DAIKIN

Installation, Operation, and Maintenance Manual

IOM 1322-1

Group: **Chiller**
Part Number: **IOM1322-1**
Date: **January 2022**

Water-Cooled Scroll Compressor Chillers

WGZ030DW - WGZ200DW, Packaged Water-Cooled Chillers
30 - 200 Tons (105 - 700 kW)
R-410A
50/60 Hz

Manufactured in an ISO 9001 & ISO 14001 certified facility

Pre-Start Checklist – Scroll Compressor Chillers

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

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

Chilled Water 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 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 12 hours before startup				
Oil heaters energized at least 12 hours before startup				
Chiller components (EXV Sensors Transducers) installed and wired properly.				
*Wiring complies with National Electrical Code and local codes (See Notes)				
Remote EXV wired with shielded cable				
Miscellaneous	**Yes**	**No**	**N/A**	**Initials**
Unit control switches all off				
Remote Evaporator / Condenser Piping factory reviewed				
All refrigerant components/piping leak tested, evacuated and charged				
Thermometers, wells, gauges, control, etc., installed				
Minimum system load of 80% capacity available for testing/adjusting controls				
Document Attached: Technical Breakdown from Selection Software				
Document Attached: Final Order Acknowledgement				
Document Attached: Remote piping approval				

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

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

* Refer to NFPA 70-2017, Article 440.35

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

Contractor Representative

Signed: _____

Name: _____

Company: _____

Date: _____

Phone/Email: _____

Daikin Applied Sales Representative

Signed: _____

Name: _____

Company: _____

Date: _____

Phone/Email: _____

This manual provides installation, operation, and maintenance information for Daikin scroll chillers with the MicroTech® controller.

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. Disconnect electrical power before servicing the equipment. More than one disconnect may be required to de-energize the unit. Be sure to read and understand the installation, operation, and service instructions within this manual.

⚠ WARNING

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

⚠ CAUTION

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

⚠ CAUTION

When moving refrigerant to/from the chiller from 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.

⚠ WARNING

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 is likely to 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

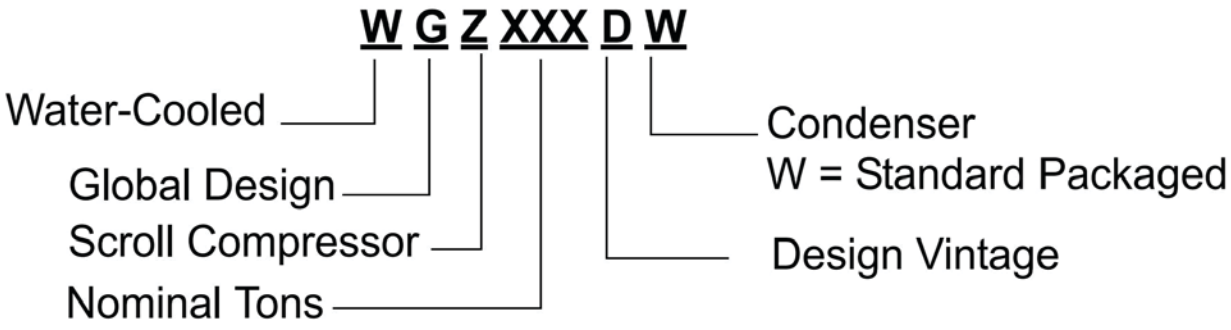
Warning indicates a potentially hazardous situations which can result in property damage, personal injury, or death if not avoided.

⚠ CAUTION

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

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

Chiller Nomenclature



General Description

Daikin Applied WGZ water chillers are designed for indoor installations Equipment room temperature for operating and standby conditions is 40°F to 122°F (4.4°C to 50°C).

Each water-cooled unit is completely assembled and factory wired before evacuation, charging and testing. They consist of hermetic scroll compressors, brazed-plate evaporators on Models WGZ 030 to 130 or shell-and-tube on Models WGZ 150 to 200, water-cooled condenser on Model WGZ-DW, and complete refrigerant piping.

Liquid line components that are included are manual liquid line shutoff valves, charging valves, filter-driers, liquid line solenoid valves, sight glass/moisture indicators, and expansion valves. Other features include compressor crankcase heaters, and a MicroTech II microprocessor controller.

The electrical control center includes all equipment protection and operating controls necessary for dependable automatic operation. Optional unit-mounted disconnect switch(es) may not be present, in which case a field-supplied and installed, fused disconnect switch is required.

NOTE: Information for Model TGZ Templifiers with R-134a can be found in IOM 1319 at www.DaikinApplied.com.

Inspection

When the equipment is received, all items should be carefully checked against the bill of lading to be sure of a complete shipment. All units must be carefully inspected for damage upon arrival. All shipping damage must be reported to the carrier and a claim must be filed with the carrier. The unit serial plate should be checked before unloading the unit to be sure that it agrees with the power supply available. Physical damage to unit after acceptance is not the responsibility of Daikin Applied.

Refrigerant Charge

Every model WGZ-DW water chiller with water-cooled condensers is shipped with a full refrigerant charge. For shipment, the charge is contained in the condenser and is isolated by the condenser liquid shutoff valve and the compressor discharge valve common to a pair of compressors.

⚠ DANGER

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

Installation

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.

⚠ 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.

Location

WGZ chillers are intended only for installation in an indoor or weather protected area consistent with the NEMA 1 rating on the chiller, controls, and electrical panels. Equipment room temperature for operating and standby conditions is 40°F to 122°F (4.4°C to 50°C).

Because of the electrical control devices, the units should not be exposed to the weather. A plastic cover over the control box is supplied as temporary protection during shipment. A reasonably level and sufficiently strong floor is required for the water chiller. If necessary, additional structural members should be provided to transfer the weight of the unit to the nearest beams

Space Requirements for Connections and Servicing

For brazed plate evaporators - the chilled water and condenser water (on units with a water-cooled condenser) piping enters and leaves the unit from the right side when looking at the

control panel. Left-hand condenser connections are an option.

For shell and tube evaporators, the water connections are on the back side of the unit. A clearance of at least 3 feet (1219 mm), or more if codes require, should be provided beyond this piping and on all other sides and ends of the unit for general servicing or for changing the compressors, if it ever becomes necessary. Allow a minimum of 4-ft clearance in front of the control panel or as required by NEC or local codes.

Clearance should also be provided for cleaning or removal of condenser tubes on one end of the unit. The clearance for cleaning depends on the type of apparatus used, but can be as much as the length of the condenser (10 feet, 3050 mm). Tube replacement requires the length of the condenser (as much as 12 feet) plus three feet of workspace. This space can be provided via a doorway or other opening.

Moving the Unit

Refer to Lifting/Mounting weights beginning on page 20.

The packaged unit skid option is strongly recommended for ease of handling and to help prevent damage if a crane is not available for rigging at site. Properly designed field supplied skids or dollies are acceptable. Do not push unit along a floor without them.

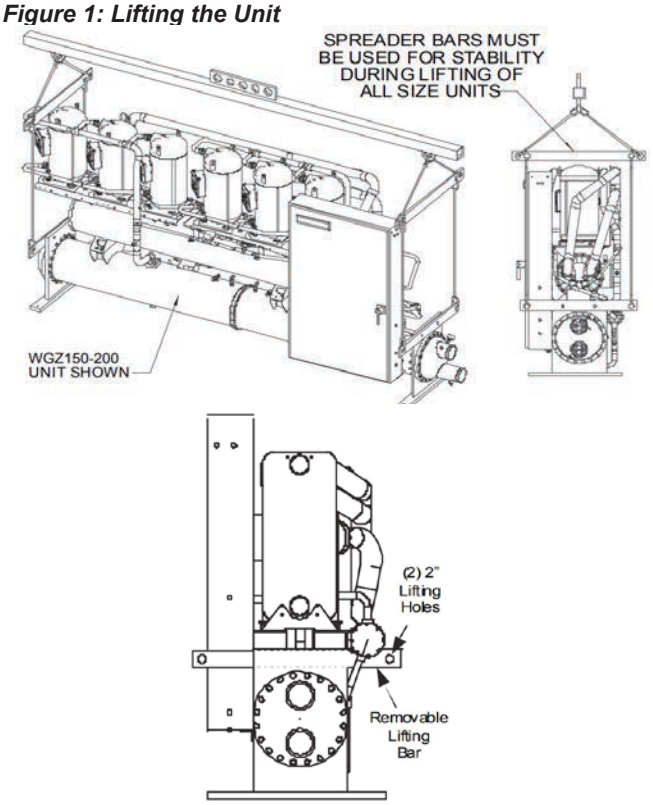
All moving and handling of packaged units (Figure 1: Lifting the Unit) must be performed with skids or dollies under the unit and they should not be removed until the unit is in the final location. Never put the weight of the unit against the control box.

In moving, always apply pressure to the base on the skids only and not to the piping or other components. A long bar will help move the unit. Avoid dropping the unit at the end of the roll.

If the unit must be hoisted, lift the unit from the removable lifting arms factory-bolted to each end of the unit adjacent to the tube sheet by attaching cables or chains to the end of the arms. A spreader bar must be used to protect the piping, control panel and other areas of the chiller (Figure 1: Lifting the Unit). The lifting arms should be removed after use.

Do not attach slings to piping or equipment. Do not attempt to lift the unit by lifting points mounted on the compressors. They are for lifting only the compressor should one need to be removed from the unit. Move unit in the upright horizontal position at all times. Set unit down gently when lowering from the truck or rollers. Improper rigging, lifting, or moving of a unit can result in property damage, severe personal injury or death. Follow rigging and moving instructions carefully. Do not stand beneath the unit while it is lifted or being installed.

Figure 1: Lifting the Unit



Placing the Unit

The small amount of vibration normally encountered makes this unit particularly desirable for basement or ground floor installations where the unit can be mounted directly to the floor. The floor construction should be such that the unit will not affect the building structure, or transmit noise and vibration into the structure. Isolator pads or spring isolators are available options.

Mounting

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

Figure 2: Compressor Base Plate Mounting

Chilled Water Piping Guidelines

Due to the variety of piping practices, it is advisable to follow the recommendations of local codes for compliance. They can supply the installer with the proper building and safety guidelines required for a safe and proper installation

The piping should be designed with a minimum number of bends and changes in elevation to keep system cost down and performance up.

⚠ 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.

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

- A cleanable strainer installed at the water inlet to the evaporator to remove debris and impurities before they reach the evaporator. Install cleanable strainer within 5 feet (1500 mm) of pipe length from the evaporator inlet connection and downstream of any welded connections (no welded connections between strainer and evaporator WGZ-D models with braze plate evaporators require a strainer with perforations no larger than 0.063" (1.6 mm) diameter. Models with shell and tube evaporators require a strainer with perforations no larger than 0.125" (3.2 mm) diameter.
- A water flow switch must be installed in the horizontal piping of the evaporator outlet. The flow switch may be ordered as a factory-installed option, a filed-installed kit,or may be supplied and installed in the field. See page 10 for further information regarding flow switches.
- All piping should be installed and supported to prevent the chiller connections from bearing any strain or weight of the system piping.
- Manual or automatic air vent valves at the high points of the system. Drains should be placed at the lowest points in the system. Braze plate evaporators do not have vent or drain connections and provisions must be made in the entering and leaving chilled water piping for venting and draining.
- Chilled water piping must be insulated to reduce heat loss and prevent condensation per code requirements. Complete unit and system leak tests should be performed prior to insulating the water piping. Insulation with a vapor barrier would be the recommended type of insulation. The vent and drain connections must extend beyond the proposed insulation thickness for accessibility.

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

- Some means of maintaining adequate system water pressure (e.g., expansion tank or regulating valve).
- Temperature and pressure indicators located within 3 feet (0.9 meters) of the inlet and outlet of the vessels to aid in unit servicing. Pressure drop through the vessel should be measured to determine water flow from the flow pressure drop curves beginning on page 13.
- Flush the system thoroughly prior to unit installation.
- A preliminary leak check of the water piping should be made before filling the system.
- Vibration eliminators to reduce vibration and noise transmission to the building.
- Shutoff valves to isolate the unit from the piping system during unit servicing.
- Regular water analysis and chemical water treatment on the evaporator is recommended immediately upon equipment start-up.
- Chillers not run in the winter should have their water systems thoroughly drained if subject to sub-freezing temperatures. If the chiller operates year-round, or if the system is not drained for the winter, the chilled water piping exposed to sub-freezing ambient temperatures should be protected against freezing by wrapping the lines with a heater cable. In addition, an adequate percentage of glycol should be added to the system to further protect the system during low ambient temperature periods. It should be noted that water piping that has been left drained is subject to more corrosion than if filled with water. Use of a Vapor Corrosion Inhibitor (VCI) or some other protection should be considered. See the section titled "Glycol Solutions" for additional information concerning the use of glycol.

This product is equipped with a copper-brazed 304 series stainless steel evaporator plate or a shell and tube evaporator with carbon steel shell and copper tubes. The water or other fluid used in these evaporators must be clean and noncorrosive to the materials used in the evaporator. The use of non-compatible fluids can void the equipment warranty. If the compatibility of the fluid with the evaporator is in question, a professional water quality consultant should administer the proper testing and evaluate compatibility.

System Water Volume

It is important to have adequate water volume in the system to provide an opportunity for the chiller to sense a load change, adjust to the change, and then stabilize. The system water volume is the total amount of water in the evaporator, air handling equipment, and associated piping. As the expected load change becomes more rapid, a greater water volume is needed. If the water volume is too low, operational problems can occur including rapid compressor cycling, rapid loading and unloading of compressors, erratic refrigerant flow in the chiller, improper motor cooling, shortened equipment life and other undesirable occurrences.

Figure 3: Typical Evaporator Field Water Piping (WGZ030 - WGZ130)

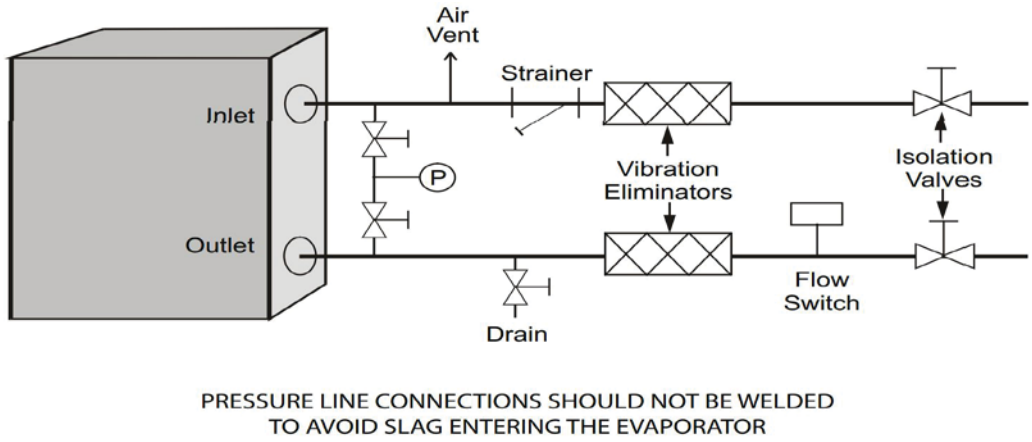
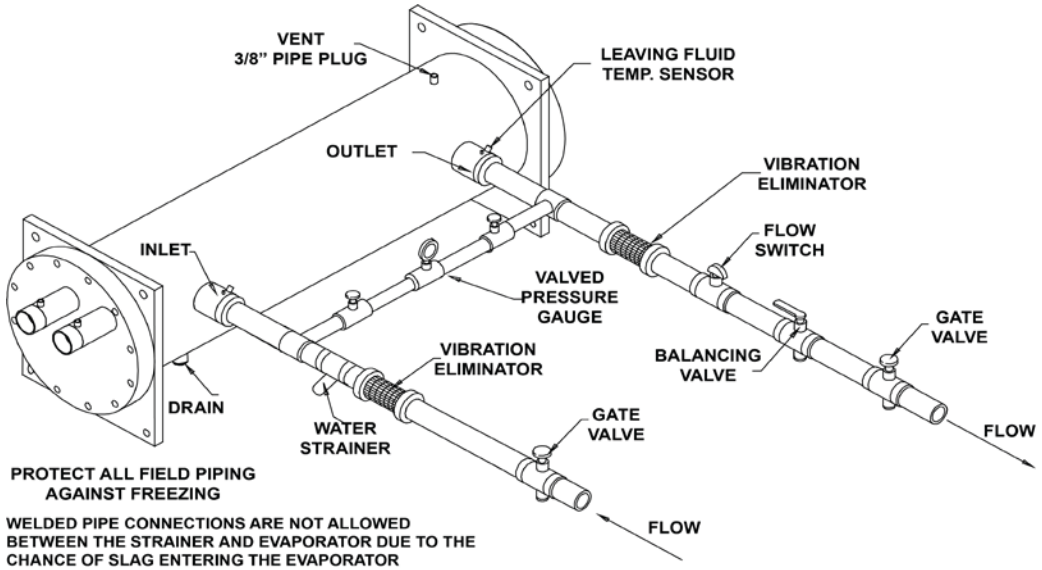


Figure 4: Typical Evaporator Field Water Piping (WGZ150 - WGZ200)



For normal comfort cooling applications where the cooling load changes relatively slowly, a minimum system volume of two to three minutes times the flow rate (GPM) is recommended. For example, if the design chiller flow rate is 120 gpm, we recommend a system volume of 240 to 360 gallons.

