, open all valves that were closed at the factory for shipping. The valves to be opened are:

1. Valve (optional) installed on the compressor line
2. Oil return pipe shutoff valves (jet pump). These valves are positioned below the evaporator sleeve in the vicinity of the jet pump.
3. Liquid line valve installed under the condenser.
4. Oil valves installed on the line that feeds the compressor lubrication system. This line comes from the bottom of the oil separator located inside the condenser.
5. Valve (optional) installed on the compressor pump line.

Startup

1. Double check that the discharge shutoff valve and the optional compressor suction butterfly valves are open.
2. Check that the manual liquid-line shutoff valves at the outlet of the subcooler coils are open.
3. Check the leaving chilled water temperature set point on the MicroTech® III controller to be sure it is set at the desired chilled water temperature.
4. Start the auxiliary equipment for the installation by turning on the time clock, and/or remote on/off switch, and chilled water pump.
5. Under the "Control Mode" menu of the keypad, place the unit into the automatic cool mode.

Temporary Shutdown

Move pumpdown switches Q1 and Q2 to the "Pumpdown and Stop" position. After the compressors have pumped down, turn off the chilled water pump.

⚠ CAUTION

Water flow to the unit must not be interrupted before the compressors pump down to avoid freeze-up in the evaporator. Interruption will cause equipment damage.

Startup After Temporary Shutdown

1. Start the chilled water pump.
2. With System switch Q0 in the "on" position, move pumpdown switches Q1 and Q2 to the "auto" position.
3. Observe the unit operation until the system has stabilized.

Extended (Seasonal) Shutdown

1. Move Q1 & Q2 switches to manual pumpdown position.
2. After the compressors have pumped down, turn off the chilled water pump.
3. Turn off all power to unit and to the chilled water pump.
4. Move the emergency stop switch S1 to the "off" position.
5. Close the compressor discharge valve and the optional compressor suction valve (if so equipped) as well as the liquid line shutoff valves.
6. Tag all opened compressor disconnect switches to warn against startup before opening the compressor suction valve and liquid line shutoff valves.

Startup After Extended (Seasonal) Shutdown

1. With all electrical disconnects locked and tagged out, check all screw or lug-type electrical connections to be sure they are tight for good electrical contact.
2. Check the voltage of the unit power supply and see that it is within the ±10% tolerance that is allowed. Voltage unbalance between phases must be within ±2%.
3. See that all auxiliary control equipment is operative and that an adequate cooling load is available for startup.
4. Check all compressor flange connections for tightness to avoid refrigerant loss. Always replace valve seal caps.
5. Make sure system switch Q0 is in the "Stop" position. Turn compressor circuit breakers to "off" position until ready to start unit.
6. Open optional compressor suction butterfly as well as the liquid line shutoff valves, compressor discharge valves.
7. Vent the air from the evaporator water side as well as from the system piping. Open all water flow valves and start the chilled water pump. Check all piping for leaks and recheck for air in the system.
8. Set chilled water setpoint to the required temperature.
9. Under the "Control Mode" menu of the keypad, place the unit into the automatic cool mode.
10. Start the system by moving pumpdown switches to "auto" position.

General Maintenance

On initial startup and periodically during operation, it will be necessary to perform certain routine service checks. Among these are checking the liquid line sight glasses, and the compressor oil level sight glass. In addition, check the MicroTech® III controller temperature and pressure readings with gauges and thermometers to see that the unit has normal condensing and suction pressure and superheat and subcooling readings.

A Periodic Maintenance Log is located at the end of this manual. It is suggested that the log be copied and a report be completed on a regular basis. The log will serve as a useful tool for a service technician in the event service is required.

Initial startup date, vibration readings, and oil analysis information should be kept for reference base-line data.

If the service technician has determined that the refrigerant charge has been contaminated, the charge should be recovered and tested for contaminates or noncondensables. Appropriate actions should be taken based on testing and Clean Air Act regulations.

Vibration Monitoring (Optional)

Vibration readings are often used as an indicator of a possible problem requiring maintenance. If vibration monitoring is part of the site PM program, the compressor can be checked with a vibration analyzer on an annual basis. When doing the annual testing, the load should be maintained as closely as possible to the load of the original test. The initial vibration analysis test provides a benchmark of the compressor, and when performed routinely, can give a warning of impending problems.

Lubrication

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

⚠ CAUTION

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

⚠ WARNING

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

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

- Emkarate RL 220H

Oil charges given in Table 29 are guidelines only. The unit is properly charged with oil when the higher sight glass on the condenser has the red ball aligned with the middle indicator when unit is running at full capacity, see Figure 31. The lower sightglass is used to ensure there is a minimum amount of charge in the unit for running.