For process applications where the cooling load can change rapidly, additional system water volume is needed. A process example would be the quenching of hot metal objects. The load would be very stable until the hot metal is dipped into the water tank. Then, the load would increase drastically.

Since there are many other factors that can influence performance, systems can successfully operate below these suggestions. But as the water volume decreases below these guidelines, the possibility of system instability increases.

Variable Chilled Water Flow

Reducing chilled water flow in proportion to load can reduce total system power consumption. Certain restrictions apply to the amount and rate of flow change. The rate of flow change should be a maximum of 10 percent of the change, per minute. For example, if the maximum design flow is 200 gpm and it will be reduced to a flow of 140 gpm, the change in flow is 60 gpm. Ten percent of 200 gpm equals 20 gpm change per minute, or a minimum of three minutes to go from maximum to desired flow. Do not reduce flow lower than the part load minimum flows listed on page 13 or page 14.

Flow Switch

A water flow switch must be mounted in the leaving evaporator and condenser water lines to prove adequate water flow before the unit can start. This will safeguard against slugging the compressors on start-up. It also serves to shut down the unit in the event that water flow is interrupted to guard against evaporator freeze-up. There are two options for meeting this requirement.

1. A factory-mounted thermal dispersion flow switch.
2. A “paddle” type flow switch is available from Daikin Applied for field mounting and wiring. Wire from switch terminals Y and R to the unit control panel terminals shown on the field wiring diagram, page 27. Mount the flow switch in the leaving water line to shut down the unit when water flow is interrupted. A flow switch is an equipment protection control and should never be used to cycle a unit.

Installation should be per manufacturer’s instructions included with the switch. There is also a set of normally closed contacts on the switch that can be used for an indicator light or an alarm to indicate when a “no flow” condition exists. Flow switches should be calibrated to shut off the unit when operated below the minimum listed flow rate for the unit listed on page 13. Provide freeze/condensation protection for any flow switch that is installed outdoors. Differential pressure switches are not recommended. They can freeze and fail to indicate a no-flow condition.

On units with factory-mounted flow switches and where flange connections (grooved-to-flange adaptors or weld-on flanges) are to be used, relocating the flow switch is required to allow for possible future replacement since the flange will interfere with unscrewing the switch. The following is recommended, before installing a flange, to avoid interference

1. Remove the flow switch before and plug the switch opening in the nozzle.
2. Install the grooved-to-flange adaptor or weld on flange.
3. Relocate the flow switch in the water piping outside the flange, close enough to it that the wire leads will reach and the switch can still be unscrewed.

NOTE: A water flow switch must be mounted in the evaporator outlet water line to signal that there is water flow before unit will start.

Glycol Solutions

⚠ CAUTION

Do not use automotive antifreeze. Industrial glycols must be used. Automotive antifreeze contains inhibitors that causes plating on copper tubes. The type and handling of glycol used must be consistent with local codes.

WGZ units are designed to operate with a leaving chilled fluid temperature from 15°F (-9.4°C) to 60°F (16°C). Leaving chilled fluid temperatures below 40°F (4.6°C) result in suction temperatures at or below the freezing point of water and a glycol anti-freeze solution is required. When glycol is added to the chilled water system for freeze protection, recognize that the refrigerant suction pressure will be lower, cooling performance less, and water side pressure drop will be higher. The reduction in performance depends upon the glycol concentration and temperature. This should be taken into consideration during initial system design.

Daikin Applied recommends a minimum concentration of 25% be provided on all glycol applications. Glycol concentrations below 25% are too diluted for long-term corrosion protection of ferrous metals and corrosion inhibitors need to be recalculated and possibly added to the system.Glycol concentrations greater than 35% are not recommended due to the higher pressure drops and losses of capacity and efficiency. Glycol concentrations higher than 35% do not offer any additional burst protection.

When glycol is required in the chilled water system, reset the freezestat and low leaving water alarm temperatures. The freezestat is factory set to default at 36°F (2.2°C). Reset the freezestat setting to approximately 4° to 5°F (2.3° to 2.8°C) below the leaving chilled water setpoint temperature.

Glycol in the condenser will have a negligible effect on performance because glycol at these higher temperatures will perform with characteristics similar to water.

Condenser Water Piping

Arrange the condenser water so the water enters the bottom connection of the condenser. The condenser water will discharge from the top connection. Failing to arrange the condenser water as stated above will negatively affect the capacity and efficiency.

Water flow through the condenser should only be during compressor operation. Pumps may be enabled by the chiller or BAS.

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

- Install a cleanable strainer with perforations no larger than 0.125” (3.2 mm) diameter in the inlet piping .
- Install pressure gauges in the inlet and outlet water lines to the condenser. Pressure drop through the condenser should be measured to determine flow on the pressure drop/flow curves beginning on page 14.

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

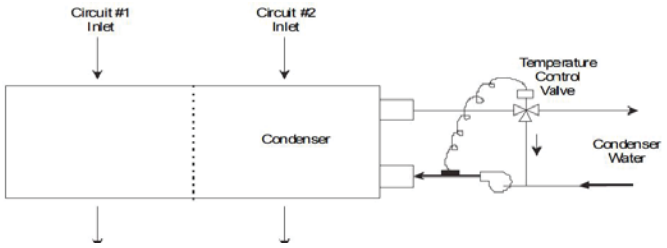
- Vibration eliminators are recommended in both the supply and return water lines to reduce vibration and noise transmissions to the building.
- A preliminary leak check of the water piping should be made before filling the system.
- Shutoff valves to isolate the unit from the piping system during unit servicing.
- Regular water analysis and chemical water treatment on the condenser is recommended immediately upon equipment start-up.

Condensers are drained of water in the factory and are shipped with the condenser drain plugs in the heads removed and stored in a bag in the control panel. Be sure to replace plugs prior to filling the vessel with fluid.

Water-cooled condensers can be piped for use with cooling towers, well water, or heat recovery applications. Cooling tower applications must be made with consideration of freeze protection and scaling problems. Contact the cooling tower manufacturer for equipment characteristics and limitations for the specific application. Head pressure control must be provided if the entering condenser water can fall below 60°F. The WGZ condenser has two refrigerant circuits with a common condenser water circuit. This arrangement makes head pressure control with discharge pressure actuated control valves difficult.

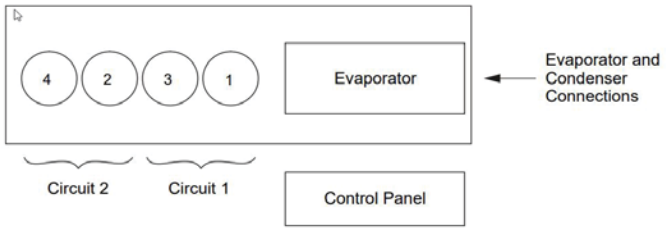
If the tower water temperature cannot be maintained at a 60°F minimum, or when pond, lake, or well water that can fall below 60°F (15°C) is used as the condensing medium, special discharge pressure control must be used. A water recirculating system with recirculating pump as shown in Figure 5: Recirculating Discharge Water System is recommended. This system also has the advantage of maintaining tube velocity to help prevent tube fouling. The pump must cycle with the chiller.

Figure 5: Recirculating Discharge Water System



Components

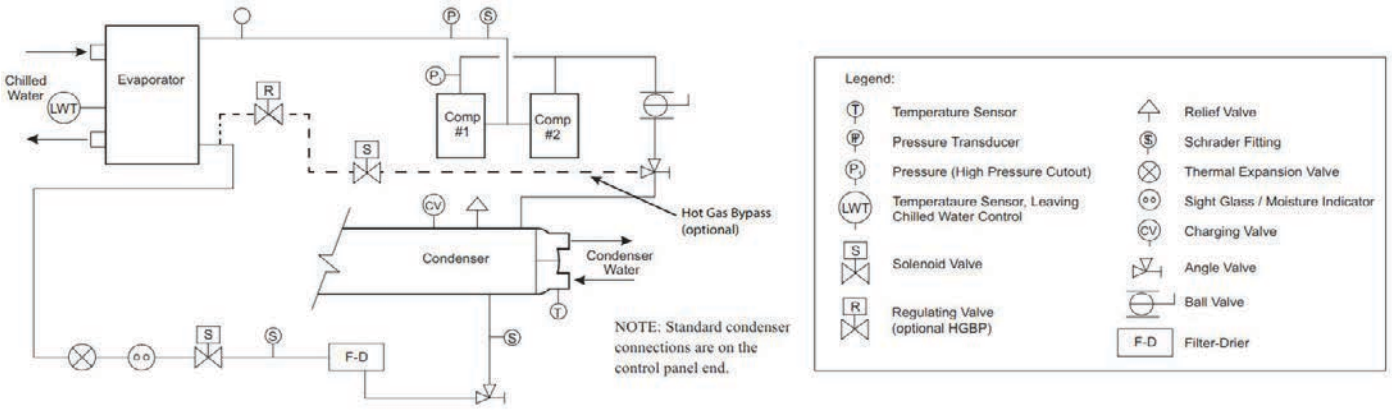
Figure 6: Compressor Locations



Packaged Unit Refrigerant Piping

WGZ 030DW to 130DW have two refrigerant circuits, two tandem scroll compressors (total of four), a single two-circuited brazed plate evaporator, a single two-circuited water-cooled condenser, interconnecting refrigerant piping and a control panel with associated sensors and transducers. Models WGZ 150DW to 200DW have two trio-compressors (total of 6) and a shell-and-tube evaporator. Packaged units are provided with complete refrigerant piping and full operating refrigerant charge at the factory.

Figure 7: Schematic Piping Diagram (One of Two Circuits for Brazed Plate Evaporators)



Relief Valve Piping

The ANSI/ASHRAE Standard 15, Safety Standard for Refrigeration Systems, specifies that pressure relief valves on vessels containing Group 1 refrigerant (R-410A) “shall discharge to the atmosphere at a location not less than 15 feet (4.6 meters) above the adjoining ground level and not less than 20 feet (6.1 meters) from any window, ventilation opening or exit in any building.” The piping must be provided with a rain cap at the outside terminating point and with a drain at the low point on the vent piping to prevent water buildup on the atmospheric side of the relief valve. Also, a flexible pipe section should be installed in the line to eliminate any piping stress on the relief valve(s).

Relief valves are located in the following places depending on unit configuration:

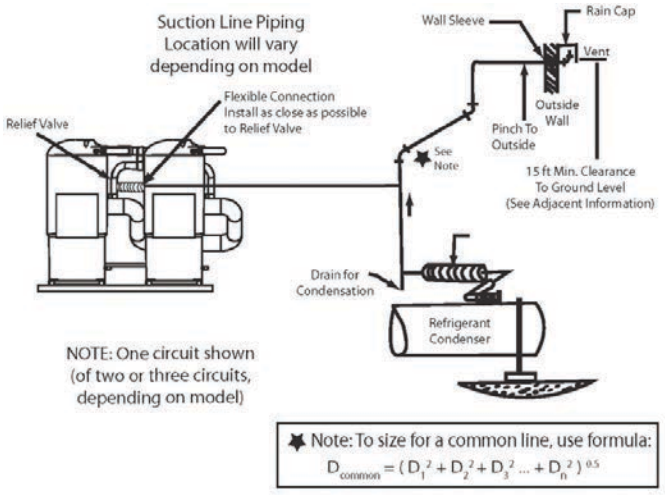
- Low side with brazed plate evaporator - on the suction line
- Low side with shell and tube evaporator - on the suction line
- High side on packaged unit - on the condenser shell

Table 1: Relief Valve Information

Configuration	High or Low Side	Connection Size		Relief Pressure PSI	Relief Volume lb air/ min
		Inlet	Outlet		
Packaged	Low	0.50” NPT	0.625” Flare	450	37.6
	High	0.50” NPT	0.625” Flare	500	33.3
Remote Condenser	Low	0.50” NPT	0.625” Flare	450	37.6
	High	If Required - Field Supplied			

The size of the discharge pipe from the pressure relief valve should not be less than the size of the pressure relief outlet (5/8 in. flare). See Figure 8 for pipe size when combining low side relief on compressor suction with the condenser relief valve.

Figure 8: Relief Valve Piping



NOTE: Fittings should be provided to permit vent piping to be easily disconnected for inspection or replacement of the relief valve.

Water Pressure Drop

Water flow rates should be maintained as closely as possible to job design values. The vessel flow rates must fall between the minimum and maximum values shown on the appropriate evaporator and condenser curves. Measure the water pressure drop through the vessels at field-installed pressure taps and check the flow rate using the following tables. Do not include valves or strainers in these readings.

The evaporator flow rates and pressure drops shown on the following page are for full load design purposes. The maximum flow rate and pressure drop are based on a 6-degree temperature drop. Avoid higher flow rates with resulting lower temperature drops to prevent potential control problems resulting from very small control bands and limited start up/shut off temperature changes.

The minimum flow and pressure drop is based on a full load evaporator temperature drop of 16-degrees.

Figure 9: WGZ-D Condenser Pressure Drop Curves

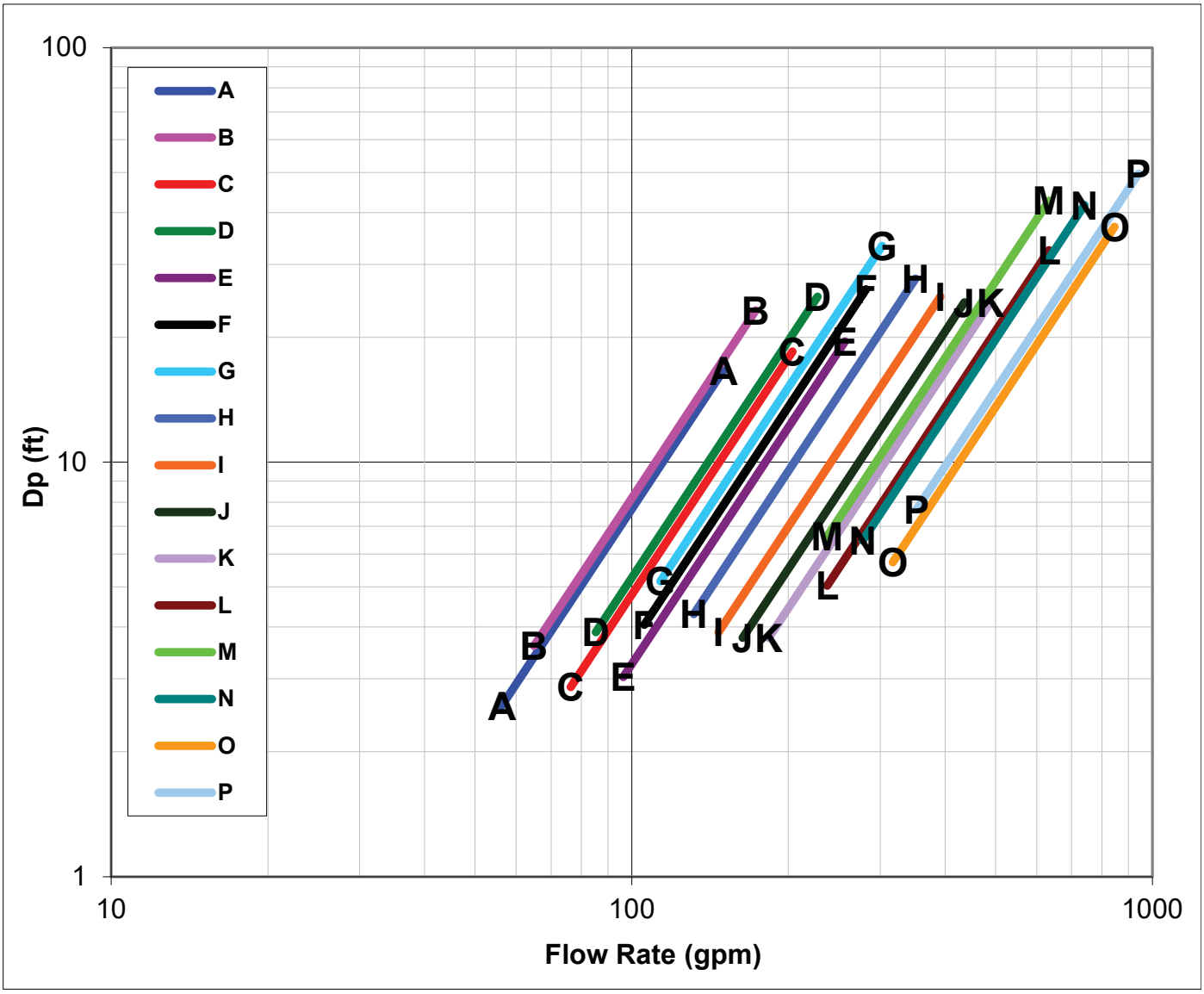


Table 2: WGZ-D Evaporator Pressure Drop Curves

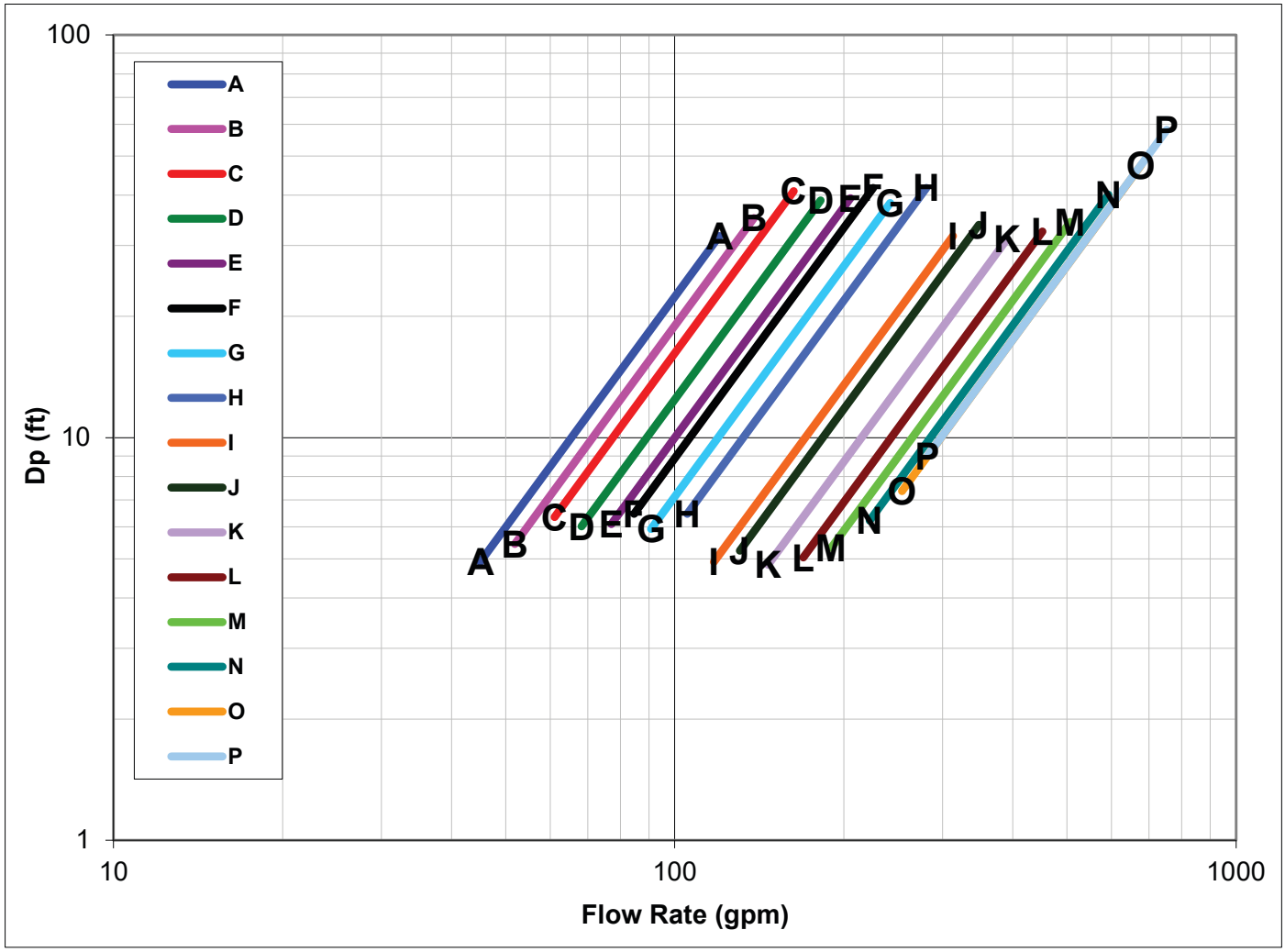


Table 3: WGZ-D Condenser Pressure Drop Data

Model	Curve Ref	Minimum Flow & Pressure Drop				Nominal Flow & Pressure Drop				Maximum Flow & Pressure Drop			
		Inch-Pound		S.I.		Inch-Pound		S.I.		Inch-Pound		S.I.	
		GPM	Ft	L/S	kPa	GPM	Ft	L/S	kPa	GPM	Ft	L/S	kPa
WGZ030D	A	56.3	2.6	3.5	7.7	90.0	6.3	5.6	18.8	150.0	16.6	9.4	49.7
WGZ035D	B	64.9	3.6	4.1	10.8	103.8	8.8	6.5	26.3	173.0	23.2	10.8	69.4
WGZ040D	C	76.3	2.9	4.8	8.6	122.1	7.0	7.6	20.9	203.5	18.5	12.7	55.2
WGZ045D	D	85.3	3.9	5.3	11.6	136.5	9.5	8.5	28.4	227.5	25.1	14.2	74.9
WGZ050D	E	96.4	3.0	6.0	9.1	154.2	7.4	9.6	22.1	257.0	19.5	16.1	58.4
WGZ055D	F	105.8	4.1	6.6	12.1	169.2	9.9	10.6	29.6	282.0	26.1	17.6	78.1
WGZ060D	G	113.4	5.2	7.1	15.4	181.5	12.6	11.3	37.7	302.5	33.3	18.9	99.4
WGZ070D	H	131.6	4.3	8.2	12.8	210.6	10.5	13.2	31.4	351.0	27.7	21.9	82.8
WGZ080D	I	146.8	3.9	9.2	11.6	234.9	9.5	14.7	28.4	391.5	25.1	24.5	74.9
WGZ090D	J	163.3	3.8	10.2	11.3	261.3	9.2	16.3	27.5	435.5	24.3	27.2	72.6
WGZ100D	K	183.4	3.8	11.5	11.3	293.4	9.2	18.3	27.5	489.0	24.3	30.6	72.6
WGZ115D	L	237.6	5.0	14.8	15.1	380.1	12.3	23.8	36.8	633.5	32.5	39.6	97.0
WGZ130D	M	237.6	6.6	14.8	19.8	380.1	16.2	23.8	48.4	633.5	42.8	39.6	127.8
WGZ150D	N	277.9	6.5	17.4	19.3	444.6	15.8	27.8	47.2	741.0	41.7	46.3	124.7
WGZ170D	O	317.4	5.7	19.8	17.1	507.9	14.0	31.7	41.8	846.5	37.0	52.9	110.5
WGZ200D	P	352.7	7.7	22.0	23.0	564.3	18.8	35.3	56.2	940.5	49.6	58.8	148.3

Table 4: WGZ-D Evaporator Pressure Drop Data

Model	Curve Ref	Minimum Flow & Pressure Drop				Nominal Flow & Pressure Drop				Maximum Flow & Pressure Drop			
		Inch-Pound		S.I.		Inch-Pound		S.I.		Inch-Pound		S.I.	
		GPM	Ft	L/S	kPa	GPM	Ft	L/S	kPa	GPM	Ft	L/S	kPa
WGZ030D	A	45.0	4.9	2.8	14.7	72.0	12.0	4.5	35.9	120.0	31.7	7.5	94.7
WGZ035D	B	51.9	5.4	3.2	16.3	83.0	13.3	5.2	39.8	138.3	35.1	8.6	104.9
WGZ040D	C	61.1	6.3	3.8	19.0	97.7	15.5	6.1	46.3	162.8	40.9	10.2	122.3
WGZ045D	D	68.3	6.0	4.3	18.0	109.2	14.7	6.8	43.9	182.0	38.8	11.4	116.0
WGZ050D	E	77.1	6.1	4.8	18.2	123.4	14.9	7.7	44.5	205.7	39.3	12.9	117.6
WGZ055D	F	84.6	6.5	5.3	19.3	135.4	15.8	8.5	47.2	225.7	41.7	14.1	124.7
WGZ060D	G	90.8	5.9	5.7	17.7	145.2	14.5	9.1	43.3	242.0	38.3	15.1	114.4
WGZ070D	H	105.3	6.5	6.6	19.3	168.5	15.8	10.5	47.2	280.8	41.7	17.6	124.7
WGZ080D	I	117.4	4.9	7.3	14.7	187.9	12.0	11.7	35.9	313.2	31.7	19.6	94.7
WGZ090D	J	130.6	5.2	8.2	15.7	209.0	12.8	13.1	38.3	348.3	33.8	21.8	101.0
WGZ100D	K	146.7	4.8	9.2	14.4	234.7	11.8	14.7	35.3	391.2	31.1	24.4	93.1
WGZ115D	L	169.4	5.0	10.6	15.1	271.0	12.3	16.9	36.8	451.7	32.5	28.2	97.0
WGZ130D	M	190.1	5.3	11.9	15.9	304.1	13.0	19.0	38.9	506.8	34.3	31.7	102.6
WGZ150D	N	222.3	6.2	13.9	18.6	355.7	15.2	22.2	45.4	592.8	40.1	37.1	119.9
WGZ170D	O	253.9	7.4	15.9	22.0	406.3	18.0	25.4	53.8	677.2	47.5	42.3	142.0
WGZ200D	P	282.1	9.0	17.6	26.9	451.4	22.0	28.2	65.8	752.3	58.1	47.0	173.6

Figure 10: WGZ030DW - 060DW (Packaged)

WGZ MODEL NUMBER	CHILLER WATER CONNECTION IN(MM) VICTAULIC		CONDENSER WATER CONNECTION IN(MM) VICTAULIC	CENTER OF GRAVITY		
	SIZE (NOM)	A	SIZE (NOM)	X	Y	Z
WGZ030D	2.5 (64)	14.4 (366)	4 (102)	59.2 (1504)	22.4 (569)	14.1 (358)
WGZ035D	2.5 (64)	13.7 (349)	4 (102)	59.9 (1522)	23.3 (592)	14.2 (361)
WGZ040D	2.5 (64)	13.0 (331)	4 (102)	59.5 (1511)	23.2 (589)	14.2 (361)
WGZ045D	2.5 (64)	11.7 (296)	4 (102)	59.1 (1501)	23.3 (592)	14.2 (361)
WGZ050D	2.5 (64)	10.3 (260)	4 (102)	58.9 (1496)	20.2 (513)	14.2 (361)
WGZ055D	2.5 (64)	9.6 (243)	4 (102)	58.5 (1486)	20.3 (516)	14.2 (361)
WGZ060D	2.5 (64)	7.8 (199)	4 (102)	57.9 (1471)	20.5 (521)	14.3 (363)

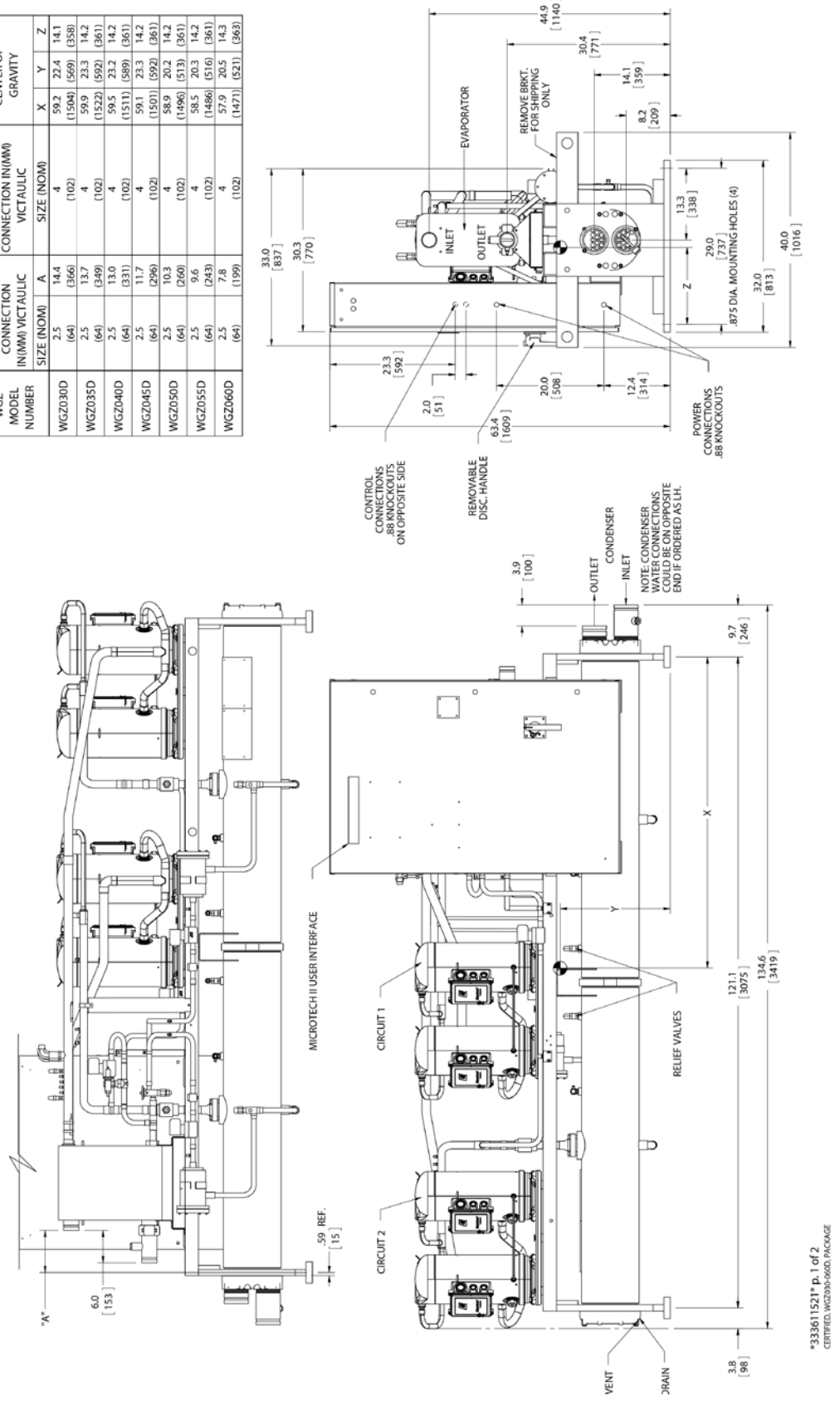


Figure 11: WGZ070DW (Packaged)

WGZ MODEL NUMBER	CHILLER WATER CONNECTION IN(MM) VICTAULIC		CONDENSER WATER CONNECTION IN(MM) VICTAULIC	CENTER OF GRAVITY		
	SIZE (NOM)	A	SIZE (NOM)	X	Y	Z
WGZ070D	3 (76)	11.3 (287)	4 (102)	61.7 (1568)	28.2 (716)	15.0 (381)

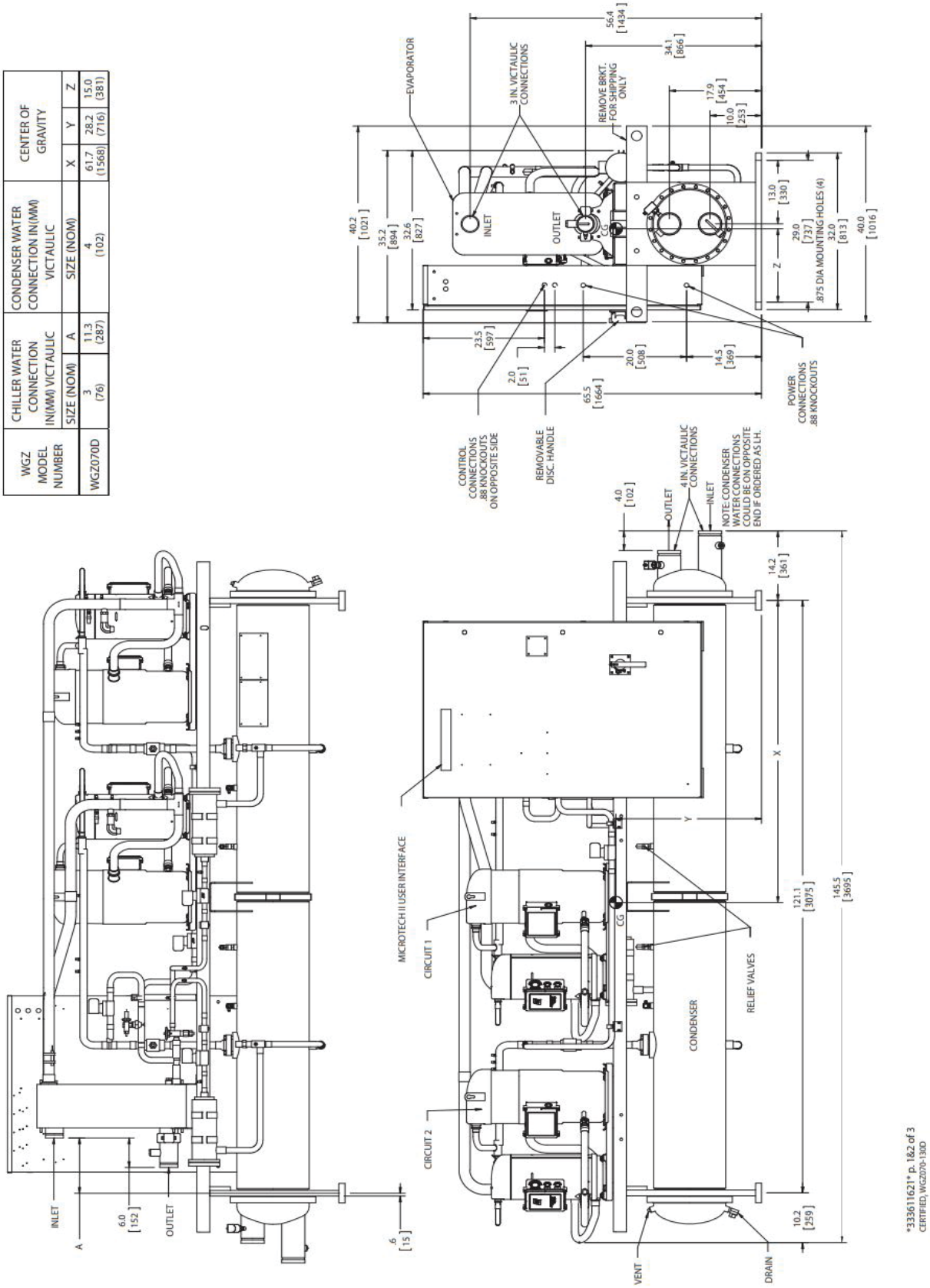


Figure 12: WGZ080DW - 130DW (Packaged)