Figure 31: Sight Glasses - Condenser

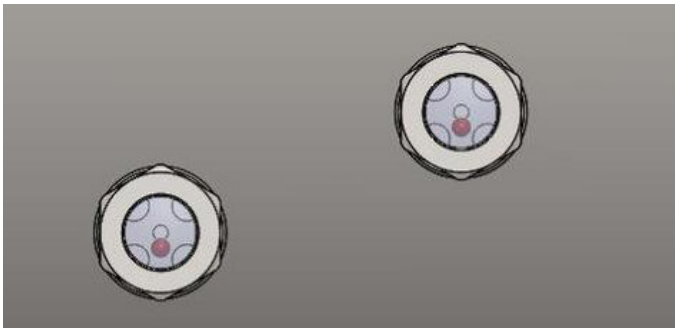


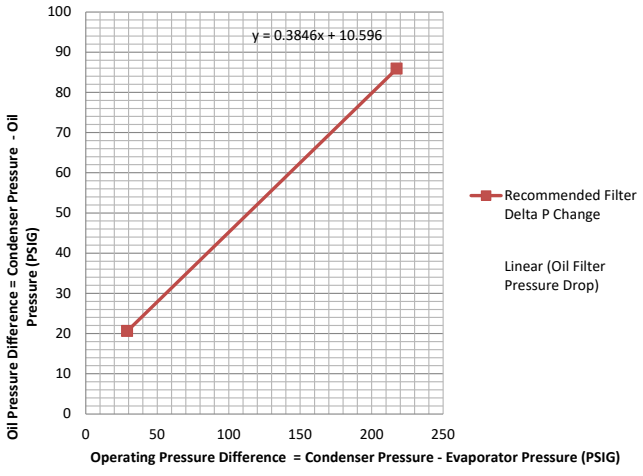
Table 29: Oil Charge Guideline

Unit Configuration Compressor/Evaporator/Condenser	Oil Charge (gal)
JNNS/E1610/C1810	6.5
JNNS/E1610/C2010	6.5
MNNS/E1610/C1810	6.5
MNNS/E1610/C2010	7.5
MNNS/E2010/C2010	7.5
MNNS/E2410/C2410	7.5
RNNS/E2010/C2010	7.5
RNNS/E2410/C2410	7.5

Oil Filter Removal and Renewal

Prior to this procedure, pump out the compressor. Isolate the electrical supply to the control panels and compressor motor terminal. Filter should be changed when pressure drop delta goes above the linear line in Figure 32.

Figure 32: Pressure Drop to Change Oil Filter



⚠ WARNING

After the compressor has been pumped down and isolated, the oil contained inside the filter housing will remain hot enough to cause burns for some time afterwards. Always allow sufficient time for the oil to cool down so that it is cool enough not to be a danger when drained off (less than 35°C is recommended). Severe injury from burns can result.

Figure 33: Oil Filter Location (Including Cutaway View)

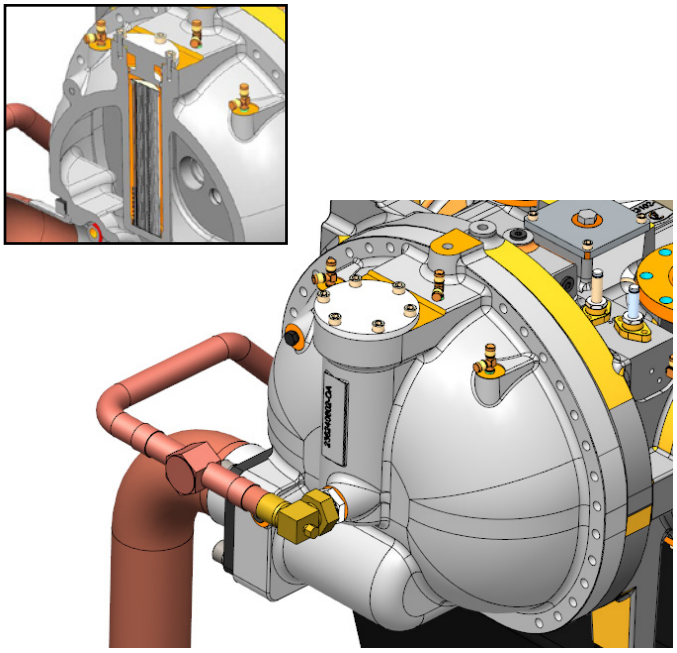
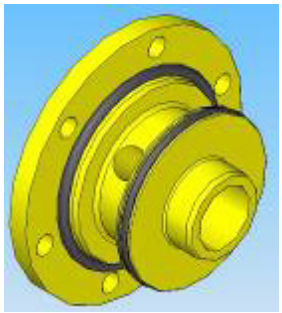


Figure 34: Oil Filter Housing Cover Plate



Oil filter assembly components are:

- Oil Filter – 250mm
- Oil Filter Housing Cover
- O-Ring – 89.5x3
- O-Ring – 76.1x3.4
- (6) M8 Bolts

Disassembly Procedure

1. Unscrew and remove two hex head side cover bolts 180° apart. Insert M8 guide studs into the vacant holes.
2. Remove remaining bolts and oil filter housing cover.
3. Pull the oil filter off of the spigot and withdraw the oil filter from the housing and clean the housing.

4. Clean oil filter housing cover plate and all other components.

Fitting a New Oil Filter Element – Reassembly

Before reassembly, remove any paint from joint faces. Inspect parts individually for damage and ensure they are completely clean before laying them out on a clean surface in a logical order ready for reassembly.