WGZ MODEL NUMBER	MAXIMUM OVERALL LENGTH IN(MM)	CHILLER WATER CONNECTION IN(MM) VICTAULIC		CONDENSER WATER CONNECTION IN(MM) VICTAULIC		CENTER OF GRAVITY			
	L	SIZE (NOM)	A	SIZE (NOM)	T	X	Y	Z
WGZ080D	149 (3785)	3 (76)	8.8 (224)	4 (102)	13.8 (351)	64.2 (1631)	29.5 (749)	15 (381)
WGZ090D	149 (3785)	3 (76)	8.0 (203)	4 (102)	13.8 (351)	67.2 (1707)	32.6 (828)	16 (406)
WGZ100D	149 (3785)	3 (76)	6.0 (152)	4 (102)	13.8 (351)	69.2 (1758)	35.4 (899)	17 (432)
WGZ115D	148 (3759)	3 (76)	3.1 (79)	4 (102)	12.9 (328)	68 (1727)	35.6 (904)	17 (432)
WGZ130D	149 (3785)	3 (76)	1.0 (25)	4 (102)	13.7 (348)	67.7 (1720)	36.1 (917)	17 (432)

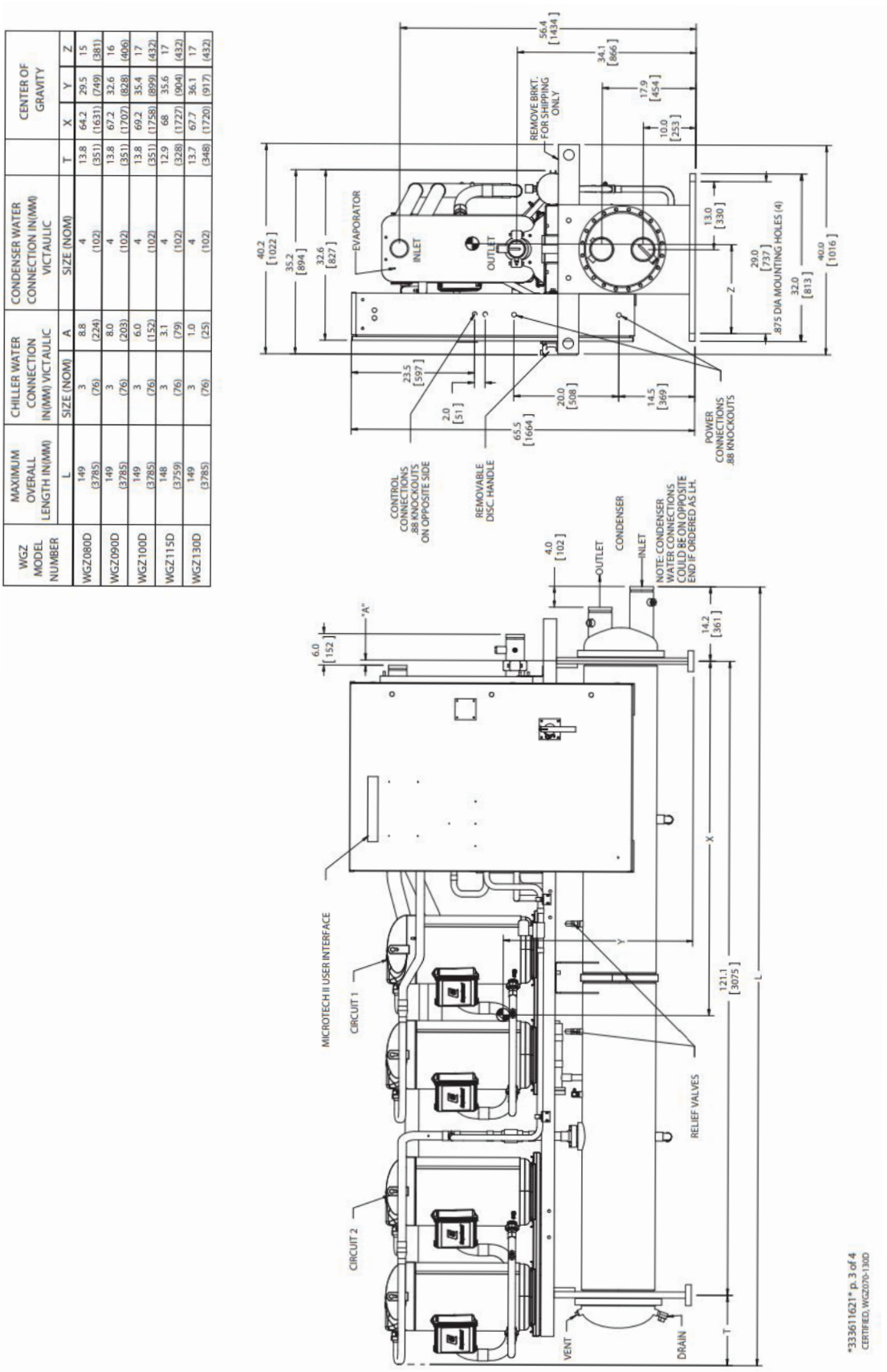


Figure 13: WGZ150DW - 200DW (Packaged)

WGZ MODEL NUMBER	MAXIMUM OVERALL HEIGHT IN(MM)	CHILLER WATER CONNECTION IN(MM) VICTAULIC	CONDENSER WATER CONNECTION IN(MM) VICTAULIC		CENTER OF GRAVITY		
	H	SIZE (NOM)	SIZE (NOM)	T	X	Y	Z
WGZ150D	76.9 (1953)	6 (203)	5 (127)	11 (279)	75 (1905)	37.8 (960)	14.8 (376)
WGZ170D	76.9 (1953)	8 (203)	5 (127)	10.9 (276)	77.7 (1974)	37.7 (958)	14.9 (379)
WGZ200D	77.7 (1973)	8 (203)	5 (127)	10.9 (276)	77.9 (1979)	38.3 (973)	15 (381)

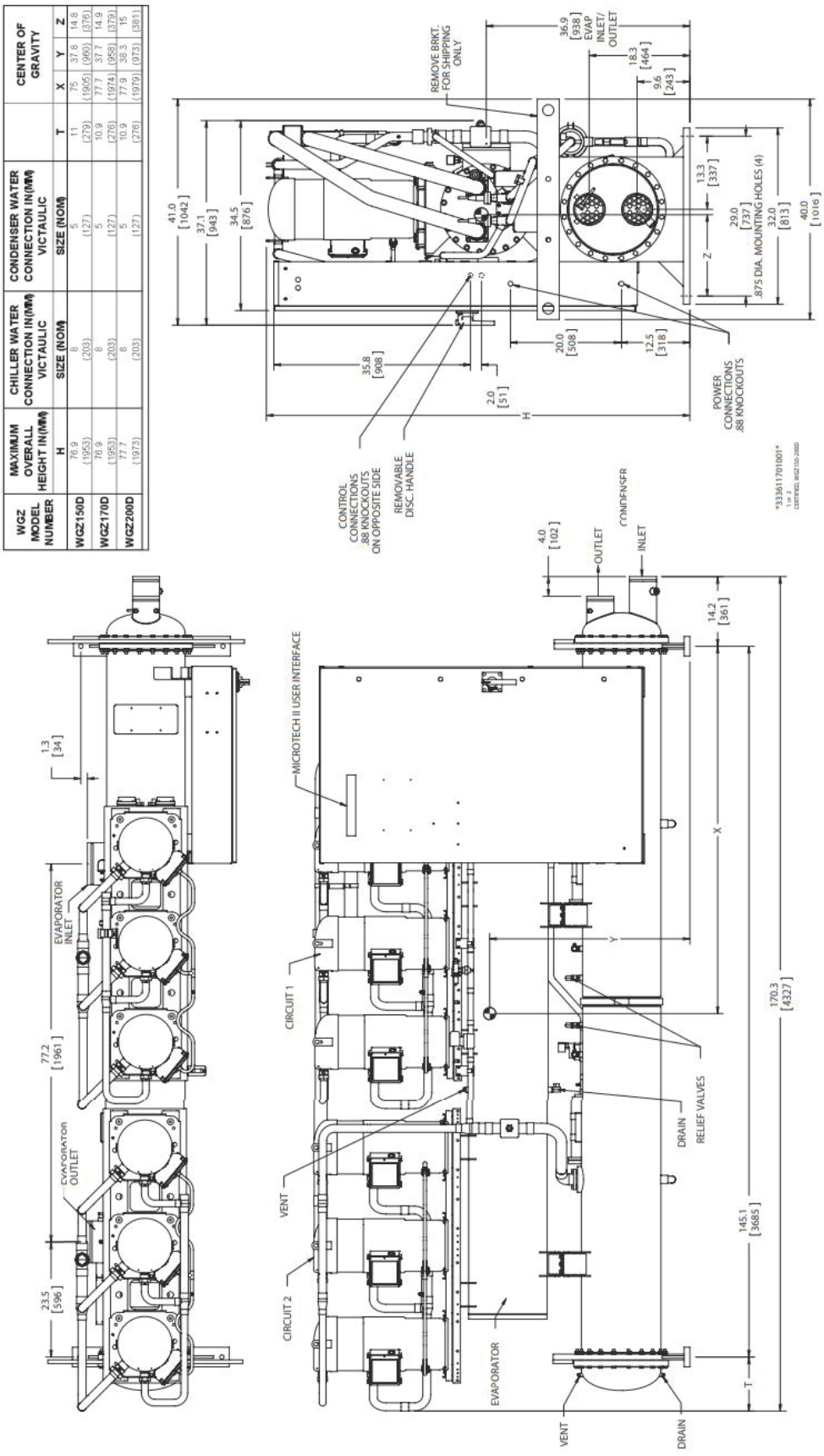


Figure 14: Lifting Locations, WGZ030-060D Packaged

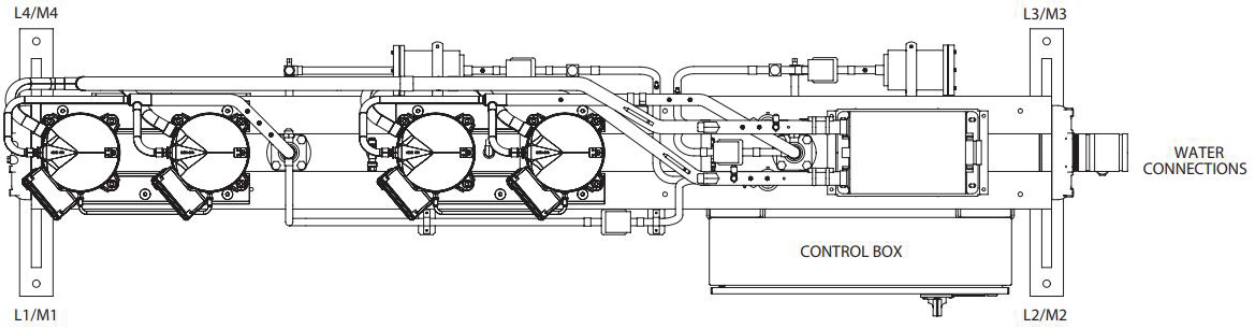


Table 5: Lifting Weights, WGZ030-060D Packaged

MODEL	LIFTING WEIGHT FOR EACH POINT LBS (KG)				MOUNTING LOADS FOR EACH POINT LBS (KG)				SHIP WT	OPER. WT
	L1	L2	L3	L4	M1	M2	M3	M4	LBS (KG)	LBS (KG)
WGZ030DW	605	632	598	572	624	652	617	590	2408	2484
	(274)	(287)	(271)	(259)	(283)	(296)	(280)	(268)	(1092)	(11127)
WGZ035DW	629	644	614	601	649	664	633	619	2488	2564
	(285)	(292)	(279)	(273)	(294)	(301)	(287)	(281)	(1129)	(1163)
WGZ040DW	634	656	627	606	657	680	650	628	2523	2615
	(288)	(298)	(284)	(275)	(298)	(308)	(295)	(285)	(1144)	(1186)
WGZ045DW	634	664	635	606	657	688	658	628	2539	2631
	(288)	(301)	(288)	(275)	(298)	(312)	(299)	(285)	(1152)	(1193)
WGZ050DW	646	683	656	621	674	713	685	648	2606	2719
	(293)	(310)	(298)	(282)	(306)	(323)	(311)	(294)	(1182)	(1233)
WGZ055DW	644	690	664	620	672	720	693	647	2618	2731
	(292)	(313)	(301)	(281)	(305)	(327)	(314)	(293)	(1188)	(1239)
WGZ060DW	646	706	682	624	674	736	711	651	2658	2771
	(293)	(320)	(309)	(283)	(306)	(334)	(323)	(295)	(1206)	(1257)

Figure 15: Lifting Locations, WGZ070-130D Packaged

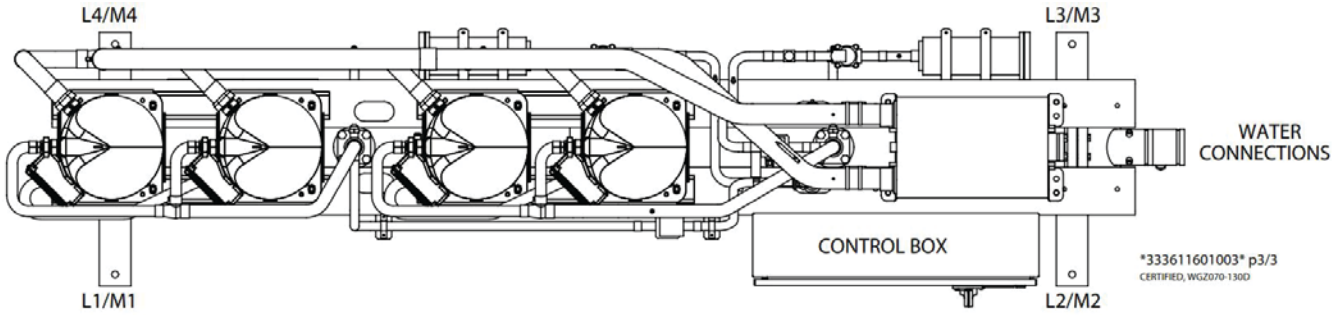


Table 6: Lifting Weights, WGZ070-130D Packaged

MODEL	LIFTING WEIGHT FOR EACH POINT LBS (KG)				MOUNTING LOADS FOR EACH POINT LBS (KG)				SHIP WT	OPER. WT
	L1	L2	L3	L4	M1	M2	M3	M4	LBS (KG)	LBS (KG)
WGZ070DW	877	843	900	935	912	877	935	973	3555	3696
	(398)	(382)	(408)	(424)	(414)	(398)	(424)	(441)	(1613)	(1676)
WGZ080DW	1016	900	965	1090	1056	935	1003	1133	3971	4128
	(461)	(408)	(438)	(494)	(479)	(424)	(455)	(514)	(1801)	(1872)
WGZ090DW	1026	824	1020	1270	1071	860	1064	1325	4140	4320
	(465)	(374)	(463)	(576)	(486)	(390)	(483)	(601)	(1878)	(1960)
WGZ100DW	1018	763	1084	1446	1066	799	1135	1515	4311	4515
	(462)	(346)	(492)	(656)	(484)	(362)	(515)	(687)	(1955)	(2048)
WGZ115DW	984	769	1087	1390	1032	806	1139	1457	4230	4434
	(446)	(349)	(493)	(630)	(468)	(366)	(517)	(661)	(1919)	(2011)
WGZ130DW	1046	824	1173	1490	1093	861	1226	1557	4533	4737
	(475)	(374)	(532)	(676)	(496)	(391)	(556)	(706)	(2056)	(2149)