Use fresh refrigerant oil to lubricate parts during reassembly.

1. Install new O-rings on the oil filter housing cover.
2. Insert new oil filter into the housing, ensuring the filter sits tightly on the sealing spigot.
3. Replace the oil filter housing cover.
4. Evacuate air and non-condensibles before valving refrigerant back into the compressor.

Electrical Terminals

⚠ DANGER

Electric equipment can cause electric shock which will cause severe personal injury or death. Turn off, lock out and tag all power before continuing with following service. Panels can have more than one power source.

⚠ CAUTION

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

Liquid Line Sight Glass

Observe the refrigerant sight glasses weekly. A clear glass of liquid indicates that there is adequate refrigerant charge in the system to provide proper feed through the expansion valve.

Bubbling refrigerant in the sight glass, during stable run conditions, may indicate that there can be an electronic expansion valve (EXV) problem since the EXV regulates refrigerant flow. 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. At full load operating conditions, subcooling values will be approximately 7.2°F (4°C) and suction superheat values will be approximately 0.9°F (0.5°C).

An element inside the sight glass indicates the moisture condition corresponding to a given element color. If the sight glass does not indicate a dry condition after about 12 hours of operation, an oil acid test is recommended.

Do not use the sight glass on the EXV body for refrigerant charging. Its purpose is to view the position of the valve.

Pump Operation

It is highly recommended that the chiller unit control the chilled water pump(s). The integral chiller control system has the capability to selectively start pump A or B or automatically alternate pump selection at each start and also has pump standby operation capability.

Failure to have the chiller control the pumps may cause the following problems:

1. If any device, other than the chiller, should try to start the chiller without first starting the pumps, the chiller will lock out on the no-flow alarm and require a manual reset to restart. This can be disruptive to the normal cooling process.
2. In areas where freeze-up is a concern, the chiller control senses the chilled water temperature. It also signals the chilled water pump to start to providing flow through the evaporator and additional protection against evaporator and outside pipe freeze-up . Other pump starting methods will not automatically provide this protection. Note: the owner/operator must be aware that when the water temperature falls below freezing temperatures it is imperative NOT to stop the pump(s) as immediate freeze-up can occur.

   This method of freeze protection is only effective as long as the facility and the chiller have power. The only positive freeze protection during power failures is to drain the evaporator and blow out each tube or add the appropriate concentration of glycol to the system.

Compressor VFD

Table 30: Compressor VFD Inspection Areas

Inspection Area	Inspection Points	Corrective Action
General	Inspect equipment for discoloration from overheating or deterioration.	Replace damaged equipment as required.
	Inspect for dirt, foreign particles, or dust collection on components	Inspect door seal if so equipped. Use dry air to clear foreign matter.
Conductors and Wiring	Inspect wiring and connections for discoloration, damage or heat stress.	Repair or replace damaged wire.
Terminals	Inspect terminals for loose, stripped, or damaged connections.	Tighten loose screws and replace damaged screws or terminals.
Relays and Contactors	Inspect contactors and relays for excessive noise during operation.	Check coil voltage for over or under voltage condition.
	Inspect coils for signs of overheating such as melted or cracked insulation.	Replace damaged removable relays, contactors or circuit board.

Figure 35: Preventative Maintenance Schedule

Operation	Weekly	Monthly (Note 1)	Annual (Note 2)
General			
Complete unit log and review (Note 3)	X		
Inspect unit for loose or damaged components and visible leaks		X	
Inspect thermal insulation for integrity			X
Clean and paint as required			X
Electrical (* including the VFDs)			
Sequence test controls *			X
Check contactors for pitting, replace as required *			X
Check terminals for tightness, tighten as necessary *			X
Clean control panel interior *			X
Clean control box fan filter * (Note 7)	X		
Visually inspect components for signs of overheating *		X	
Refrigeration/Lubricant			
Leak test		X	
Check liquid line sight glasses for clear flow	X		
Check oil sight glass for correct level (lubricant charge)	X		
Perform compressor vibration test (optional)			X
Perform oil analysis test on compressor oil			X
Evaporator and Condenser (water-cooled)			
Confirm correct water flow and pressure drop		X	
Confirm appropriate water treatment		X	
Clean and Leak Test tubes			X
Clean Flow Sensor			X

NOTE: 1 Monthly operations include all weekly operations.

2 Annual (or spring startup) operations include all weekly and monthly operations.

3 Log readings can be taken daily for a higher level of unit observation.

4 Replace the filter if pressure drop exceeds 20 psi.

5 The weekly fan filter cleaning schedule can be modified to meet job conditions. It is important that the filter allows full air flow.

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

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

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

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

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

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

EXCEPTIONS

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

ASSISTANCE

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

SOLE REMEDY

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

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

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

Daikin Applied Training and Development

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

Warranty

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

Aftermarket Services

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

This document contains the most current product information as of this printing. For the most up-to-date product information, please go to www.DaikinApplied.com.

Products manufactured in an ISO Certified Facility.