Figure 16: Lifting Locations, WGZ150-200D Packaged

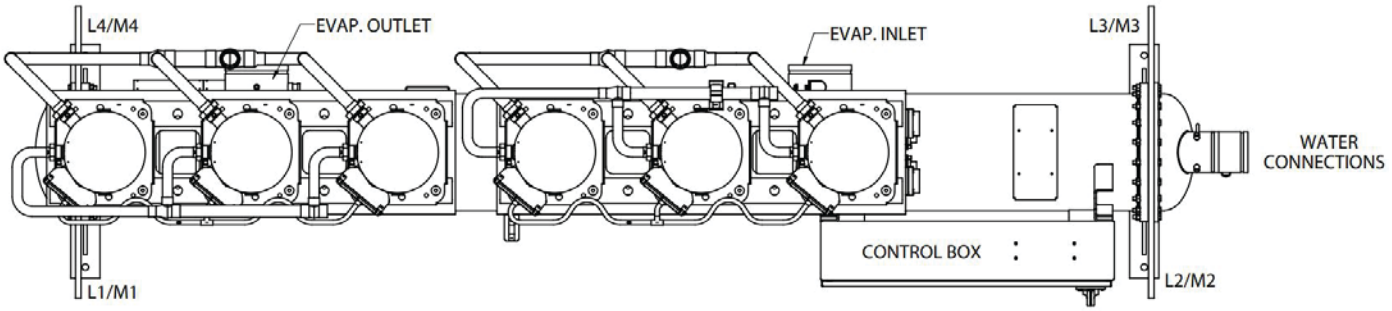


Table 7: Lifting Weights, WGZ150-200D Packaged

MODEL	LIFTING WEIGHT FOR EACH POINT LBS (KG)				MOUNTING LOADS FOR EACH POINT LBS (KG)				SHIP WT LBS (KG)	OPER. WT LBS (KG)
	L1	L2	L3	L4	M1	M2	M3	M4		
WGZ150DW	1490	1393	1444	1545	1691	1581	1638	1752	5873	6662
	(676)	(632)	(655)	(701)	(767)	(717)	(743)	(795)	(2664)	(3022)
WGZ170DW	1661	1439	1521	1756	1880	1628	1720	1986	6377	7214
	(753)	(653)	(690)	(797)	(853)	(738)	(780)	(901)	(2893)	(3272)
WGZ200DW	1729	1492	1599	1852	1946	1679	1799	2085	6672	7509
	(784)	(677)	(725)	(840)	(883)	(762)	(816)	(946)	(3026)	(3406)

NOTE: Refer to "Moving the Unit" on page 7 for details on transferring/lifting the unit. Do not lift unit by mounting holes in feet.

Isolator Information

It is recommended that isolators be used on all upper level installations or in areas where vibration transmission is a consideration. Transfer the unit as indicated under Moving the Unit." In all cases, set the unit in place and level. When spring-type isolators are required, install springs running under the main unit supports.

The unit should be set initially on shims or blocks at the listed spring free height. When all piping, wiring, flushing, charging, etc., is completed, the springs are adjusted upward to loosen the blocks or shims that are then removed.

A rubber anti-skid pad should be used under isolators if holddown bolts are not used.

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

Refer to unit dimension drawing for mounting locations.

Figure 17: Isolator Locations

Table 8: WGZ-DW Isolator Kit Part Numbers

Model Number	030-060	070-080	90	100-130	150-200
Spring-Flex	332320501	332320502	332320503	332320504	332320505
R-I-S	332325501	332325502	332325502	332325503	332325503

Table 9: Vibration Isolator Mounting Locations (Packaged Chillers)

Unit	Spring-Flex Mountings				R-I-S Mountings			
Size	M1	M2	M3	M4	M1	M2	M3	M4
WGZ030DW	ID-900 Green	ID-900 Green	ID-900 Green	ID-900 Green	RP-3 Gray	RP-3 Gray	RP-3 Gray	RP-3 Gray
WGZ035DW	ID-900 Green	ID-900 Green	ID-900 Green	ID-900 Green	RP-3 Gray	RP-3 Gray	RP-3 Gray	RP-3 Gray
WGZ040DW	ID-900 Green	ID-900 Green	ID-900 Green	ID-900 Green	RP-3 Gray	RP-3 Gray	RP-3 Gray	RP-3 Gray
WGZ045DW	ID-900 Green	ID-900 Green	ID-900 Green	ID-900 Green	RP-3 Gray	RP-3 Gray	RP-3 Gray	RP-3 Gray
WGZ050DW	ID-900 Green	ID-900 Green	ID-900 Green	ID-900 Green	RP-3 Gray	RP-3 Gray	RP-3 Gray	RP-3 Gray
WGZ055DW	ID-900 Green	ID-900 Green	ID-900 Green	ID-900 Green	RP-3 Gray	RP-3 Gray	RP-3 Gray	RP-3 Gray
WGZ060DW	ID-900 Green	ID-900 Green	ID-900 Green	ID-900 Green	RP-3 Gray	RP-3 Gray	RP-3 Gray	RP-3 Gray
WGZ070DW	ID-1350 Purple	ID-1350 Purple	ID-1350 Purple	ID-1350 Purple	RP-4 Brown	RP-4 Brown	RP-4 Brown	RP-4 Brown
WGZ080DW	ID-1350 Purple	ID-1350 Purple	ID-1350 Purple	ID-1350 Purple	RP-4 Brown	RP-4 Brown	RP-4 Brown	RP-4 Brown
WGZ090DW	ID-1800 Green	ID-1800 Green	ID-1800 Green	ID-1800 Green	RP-4 Brown	RP-4 Brown	RP-4 Brown	RP-4 Brown
WGZ100DW	ID-1800 Green	ID-1800 Green	ID-1800 Green	ID-2400 Gray	RP-4 Brick Red	RP-4 Brick Red	RP-4 Brick Red	RP-4 Brick Red
WGZ115DW	ID-1800 Green	ID-1800 Green	ID-1800 Green	ID-2400 Gray	RP-4 Brick Red	RP-4 Brick Red	RP-4 Brick Red	RP-4 Brick Red
WGZ130DW	ID-1800 Green	ID-1800 Green	ID-1800 Green	ID-2400 Gray	RP-4 Brick Red	RP-4 Brick Red	RP-4 Brick Red	RP-4 Brick Red
WGZ150DW	ID-2400 Gray	ID-2400 Gray	ID-2400 Gray	ID-2400 Gray	RP-4 Brick Red	RP-4 Brick Red	RP-4 Brick Red	RP-4 Brick Red
WGZ170DW	ID-2400 Gray	ID-2400 Gray	ID-2400 Gray	ID-2400 Gray	RP-4 Brick Red	RP-4 Brick Red	RP-4 Brick Red	RP-4 Brick Red
WGZ200DW	ID-2400 Gray	ID-2400 Gray	ID-2400 Gray	ID-2400 Gray	RP-4 Brick Red	RP-4 Brick Red	RP-4 Brick Red	RP-4 Brick Red

NOTES:
1. ID 900 has one spring per housing.
2. ID 1350, ID 1800, ID 2400 have two springs per housing.

Table 10: Physical Data - WGZ030D - WGZ040D

Physical Data (Packaged Chillers)	WGZ030D		WGZ035D		WGZ040D	
	CIRCUIT 1	CIRCUIT 2	CIRCUIT 1	CIRCUIT 2	CIRCUIT 1	CIRCUIT 2
BASIC DATA						
Operating Weight- lb (kg)	2484 (1127)		2564 (1163)		2615 (1186)	
Shipping Weight- lb (kg)	2408 (1092)		2488 (1129)		2523 (1144)	
R410A Operating Charge- lb (kg)	43 (19.5)	43 (19.5)	43 (19.5)	43 (19.5)	43 (19.5)	43 (19.5)
COMPRESSORS, SCROLL, HERMETIC						
Nominal HP	7.5 / 7.5	7.5 / 7.5	9 / 9	9 / 9	10 / 10	10 / 10
Oil Charge, per Tandem Compressor Set - oz. (L)	170 (5.0)	170 (5.0)	220 (6.6)	220 (6.6)	220 (6.6)	220 (6.6)
4 Stages (Dependent on Lead Compressor)	25-50-75-100	25-50-75-100	25-50-75-100	25-50-75-100	25-50-75-100	25-50-75-100
CONDENSER						
Diameter- in. (mm)	10 (254)		10 (254)		10 (254)	
Tube Length- in. (mm)	120 (3048)		120 (3048)		120 (3048)	
Refrigerant Side Working Pressure- psig (kPa)	500 (3447)		500 (3447)		500 (3447)	
Water Side Working Pressure- psig (kPa)	232 (1599)		232 (1599)		232 (1599)	
Pump-Out Capacity- lb (kg) [90% Full at 90°F]	245.8 (111.7)		245.8 (111.7)		228.2 (103.7)	
Grooved Conn. In & Out- in. (mm)	4 (102)		4 (102)		4 (102)	
Relief Valve, Flare- in. (mm)	5/8 (15.9)		5/8 (15.9)		5/8 (15.9)	
Service Valve, Flare- in. (mm)	1/2 (12.7)		1/2 (12.7)		1/2 (12.7)	
Vent & Drain- in. (mm) NPT	1/4 (6.4)		1/4 (6.4)		1/4 (6.4)	
EVAPORATOR, BRAZED-PLATE						
Water Volume- gal (L)	1.6 (6.1)		1.8 (6.8)		2.0 (7.6)	
Refrigerant Side Working Pressure- psig (kPa)	653 (4500)		653 (4500)		653 (4500)	
Water Side Working Pressure- psig (kPa)	653 (4500)		653 (4500)		653 (4500)	
Grooved Conn. In & Out- in. (mm)	2.5 (65)		2.5 (65)		2.5 (65)	
Relief Valve, Flare- in. (mm)	5/8 (15.9)		5/8 (15.9)		5/8 (15.9)	
Vent & Drain	Field		Field		Field	

Table 11: Physical Data - WGZ045D - WGZ055D

Physical Data (Packaged Chillers)	WGZ045D		WGZ050D		WGZ055D	
	CIRCUIT 1	CIRCUIT 2	CIRCUIT 1	CIRCUIT 2	CIRCUIT 1	CIRCUIT 2
BASIC DATA						
Operating Weight- lb (kg)	2631 (1193)		2719 (1233)		2731 (1239)	
Shipping Weight- lb (kg)	2539 (1152)		2606 (1182)		2618 (1188)	
R410A Operating Charge- lb (kg)	47 (21.4)	47 (21.4)	47 (21.4)	47 (21.4)	50 (22.7)	50 (22.7)
COMPRESSORS, SCROLL, HERMETIC						
Nominal HP	12 / 12	12 / 12	13 / 13	13 / 13	13 / 13	15 / 15
Oil Charge, per Tandem Compressor Set - oz. (L)	220 (6.6)	220 (6.6)	220 (6.6)	220 (6.6)	220 (6.6)	220 (6.6)
4 Stages (Dependent on Lead Compressor)	25-50-75-100	25-50-75-100	25-50-75-100	25-50-75-100	23-50-73-100	27-50-77-100
CONDENSER						
Diameter- in. (mm)	10 (254)		10 (254)		10 (254)	
Tube Length- in. (mm)	120 (3048)		120 (3048)		120 (3048)	
Refrigerant Side Working Pressure- psig (kPa)	500 (3447)		500 (3447)		500 (3447)	
Water Side Working Pressure- psig (kPa)	232 (1599)		232 (1599)		232 (1599)	
Pump-Out Capacity- lb (kg) [90% Full at 90°F]	228.2 (103.7)		205.4 (93.4)		205.4 (93.4)	
Grooved Conn. In & Out- in. (mm)	4 (102)		4 (102)		4 (102)	
Relief Valve, Flare- in. (mm)	5/8 (15.9)		5/8 (15.9)		5/8 (15.9)	
Service Valve, Flare- in. (mm)	1/2 (12.7)		1/2 (12.7)		1/2 (12.7)	
Vent & Drain- in. (mm) NPT	1/4 (6.4)		1/4 (6.4)		1/4 (6.4)	
EVAPORATOR, BRAZED-PLATE						
Water Volume- gal (L)	2.3 (8.7)		2.6 (9.8)		2.8 (10.6)	
Refrigerant Side Working Pressure- psig (kPa)	653 (4500)		653 (4500)		653 (4500)	
Water Side Working Pressure- psig (kPa)	653 (4500)		653 (4500)		653 (4500)	
Grooved Conn. In & Out- in. (mm)	2.5 (65)		2.5 (65)		2.5 (65)	
Relief Valve, Flare- in. (mm)	5/8 (15.9)		5/8 (15.9)		5/8 (15.9)	
Vent & Drain	Field		Field		Field	

Table 12: Physical Data - WGZ060D - WGZ070D

Physical Data (Packaged Chillers)	WGZ060D		WGZ070D	
	CIRCUIT 1	CIRCUIT 2	CIRCUIT 1	CIRCUIT 2
BASIC DATA				
Operating Weight- lb (kg)	2771 (1257)		3696 (1676)	
Shipping Weight- lb (kg)	2658 (1206)		3555 (1613)	
R410A Operating Charge- lb (kg)	50 (22.7)	50 (22.7)	74 (33.6)	74 (33.6)
COMPRESSORS, SCROLL, HERMETIC				
Nominal HP	15 / 15	15 / 15	15 / 20	15 / 20
Oil Charge, per Tandem Compressor Set - oz. (L)	220 (6.6)	220 (6.6)	255 (7.6)	255 (7.6)
4 Stages (Dependent on Lead Compressor)	25-50-75-100	25-50-75-100	22-44-72-100	22-44-72-100
CONDENSER				
Diameter- in. (mm)	10 (254)		14 (356)	
Tube Length- in. (mm)	120 (3048)		120 (3048)	
Refrigerant Side Working Pressure- psig (kPa)	500 (3447)		500 (3447)	
Water Side Working Pressure- psig (kPa)	232 (1599)		232 (1599)	
Pump-Out Capacity- lb (kg) [90% Full at 90°F]	205.4 (93.4)		415.1 (188.7)	
Grooved Conn. In & Out- in. (mm)	4 (102)		4 (102)	
Relief Valve, Flare- in. (mm)	5/8 (15.9)		5/8 (15.9)	
Service Valve, Flare- in. (mm)	1/2 (12.7)		1/2 (12.7)	
Vent & Drain- in. (mm) NPT	1/4 (6.4)		1/4 (6.4)	
EVAPORATOR, BRAZED-PLATE				
Water Volume- gal (L)	3.2 (12.0)		5.6 (21.2)	
Refrigerant Side Working Pressure- psig (kPa)	653 (4500)		653 (4500)	
Water Side Working Pressure- psig (kPa)	653 (4500)		653 (4500)	
Grooved Conn. In & Out- in. (mm)	2.5 (65)		3 (76)	
Relief Valve, Flare- in. (mm)	5/8 (15.9)		5/8 (15.9)	
Vent & Drain	Field		Field	

Table 13: Physical Data - WGZ080D - WGZ090D

Physical Data (Packaged Chillers)	WGZ080D		WGZ090D	
	CIRCUIT 1	CIRCUIT 2	CIRCUIT 1	CIRCUIT 2
BASIC DATA				
Operating Weight- lb (kg)	4128 (1872)		4320 (1960)	
Shipping Weight- lb (kg)	3971 (1801)		4140 (1878)	
R410A Operating Charge- lb (kg)	80 (36.4)	80 (36.4)	80 (36.4)	80 (36.4)
COMPRESSORS, SCROLL, HERMETIC				
Nominal HP	20 / 20	20 / 20	20 / 26	20 / 26
Oil Charge, per Tandem Compressor Set - oz. (L)	290 (8.7)	290 (8.7)	290 (8.7)	290 (8.7)
4 Stages (Dependent on Lead Compressor)	25-50-75-100	25-50-75-100	22-44-72-100	22-44-72-100
CONDENSER				
Diameter- in. (mm)	14 (356)		14 (356)	
Tube Length- in. (mm)	120 (3048)		120 (3048)	
Refrigerant Side Working Pressure- psig (kPa)	500 (3447)		500 (3447)	
Water Side Working Pressure- psig (kPa)	232 (1599)		232 (1599)	
Pump-Out Capacity- lb (kg) [90% Full at 90°F]	397.5 (180.7)		371.1 (168.7)	
Grooved Conn. In & Out- in. (mm)	4 (102)		4 (102)	
Relief Valve, Flare- in. (mm)	5/8 (15.9)		5/8 (15.9)	
Service Valve, Flare- in. (mm)	1/2 (12.7)		1/2 (12.7)	
Vent & Drain- in. (mm) NPT	1/4 (6.4)		1/4 (6.4)	
EVAPORATOR, BRAZED-PLATE				
Water Volume- gal (L)	6.3 (23.8)		6.8 (25.7)	
Refrigerant Side Working Pressure- psig (kPa)	653 (4500)		653 (4500)	
Water Side Working Pressure- psig (kPa)	653 (4500)		653 (4500)	
Grooved Conn. In & Out- in. (mm)	3 (76)		3 (76)	
Relief Valve, Flare- in. (mm)	5/8 (15.9)		5/8 (15.9)	
Vent & Drain	Field		Field	

Table 14: Physical Data - WGZ100D - WGZ130D

Physical Data (Packaged Chillers)	WGZ100D		WGZ115D		WGZ130D	
	CIRCUIT 1	CIRCUIT 2	CIRCUIT 1	CIRCUIT 2	CIRCUIT 1	CIRCUIT 2
BASIC DATA						
Operating Weight- lb (kg)	4515 (2048)		4434 (2011)		4737 (2149)	
Shipping Weight- lb (kg)	4311 (1955)		4230 (1919)		4533 (2056)	
R410A Operating Charge- lb (kg)	90 (40.9)	90 (40.9)	100 (45.5)	100 (45.5)	100 (45.5)	100 (45.5)
COMPRESSORS, SCROLL, HERMETIC						
Nominal HP	26 / 26	26 / 26	26 / 30	26 / 30	30 / 30	30 / 30
Oil Charge, per Tandem Compressor Set - oz. (L)	290 (8.7)	290 (8.7)	358 (10.8)	358 (10.8)	426 (12.6)	426 (12.6)
4 Stages (Dependent on Lead Compressor)	25-50-75-100	25-50-75-100	22-44-72-100	22-44-72-100	25-50-75-100	25-50-75-100
CONDENSER						
Diameter- in. (mm)	14 (356)		14 (356)		14 (356)	
Tube Length- in. (mm)	120 (3048)		120 (3048)		120 (3048)	
Refrigerant Side Working Pressure- psig (kPa)	500 (3447)		500 (3447)		500 (3447)	
Water Side Working Pressure- psig (kPa)	232 (1599)		232 (1599)		232 (1599)	
Pump-Out Capacity- lb (kg) [90% Full at 90°F]	344.7 (156.7)		344.7 (156.7)		344.7 (156.7)	
Grooved Conn. In & Out- in. (mm)	4 (102)		4 (102)		4 (102)	
Relief Valve, Flare- in. (mm)	5/8 (15.9)		5/8 (15.9)		5/8 (15.9)	
Service Valve, Flare- in. (mm)	1/2 (12.7)		1/2 (12.7)		1/2 (12.7)	
Vent & Drain- in. (mm) NPT	1/4 (6.4)		1/4 (6.4)		1/4 (6.4)	
EVAPORATOR, BRAZED-PLATE						
Water Volume- gal (L)	8.0 (30.2)		9.6 (36.3)		10.8 (40.9)	
Refrigerant Side Working Pressure- psig (kPa)	653 (4500)		653 (4500)		653 (4500)	
Water Side Working Pressure- psig (kPa)	653 (4500)		653 (4500)		653 (4500)	
Grooved Conn. In & Out- in. (mm)	3 (76)		3 (76)		3 (76)	
Relief Valve, Flare- in. (mm)	5/8 (15.9)		5/8 (15.9)		5/8 (15.9)	
Vent & Drain	Field		Field		Field	

Table 15: Physical Data - WGZ150D - WGZ200D

Physical Data (Packaged Chillers)	WGZ150D		WGZ170D		WGZ200D	
	CIRCUIT 1	CIRCUIT 2	CIRCUIT 1	CIRCUIT 2	CIRCUIT 1	CIRCUIT 2
BASIC DATA						
Operating Weight- lb (kg)	6662 (3022)		7214 (3272)		7509 (3406)	
Shipping Weight- lb (kg)	5873 (2664)		6377 (2893)		6672 (3026)	
R410A Operating Charge- lb (kg)	150 (68.2)	150 (68.2)	150 (68.2)	150 (68.2)	150 (68.2)	150 (68.2)
COMPRESSORS, SCROLL, HERMETIC						
Nominal HP	26 / 26 / 26	26 / 26 / 26	26 / 26 / 26	30 / 30 / 30	30 / 30 / 30	30 / 30 / 30
Oil Charge, per Trio Compressor Set - oz (L)	456 (13.7)	456 (13.7)	456 (13.7)	639 (19.2)	639 (19.2)	639 (19.2)
6 Stages (Dependent on Lead Compressor)	17-33-50-67-83-100	17-33-50-67-83-100	15-33-48-67-81-100	19-33-52-67-86-100	17-33-50-67-83-100	17-33-50-67-83-100
CONDENSER						
Diameter- in. (mm)	16 (406.4)		16 (406.4)		16 (406.4)	
Tube Length- in. (mm)	144 (3658)		144 (3658)		144 (3658)	
Refrigerant Side Working Pressure- psig (kPa)	500 (3447)		500 (3447)		500 (3447)	
Water Side Working Pressure- psig (kPa)	232 (1599)		232 (1599)		232 (1599)	
Pump-Out Capacity- lb (kg) [90% Full at 90°F]	572.3 (260.1)		508.9 (231.3)		508.9 (231.3)	
Grooved Conn. In & Out- in. (mm)	5 (127)		5 (127)		5 (127)	
Relief Valve, Flare- in. (mm)	5/8 (15.9)		5/8 (15.9)		5/8 (15.9)	
Service Valve, Flare- in. (mm)	1/2 (12.7)		1/2 (12.7)		1/2 (12.7)	
Vent & Drain- in. (mm) NPT	1/4 (6.4)		1/4 (6.4)		1/4 (6.4)	
EVAPORATOR, SHELL-AND-TUBE						
Water Volume- gal (L)	57.6 (218.0)		56.9 (215.4)		56.9 (215.4)	
Refrigerant Side Working Pressure- psig (kPa)	450 (3102)		450 (3102)		450 (3102)	
Water Side Working Pressure- psig (kPa)	150 (1034)		150 (1034)		150 (1034)	
Grooved Conn. In & Out- in. (mm)	8 (203)		8 (203)		8 (203)	
Relief Valve, Flare- in. (mm)	5/8 (15.9)		5/8 (15.9)		5/8 (15.9)	

Electrical Notes

Notes for "Electrical Data Single Point" Power:

1. If a separate 115V power supply is used for the control circuit, then the wire sizing amps is 10 amps for all unit sizes.
2. Recommended power lead wire sizes for 3 conductors per conduit are based on 100% conductor ampacity in accordance with NEC. Voltage drop has not been included. It is recommended that power leads be kept short. All terminal block connections must be made with copper (type THW) wire.
3. The recommended power lead wire sizes are based on an ambient temperature of 86°F (30°C). Ampacity correction factors must be applied for other ambient temperatures. Refer to the National Electrical Code Handbook.
4. Must be electrically grounded according to national and local electrical codes.

Voltage Limitations:

1. Within +/- 10 percent of nameplate rating
2. Voltage unbalance not to exceed 2% with a resultant current unbalance of 6 to 10 times the voltage unbalance per NEMA MG-1, 1998 Standard. This is an important restriction that must be adhered to.

Notes for "Field Wiring Data"

1. Requires a single disconnect to supply electrical power to the unit. This power supply must either be fused or use an HACR type circuit breaker.
2. All field wiring to unit power block or optional non-fused disconnect switch must be copper.
3. All field wire size values given in table apply to 75°C rated wire per NEC.

Supplemental Overloads Option

The supplemental overloads option is used to reduce the required electrical service size and wire sizing (cost) to the water cooled version of WGZ chillers. The overload option is only available for models with single point electrical power connections, and can only be used if the condenser leaving water temperature is 105°F or less.

Circuit Breakers

The circuit breaker used in the High Short Circuit panel option may have a higher trip rating than the unit Maximum Overload Protection (MOP) value shown on the unit name plate. The circuit breaker is installed as a service disconnect switch and does not function as branch circuit protection, mainly that the protection device must be installed at the point of origin of the power wiring. The breaker (disconnect switch) is oversized to avoid nuisance trips at high ambient temperature conditions.

Panel Ratings

Table 16: Multi-point Power Standard Panel Ratings

Voltage	Hz	WGZ-D Model Size		
		WGZ 030-040		WGZ 045-200
		With Overloads	Without Overloads	
208-230	60	5 kA		5 kA
380	60	5 kA		5 kA
400	50	5 kA		5 kA
460	60	5 kA		5 kA
575	60	N/A	5 kA	5 kA

Table 17: Single Point Power Standard Panel Ratings - Units without Overloads

Voltage	Hz	WGZ-D Model Size	
		WGZ 030-070	WGZ 080-200
208-230	60	10 kA	10 kA
380	60	10 kA	10 kA
400	50	10 kA	10 kA
460	60	10 kA	10 kA
575	60	5 kA	10 kA

Table 18: Single Point Power Standard Panel Ratings - Units with Overloads

Voltage	Hz	WGZ-D Model Size		
		WGZ 030-040	WGZ 045-070	WGZ 080-200
208-230	60	10 kA	10 kA	10 kA
380	60	10 kA	10 kA	10 kA
400	50	10 kA	10 kA	10 kA
460	60	10 kA	10 kA	10 kA
575	60	N/A	5 kA	10 kA

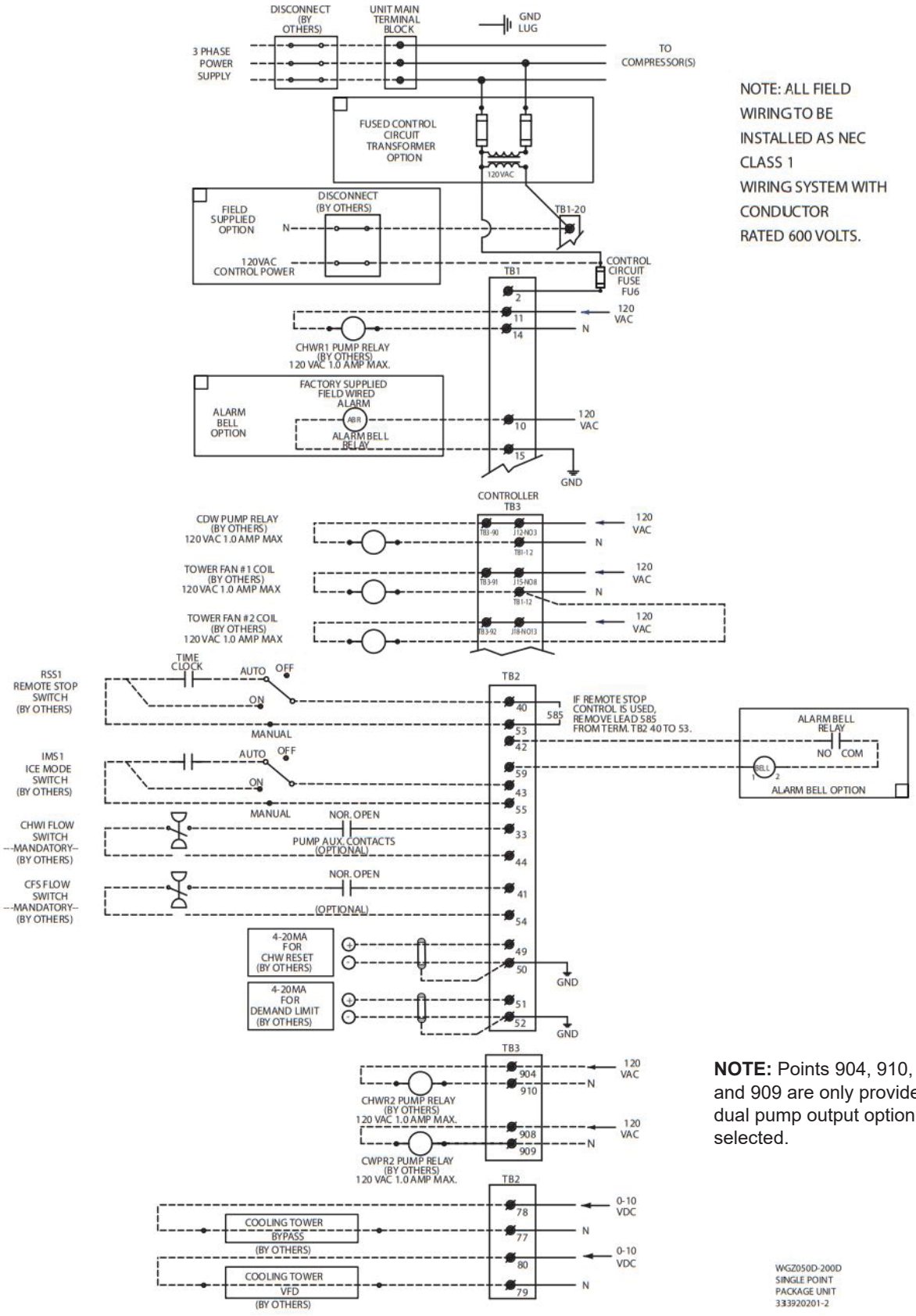
Table 19: Single Point Power Optional HSCCR Ratings - Units without Overloads

Voltage	Hz	WGZ-D Model Size			
		WGZ 030-045	WGZ 050-090	WGZ 100-150	WGZ 170-200
208-230	60	100 kA	100 kA	100 kA	N/A
380	60	65 kA	65 kA	65 kA	65 kA
400	50	65 kA	65 kA	65 kA	65 kA
460	60	65 kA	65 kA	65 kA	65 kA
575	60	25 kA	18 kA	25 kA	30 kA

Table 20: Single Point Power Optional HSCCR Ratings - Units with Overloads

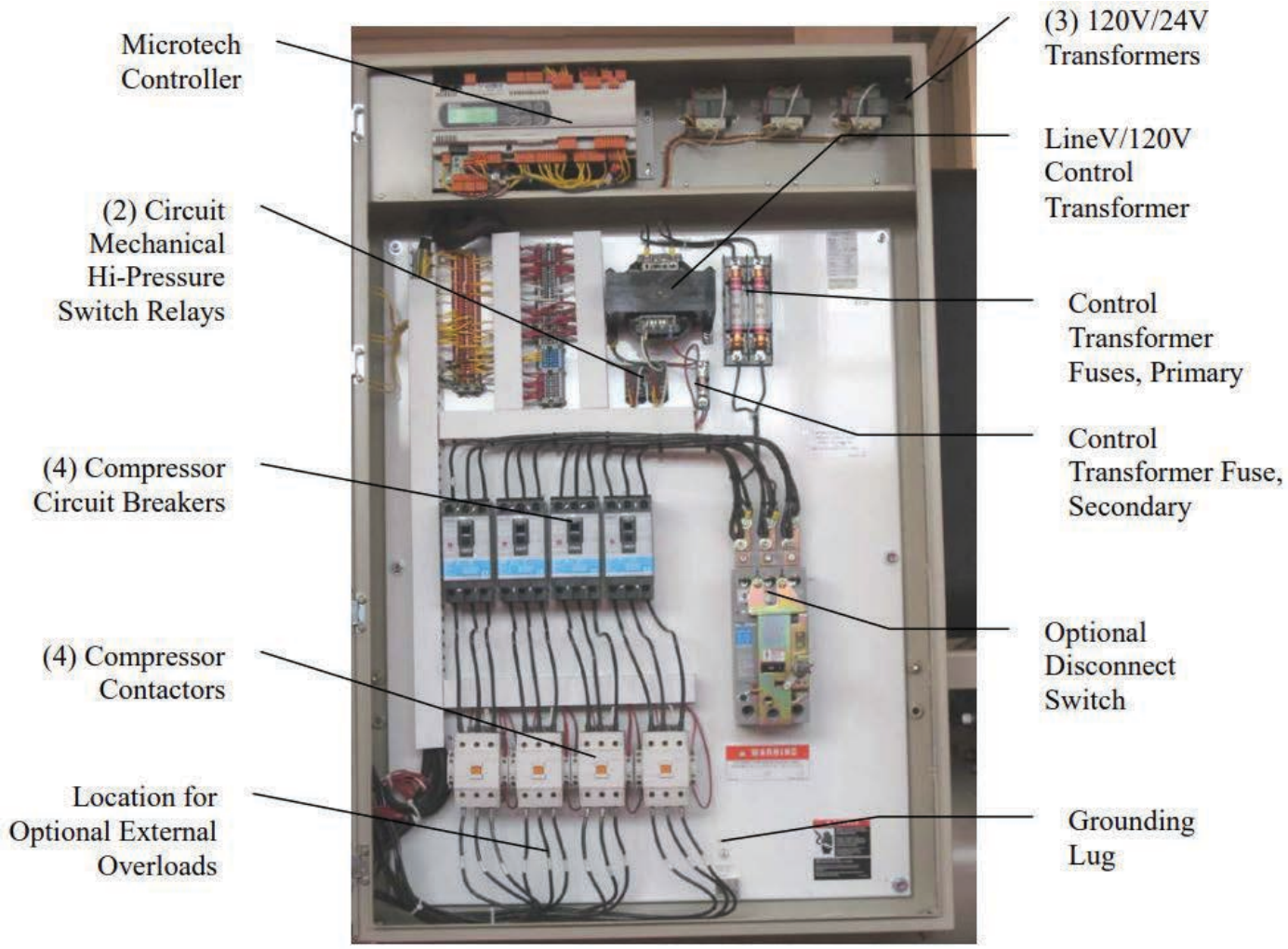
Voltage	Hz	WGZ-D Model Size		
		WGZ 030-040	WGZ 045-060	WGZ 070-200
208-230	60	100 kA	100 kA	100 kA
380	60	65 kA	65 kA	65 kA
400	50	65 kA	65 kA	65 kA
460	60	65 kA	65 kA	65 kA
575	60	N/A	25 kA	18 kA

Figure 18: **Field Wiring Diagram (Packaged Units)**



Control Panel Layout

Figure 19: Typical Control Panel, 4-Compressor Unit



NOTE: 1. Additional space provided in the upper right section for optional multiple point power connection and optional circuit breakers.

NOTE: 2. Front door has a slot opening at the top for access to the MicroTech II controller for viewing display and making keypad entries without opening the panel door.

Motor Protection Module

The motor protection system consists of an external control module, located on each compressor, motor terminal box, connected to a series of thermistors located in the motor windings and the compressor discharge port. If the windings experience an over-temperature condition or the discharge temperature is excessive, the module will trip and shut off the compressor.

⚠ WARNING

Disconnect the compressor three-phase power before removing the terminal box cover Removal of the terminal box cover will expose the three-phase power connections. Contact with them can cause serious injury or death.

MicroTech II Controller

Controller Software Version

The version installed in a unit can be viewed by pressing the MENU and ENTER keys simultaneously, then pressing MENU to return to the regular menu screen.

General Description

The MicroTech II controller's state-of-the-art design will not only permit the chiller to run more efficiently but will also simplify troubleshooting if a system failure occurs. Every MicroTech II controller is programmed and tested prior to shipment to assist in a trouble-free start-up.

Operator Friendly

The MicroTech II controller menu structure is separated into three distinct categories, which provide the operator or service technician with a full description of

1. Current unit status,
2. Control parameters (set points)
3. Alarms. Security protection prevents unauthorized changing of the set points and control parameters.

The MicroTech II controller continuously performs self-diagnostic checks, monitoring all system temperatures, pressures and protection devices, and will automatically shutdown a compressor, a refrigerant circuit or the entire unit should a fault occur. The cause of the shutdown and date stamp are retained in memory and can be easily displayed in plain English for operator review, which is an extremely useful feature for troubleshooting. In addition to displaying alarm diagnostics, the MicroTech II chiller controller also provides the operator with a warning of pre-alarm conditions.

Staging

The four scroll (or six) compressors are staged on and off as a function of leaving chilled water temperature, number of starts and run-hours. See Sequence of Operation.

Equipment Protection

The unit is protected by alarms that shut it down and require manual reset, and also by limit alarms that limit unit operation in response to some out-of-limit condition. Shut down alarms activate an alarm signal that can be wired to a remote device.

Unit Enable Selection

Enables unit operation from local keypad or digital input

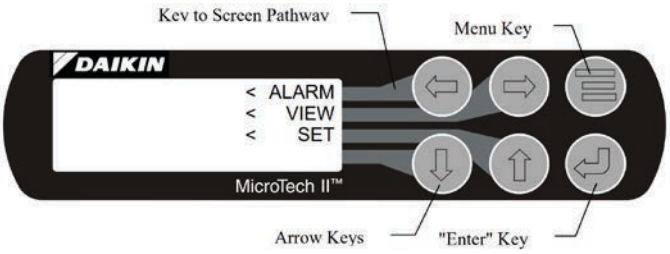
Unit Mode Selection

Selects standard cooling, ice, glycol, or test operation mode.

Keypad/Display

A 4-line by 20-character/line liquid crystal display and 6-key keypad is mounted on the unit controller. Its layout is shown below.

Figure 20: Keypad and Display in MENU Mode



The four arrow keys (UP, DOWN, LEFT, RIGHT) have three modes of use. Scroll between data screens as indicated by the arrows (default mode). Select a specific data screen in a hierarchical fashion using dynamic labels on the right side of the display (this mode is entered by pressing the MENU key).

Change field values in edit mode according to the following table:

LEFT Default

RIGHT Cancel

UP Increment

DOWN Decrement

These four edit functions are indicated by one-character abbreviation on the right side of the display (this mode is entered by pressing the ENTER key).

Inputs/Outputs

The unit controller is also used for TGZ Templifier (R-134a) in HEAT mode, see IOM 1319 on www.DaikinApplied.com for further information. Controller menu information related to HEAT mode or R-134a do no apply to WGZ-D packaged units.

Table 21: Analog Inputs

C1 = Refrigerant Circuit #1, C2 = Refrigerant Circuit #2, UT = Unit, *n = Refrig. Dependent

#	Description	Type	Signal Source	Range
*1	Evaporator Refrigerant Pressure #1 (R134a)	C1	0.1 to 0.9 VDC	0 to 132 psi
*1	Evaporator Refrigerant Pressure #1 (R410A)	C1	0.1 to 0.9 VDC	0 to 350 psi
*2	Evaporator Refrigerant Pressure #2 (R134a)	C2	0.1 to 0.9 VDC	0 to 132 psi
*2	Evaporator Refrigerant Pressure #2 (R410A)	C2	0.1 to 0.9 VDC	0 to 350 psi
*3	Condenser Refrigerant Pressure #1 (R134a)	C1	0.1 to 0.9 VDC	3.6 to 410 psi
*3	Condenser Refrigerant Pressure #1 (R410A)	C1	0.1 to 0.9 VDC	0 to 700 psi
4	Leaving Evaporator Water Pressure	UT	NTC Thermister (10k@25°C)	-58 to 212°F
5	Condenser Entering Water Temperature or Outside Ambient Temperature (See Note Below)	UT	NTC Thermister (10k@25°C)	-58 to 212°F
*6	Condenser Refrigerant Pressure #2 (R134a)	C2	0.1 to 0.9 VDC	3.6 to 410 psi
*6	Condenser Refrigerant Pressure #2 (R410A)	C2	0.1 to 0.9 VDC	0 to 700 psi
7	Reset of Water Tempertaure	UT	4-20mA Current	0-(10 to 80°F)
8	Demand Limit (R410A)	UT	4-20mA Current	0-100 % Load
9	Compressor Suction Temperature #1	C1	NTC Thermister (10k@25°C)	-58 to 212°F
10	Compressor Suction Temperature #2	C2	NTC Thermister (10k@25°C)	-58 to 212°F

NOTE: 1. If Water Cooled = Y, then Entering Condenser. If Water Cooled = N, then Outside Ambient.

NOTE: 2. Selection of R134a in unit set point screen will modify unit operation for Templifier application.

Table 22: Analog Outputs

#	Description	Output Signal	Range
1	Cooling Tower Bypass Valve Position	0 to 10 VDC	0 to 100% Open
2	Cooling Tower VFD Speed	0 to 10 VDC	0 to 100%
3	Circuit #1 Electronic Expansion Valve	0 to 10 VDC	0 to 100%
4	Circuit #2 Electronic Expansion Valve	0 to 10 VDC	0 to 100%

NOTE: Analog outputs 3 & 4 are for R410A and R134a units only.

Table 23: Digital Inputs

The following parameters are digital inputs to this controller.

C1 = Refrigerant Circuit #1, C2 = Refrigerant Circuit #2, UT = Unit, *n = Refrigerant Dependent

#	Description	Type	Signal	Signal
1	Unit OFF Switch	UT	0 VAC (Stop)	24 VAC (Auto)
2	Pump Down Switch #1	C1	0 VAC (Stop)	24 VAC (Start)
3	Evaporator Water Flow Switch	UT	0 VAC (No Flow)	24 VAC (Flow)
*4	Motor Protection #1	C1	0 VAC (Fault)	24 VAC (No Fault)
*4	Open			
5	Open			
6	Pump Down Switch #2	C2	0 VAC (Stop)	24 VAC (Start)
*7	Motor Protection #2	C2	0 VAC (Fault)	24 VAC (No Fault)
*7	Open			
*8	Open			
*8	Condenser Water Flow Switch **(R134a,R410A)**	UT	0 VAC (No Flow)	24 VAC (Flow)
9	Phase Voltage Fault #1 (See Note 1 Below)	C1	0 VAC (Fault)	24 VAC (No Fault)
10	Phase Voltage Fault #2 (See Note 1 Below)	C2	0 VAC (Fault)	24 VAC (No Fault)
11	Ground Fault Prot. #1 (See Note 2 Below)	C1	0 VAC (Fault)	24 VAC (No Fault)
12	Ground Fault Prot. #2 (See Note 2 Below)	C2	0 VAC (Fault)	24 VAC (No Fault)
13	Remote Start/Stop	UT	0 VAC (Stop)	24 VAC (Start)
*14	Condenser Water Flow Switch	UT	0 VAC (No Flow)	24 VAC (Flow)
*14	Open			
*15	Open			
*15	Motor Protection #1 **(R134a,R410A)**	C1	0 VAC (Fault)	24 VAC (No Fault)
*16	Open			
*16	Motor Protection #2 **(R134a,R410A)**	C2	0 VAC (Fault)	24 VAC (No Fault)
17	Ice Mode Switch	UT	0 VAC (Normal)	24 VAC (Ice)
18	Heat Mode Switch	UT	0 VAC (Normal)	24 VAC (Heat)

NOTE: 1. Units with single point electrical connection will have one PVM with Inputs 9 and 10 wired together. Units with multiple point connection will have two PVM's with Input 9 for Electrical Circuit #1 and Input 10 for Electrical Circuit #2.

NOTE: 2. Units with single point electrical connection will have one GFP with Inputs 11 and 12 wired together. Units with multiple point connection will have two GFP's with Input 11 for Electrical Circuit #1 and Input 12 for Electrical Circuit #2.

Table 24: Digital Outputs

The following parameters are digital outputs from this controller.

C1 = Refrigerant Circuit #1, C2 = Refrigerant Circuit #2, UT = Unit, *n = Refrigerant Dependent

#	Description	Type	Load	Output OFF	Output ON
1	Alarm	C1,C2,UT	Alarm Indicator	Alarm OFF	Alarm ON
2	Evaporator Water Pump	UT	Pump Contactor	Pump OFF	Pump ON
3	Condenser Water Pump – Water Cooled = Y	C1/UT	Pump Contactor	Fan OFF	Fan ON
4	Motor Control Relay #1 = Compr#1	C1	Starter	Compressor OFF	Compressor ON
5	Motor Control Relay #3 = Compr#3	C1	Starter	Compressor OFF	Compressor ON
*6	Tower Fan #2-Water Cooled=Y	C1/UT	Fan Contactor	Fan OFF	Fan ON
*6	Motor Control Relay #5 = Compr#5 **(R134a, R410A)**	C1	Starter	Compressor OFF	Compressor ON

#	Description	Type	Load	Output OFF	Output ON
7	Liquid Line #1	C1	Solenoid	Cooling OFF	Cooling ON
8	Tower Fan #1-Water Cooled=Y	C2/ UT	Fan Contactor	Fan OFF	Fan ON
9	Motor Control Relay #2 = Compr#2	C2	Starter	Compressor OFF	Compressor ON
10	Motor Control Relay #4 = Compr#4	C2	Starter	Compressor OFF	Compressor ON
*11	Motor Control Relay #6 = Compr#6 **(R134a,R410A)**	C2	Starter	Compressor OFF	Compressor ON
12	Liquid Line #2	C2	Solenoid	Cooling OFF	Cooling ON
14	Hot Gas Bypass #1	C1	Solenoid	Cooling OFF	Cooling ON
15	Hot Gas Bypass #2	C2	Solenoid	Cooling OFF	Cooling ON

Expansion I/O Controller

Digital Outputs

The following parameters are digital outputs from this controller.

Types: C1 = Refrigerant Circuit #1, C2 = Refrigerant Circuit #2, UT = Unit

#	Description	Type	Output Off	Output On
1	Evap Water Pump Output #2	UT	Pump Off	Pump On
2	Cond Water Pump Output #2	UT	Pump Off	Pump On
3	Condenser Fan #9	C1	Fan OFF	Fan ON
4	Condenser Fan #10	C2	Fan OFF	Fan ON

Analog Inputs

The following parameters are digital outputs from this controller for Templifier operation only.

Types: C1 = Refrigerant Circuit #1, C2 = Refrigerant Circuit #2, & UT = Unit

#	Description	Type	Output Off	Output On
1	Entering Evaporator Water Temperature **(R134a)**	UT	NTC Thermister (10k@25°C)	-58 to 212°F
2	Demand Limit **(R134a)**	UT	4-20 mA Current	0-100 % Load
3	Liquid Line Temperature #1 **(R134a)**	C1	NTC Thermister (10k@25°C)	-58 to 212°F
4	Liquid Line Temperature #2 **(R134a)**	C2	NTC Thermister (10k@25°C)	-58 to 212°F

Set points

The following parameters are remembered during power off, are factory set to the **Default** value, and can be adjusted to any value in the **Range** column. The unit controller is also used for TGZ Templifier (R-134a) in HEAT mode, see IOM 1319 on www.DaikinApplied.com for further information.

The **PW** (password) column indicates the password level that must be active in order to change the set point.

Passwords are: O = Operator, M = Manager

Table 25: Set points (set points with * are set at Daikin Applied factory)

Description	Default	Range	PW
Unit Enable	Off	Off, On	O
*Unit Mode (R410A)	Cool	Cool, Cool w/Glycol, Ice w/Glycol, Test	O
Unit Mode (R134a)	Cool	Cool, Cool w/Glycol, Heat, Test	
Control source	Switches	Keypad, Network, Switches	O
*Available Modes (R410A)	Cool	Cool, Cool w/Glycol, Cool/Ice w/Glycol, Ice w/Glycol, Test	M
*Available Modes (R134a)	Cool	Test, Cool, Cool w/Glycol, Cool/Heat, COOL/HEAT w/ Glycol, Heat w/Glycol	M
Evap LWT	44.0°F	Without Glycol: 40.0 to 60.0 °F 40.0 to 85.0 °F (R134a Only) With Glycol: 10.0 to 60.0 °F (R410a) 20.0 to 85.0 °F (R134a)	O
Ice LWT	40.0°F	15.0 to 40.0 °F	O
Heat LWT (R134a only)	110.0°F	110 to 165 °F	O
Evap Delta T	10.0°F	6.0 to 16.0 °F	O
Startup Delta T	10.0°F	1.0 to 15.0 °F	O
Stop Delta T	0.5°F	0.5 to 3.0 °F	O
Max Pulldown Rate	1.0°F	0.5 to 5.0 °F	M
Evap Recirculate Timer	30	15 to 300 seconds	M
Evap Pump (Refrigerent = R410A, R134a)	#1 Only	#1 Only, #2 Only, Auto, #1 Prim, #2 Prim	M
Cond Delta T (R134a only)	20.0°F	5.0 to 40.0 °F	
Cond PumpRecirculate Timer (Water-cooled=Yes)	30	15 to 90 seconds	M
Cond Pump (Water-cooled=Yes & Ref=R410A or R134a	#1 Only	#1 Only, #2 Only, Auto, #1 Prim, #2 Prim	M
Low Ambient Lockout (Water-cooled=No)	35.0 °F	35 to 70 °F If Speedtrol = Yes -10.0 to 70.0 (R410A) N/A (R134a)	M
Demand Limit	Off	Off, On	M
*Water Cooled	Off	Off, On	M
Ice Timer Delay	12 hrs	1 to 23 hrs	M
Clear Ice Delay	No	No, Yes	M
Hot Gas Delay Time	30 sec.	30 to 180 sec	M
BAS Protocol	Modbus	BACnet, LonWorks, Modbus	M
Ident Number	1	000-200	M
Baud Rate	9600	120,024,004,800,960,000,000	M
Units	f/psi	F/psi (only)	
Language	English	English (only)	
*Refrigerent Select	None	R410A, R134a	
Cooling Reset Type	None	None, 4-20mA, [Return (refrig = R134a only)]	O
Cooling Maximum Reser	10 °F	0 to 16 °F	O
Cooling Start Reset Delta T	10 °F	0 to 16 °F (Refrig = R134a only)	O

Description	Default	Range	PW
Compressor			
# of Compressors (Refrig = R410A or R134a to select 6)	4	4,6	M
Clear Cycle Tmr	Off	On/Off	M
Stage Up Delay	240 sec	90 to 480 seconds	M
Stage Down Delay	30	20 to 60 sec	M
Start-Start	15 min	10 to 60 min	M
Stop-Start	5 min	3 to 20 min	M
Expansion Valve Type	Electronic	Thermal, Electronic	M
Circuit 1 EXV Control	Auto	Auto, Manual	M
Circuit 1 EXV Control	N/A	0-100%	M
Circuit 2 EXV Control	Auto	Auto, Manual	M
Circuit 2 EXV Control	N/A	0-100%	M
MaxOpPress	156	142-170 psig	M
SuperheatTarg	10	8-12 °F	M
Alarms			
Low Evap Pressure - Hold	See following section; Automatic Adjusted Limits		M
Lpw Evap Pressure - Unload			
High Cond Pressure - Unload	Water: 405 psig Air: 550 psig	Water: 355-425 psig Air: 410-555 psig	M
High Cond Pressure - Stop	Water: 420 psig Air: 550 psig	Water: 375-435 psig Air: 425-570 psig	M
Evap, Freeze	38.0 °F	37.0 to 42.0 °F Glycol: 17.5 to 42.0 °F (R134a) 7.5 to 42.0 °F (R410A)	M
Cond, Freeze	34.0 °F	18 to 42 °F	M
High Condenser Pressure Stop (Water Cooled = Y)	280 psi 420 psi	375 to 435 psi (R410A)	M
High Condenser Pressure Stop (Water Cooled = N)	380 psi 565 psi	425 to 570 psi (R410A)	M
High Condenser Pressure Stop (R134a)	185 psi	170 to 425 psi	M
Eval Flow Proof	5 sec.	5 to 15 seconds	M
Cond Flow Proof	5 sec.	5 to 15 seconds	M
Recirc Timeout	3 min.	1 to 10 minutes	M
*Phase Voltage Protection	N	N, Y	M
*Ground Fault Protection	N	N, Y	M
Low OAT Start Time	60 sec.	30 to 240 seconds	M
Condenser Fans (Water Cooled = N)			
Number of fans	4	4 to 8 (10 for R410A)	M
Speedtrol Options	No	No, Yes	M
Stg on Deadband Stg 2	15 °F	15 to 25 °F	M
Stg on Deadband Stg 3	10 °F	10 to 15 °F	M
Stg on Deadband Stg 4	10 °F	10 to 15 °F	M
Stg Off Deadband Stg 1	20 °F	15 to 20 °F	M
Stg Off Deadband Stg 2	15 °F	10 to 15 °F	M
Stg Off Deadband Stg 3	10 °F	6 to 10 °F	M
Stg Off Deadband Stg 4	10 °F	6 to 10 °F	M
Cond Sat Temp Target	100 °F	80 to 120 °F	M
Forced Fan 1 (>75 °F)			
Forced Fan 2 (>90 °F)			
Forced Fan 3 (>105 °F)			

Description	Default	Range	PW
Cooling Towers (Water Cooled = Y)			
Tower Control	None	None, Temperature	M
Tower Stages	2	0 to 2	M
Stage Up Time	2 min	1 to 60 min	M
Stage Down Time	5 min	1 to 60 min	M
Stage Differential	3.0 °F	1.0 to 10.0 °F	M
Stage #1 On	70 °F	40 to 120 °F	M
Stage #2 On	75 °F	40 to 120 °F	M
Valve/VFD Control	None	None, Valve Set point, Valve Stage, VFD Stage, Valve SP/VFD Stage	M
Valve Setpoint	65 °F	60 to 120 °F	M
Valve Deadband	2.0 °F	1.0 to 10.0 °F	M
Stage Fan Down @	20%	0 to 100%	M
Stage Fan Up @	80%	0 to 100%	M
Valve Control Range (Min)	10%	0 to 100%	M
Valve Control Range (Max)	90%	0 to 100%	M
Valve Type	NC to Tower	NC, NO	M
Minimum Start Point	0%	0 to 100%	M
Minimum Position @	60 °F	0 to 100 °F	M
Maximum Start Position	100%	0 to 100%	M
Maximum Position @	90 °F	0 to 100 °F	M
Error Gain	25	10 to 99	M
Slope Gain	25	10 to 99	M

NOTE: Temperature sensor SO 5 is Condenser Entering water sensor when Water Cooled = ON .

Automatic Adjusted Limits

The following are set points that will be limited based on the option selected.

Evaporator Leaving Water Temperature

Mode	Refrigerant Type	Range
Unit Mode = Cool	R410A	40 to 60°F
Unit Mode = Cool w/Glycol	R410A	15 to 60°F
Unit Mode = Ice	R410A	20 to 40°F

Evaporator Freeze Temperature

Mode	Refrigerant Type	Range
Unit Mode = Cool	R410A	36 to 42°F
Unit Mode = Cool w/Glycol, Ice w/Glycol	R410A	12.5 to 42°F

Ice Leaving Water Temperature

Refrigerant Type	Range
R410A	15 to 40°F

Low Evaporator Pressure Inhibit Loading and Unloading

Mode	Refrigerant Type	Range
Unit Mode = Cool	R410A	97 to 115 psi
Unit Mode = Cool w/ Glycol, Ice w/Glycol	R410A	48 to 115 psi

Dynamic Defaults

Some set points will have a particular default value loaded when another setting is changed.

Refrigerant Dependent Defaults Set Points	Refrigerant Type	
	R134a	R410A
Low Evaporator Hold	29 psi	101 psi
Low Evaporator Unload	28 psi	100 psi
High Condenser Pressure Unload	170 psi	550 psi AC 405 psi WC
High Condenser Pressure	185 psi	565 psi AC 420 psi WC

NOTE: The backup mechanical high pressure cutout is set at 450 psi for water cooled applications.

Events & Alarms

Situations may arise that require some action from the chiller or that should be logged for future reference. Conditions that cause a shutdown and require manual reset is known as a stop alarm. Other conditions can trigger what is known as an event, which may or may not require action in response. All stop alarms and events are logged.

Unit Stop Alarms

The alarm output and red button is turned ON when any stop alarm occurs and turned off when all alarms have been cleared.

Evaporator Flow Loss

Alarm description: Evaporator Flow Loss

Trigger:

1. Evaporator Pump State = Run AND Evaporator Flow Digital Input = No Flow for time > Evap Flow Proof Set Point AND at least one compressor running.
2. Evaporator Pump State = Start for time greater than Recirc Timeout Set Point AND all pumps have been tried AND Evaporator Flow Digital Input = No Flow.

Action Taken: Rapid stop all circuits.

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

If active via trigger condition 1:

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

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

If active via trigger condition 2:

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

Condenser Flow Loss

Alarm description: Condenser Flow Loss

Trigger:

1. Condenser Pump State = Run AND Condenser Flow Digital Input = No Flow for time > Cond Flow Proof Set Point AND at least one compressor running.
2. Condenser Pump State = Start for time greater than Recirc Timeout Set Point AND all pumps have been tried AND Condenser Flow Digital Input = No Flow.

Action Taken: Rapid stop all circuits.

Reset: This alarm can be cleared at anytime manually via the keypad or via the BAS clear alarm signal.

If active via trigger condition 1:

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

For the auto-reset occurrences, the alarm will reset automatically when the condenser pump 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 condenser pump 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.

Low Evaporator Pressure

Alarm description: Evap Press Low Cir N
Trigger: [Circuit State = Run AND Freezestat trip AND Low OAT Start not active]

OR Evaporator Press < Absolute Low Pressure Limit AND Circuit State = Run

The absolute low pressure limit is 5 psi with R134a refrigerants and 20 psi with R410A refrigerant.

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 =

[60 – 2.7 x freeze error] with R134a refrigerant, limited to a range of 20-60 seconds

[60 – freeze error] with R410A refrigerant, limited to a range of 20-60 seconds

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

Action Taken: Rapid stop circuit

Reset: This alarm can be cleared manually via the keypad if the evaporator pressure is above the absolute

low-pressure limit.

High Condenser Pressure

Alarm description: Cond Press High Cir N
Trigger: Condenser Pressure > High Condenser Pressure Set Point

Action Taken: Rapid stop circuit

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

Mechanical High Pressure/Motor Protect

Alarm description: MHP or Motor Prot N
Trigger: MHP/MP input is low and over 150 seconds lapsed since controller boot-up

Action Taken: Rapid stop circuit

Reset: This alarm can be cleared manually via the keypad if the MHP/MP input is high.

Phase Voltage Protection

Alarm description: Phase/Voltage Cir N
Trigger: PVM input is low and Phase Voltage set point = enable.

Action Taken: Rapid stop circuit

Reset: Auto reset when PVM input is high

Ground Fault Protection

Alarm description: Ground Fault Cir N

Trigger: GFP input is low and Ground Fault set point = enable.

Action Taken: Rapid stop circuit

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

Low OAT Restart Fault

Alarm description: Low OAT Start Fail N
Trigger: Circuit has failed three low OAT start attempts

Action Taken: Rapid stop circuit

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

In order to avoid low evaporator pressure alarms at startup view "Low Ambient Start (WaterCooled = NO)" on page 46

Evaporator Water Freeze Protect

Alarm description: Evap Water Freeze
Trigger: Evaporator LWT drops below evaporator freeze protect set point AND Unit State = Auto

Action Taken: Rapid stop all circuits

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

Leaving Evaporator Water Temperature Sensor Fault

Alarm description: Evap LWT Sens Fault
Trigger: Sensor shorted or open

Action Taken: Normal stop all circuits

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

Suction Temperature Sensor Fault

Alarm description: SuctT Sensor Fail N

Trigger: Sensor shorted or open AND Expansion Valve Type = Electronic

Action Taken: Rapid stop circuit

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

Evaporator Pressure Sensor Fault

Alarm description: EvapP Sensor Fail N
Trigger: Sensor shorted or open. If failing high (open), logic has been added that requires the Leaving Evaporator Temperature to be below 75°F. This will prevent nuisance trips due to conditions where the evaporator water temperature is high which could cause false alarms.

Action Taken: Rapid stop circuit

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

Condenser Pressure Sensor Fault

Alarm description: CondP Sensor Fail N
Trigger: Sensor shorted or open

Action Taken: Rapid stop circuit

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

Condenser Entering or Outdoor Air Temperature Sensor Fault

Alarm description: OAT Sensor Fault

Trigger: Sensor shorted or open

Action Taken: Normal stop all circuits

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

Evaporator Water Freeze Protect

Alarm description: Evap Water Freeze
Trigger: Evaporator LWT drops below evaporator freeze protect set point AND Unit State = Auto

Action Taken: Rapid stop all circuits

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

No Pressure Change at Start

Alarm description: NoPressChgAtStartN
Trigger: Circuit has failed twice on a No Pressure Change at Start Condition. A No Pressure Change at Start Condition indicates that after the start of the first compressor on the circuit, at least a 1 psi drop in evaporator pressure OR a 1 psi increase in condenser pressure has not occurred after 15 seconds of compressor operation.

Action Taken: Rapid stop circuit

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

EXB Comm Failure on CP1

Alarm description: No EXB comm CP1
Trigger: CP1 does not have communication with either EXB1 for 60 seconds after power up. This alarm will only occur if 10 Fan , evaporator pump #2, or condenser pump #2 operation is selected. After communication is established, when communication is lost to either EXB an immediate shutdown occurs.

Action Taken: Rapid stop all circuits

Reset: Auto clear when EXB1 is communicating with CP1.

Alarm Log

An alarm log stores the last 25 alarms and/or events to occur. When an alarm or event occurs, it is put into the first slot in the alarm log and all others are moved down one, dropping the last entry. In the alarm log, the date and time the alarm occurred are stored, as well as a list of other parameters. These parameters include compressor states, evaporator pressure, condenser pressure, number of fans on, OAT, and evaporator LWT.

Active Alarms

When an alarm occurs, it appears in the active alarm list. The active alarm list holds a record of all active alarms, which includes the date and time each occurred.

Clearing Alarms

A password is NOT required to clear an active alarm. Active alarms must be cleared at the unit controller. To clear active alarms scroll down to the end of the Active Alarm list press Enter to clear all active alarms. If the user attempts to clear an alarm while the alarm condition still exists, a new alarm will be generated immediately.

Limit Events

The following events do not cause a rapid stop but limit operation of the chiller in some way as described in the Action Taken. All limit events do NOT appear in the Active Alarm window and are NOT logged in the Alarm Log

Low Evaporator Pressure - Hold

Event description: Evap Press Low HoldN
Trigger:

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

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

Action Taken: Inhibit staging on of additional compressors on the circuit.

Reset: While still running, the event will be reset if evaporator pressure > (Low Evaporator Pressure - Hold set point + 8 psi for R134a or 13 psi for R410A). The event is also reset if the circuit state is no longer run.

Low Evaporator Pressure - Unload

Event description: EvapPressLow Unload N
Trigger:

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

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

Action Taken: Stage off one compressor on the circuit every 10 seconds, except the last one.

Reset: While still running, the event will be reset if evaporator pressure > (Low Evaporator Pressure - Hold set point + 8 psi for R134a or 13 psi for R410A). The event is also reset if the circuit state is no longer run.

High Condenser Pressure - Unload

Event description: CondPressHighUnloadN

Trigger:

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

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

Action Taken: Stage off one compressor on the circuit every 10 seconds, except the last one.

Reset: While still running, the event will be reset if condenser pressure drops below the “Hold Clear @” value which is displayed on that circuit’s VIEW CIRCUIT n (1) screen. The “Hold Clear @” is calculated based on number of compressors, refrigerant, and number of High Condenser Pressure – Unload occurrences since the circuit has cycled off or since midnight. See table below:

Condenser Configuration	Compressor	R410A	R134a	Step Increase
Water-Cooled	4	40 psi	30 psi	10 psi
	6	30 psi	20 psi	10 psi
Air-Cooled	4	100 psi	N/A	15 psi
	6	80 psi	N/A	15 psi

Failed Pumpdown

Event description: Pumpdown Fail Cir N
Trigger: Circuit state = pumpdown for time > 60 seconds

Action Taken: Shutdown circuit

Reset: N/A

Condenser Freeze Event

Event description: Cond Freeze Circ N
Trigger: Cond Sat Refr Temperature < Condenser Freeze Set Point AND Condenser Pump State = OFF

Action Taken: Start condense pump.

Reset: N/A

Condenser Freeze Event (Water Cooled = Y Only)

Event description: Cond Freeze Circ N
Trigger: Cond Sat Refr Temp < Condenser Freeze Set Point AND Condenser Pump State = OFF

Action Taken: Start condenser pump.

Reset: Cond Sat Refr Temp > Condenser Freeze Set Point plus 2°F.

Suction Temperature Sensor Fail

Event description: SuctT Sensor Fail N
Trigger: Sensor shorted or open.

Action Taken: None.

Reset: N/A

Event Log

An Event Log similar to the Alarm Log stores the last 25 Event occurrences. There must be an active password for access to the Event Log. To navigate to the Event log press the Left Arrow key from any Alarm Log screen. When an event occurs, it is recorded in the first slot in the Event Log. All other entries are moved down in the Event Log and the last entry is dropped if 25 earlier event occurrences have been logged. Each Event Log entry includes an event description and a time and date stamp for the event occurrence.

Controller Operation

Calculations

The Control Band defines the temperatures around the Controlling Leaving Water Temperature set point where compressors will be staged on or off. The controlling leaving water temperature set point will be Evap LWT.

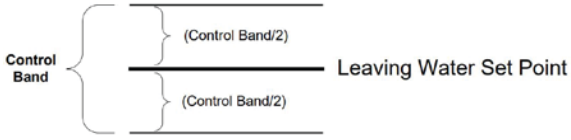
In cooling mode, the Control Band is calculated as follows:

*Control Band = Evap Delta Temperature Set Point * 0.3*

Four compressor units

*Control Band = Evap Delta Temperature Set Point * 0.2*

Six compressor units



If the Unit mode is Cool:

When the Cool Leaving Water Temperature set point is more than half the Control Band above 39.0° F the Stage Up temperature is calculated as follows:

Stage Up Temperature = Cool LWT + (Control Band/2)

The Stage Down temperature is calculated as:

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

If the Cool Leaving Water Temperature set point is less than half the Control Band above 39.0° F the Stage Down temperature is calculated as:

Stage Down Temperature = Cool LWT – (Cool LWT - 39.0° F)

Stage Up temperature is calculated as:

Stage Up temperature = Cool LWT + Control Band – (Cool LWT – 39.0°F)

In all other Unit modes the compressor staging temperatures are calculated as shown below:

Stage Up Temperature = Cool LWT + (Control Band/2)

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

The Cool Start up and Shutdown temperatures are calculated from the Control Band. The Start Up temperature determines when the first compressor on the unit will start. The Start Up temperature calculation is shown below:

Start Up Temperature = Stage Up Temperature + Start Up Delta Temperature

The Shutdown temperature defines when the last running compressor will shutdown. The Shutdown temperature calculation is:

Shutdown Temperature = Stage Down Temperature – Shutdown Delta Temperature

Leaving Water Temperature (LWT) Reset

The active leaving water set point is set to the current Leaving Water Temperature (LWT) set point unless the unit is in either cool or heat mode and any of the reset methods below are selected. The type of reset in effect is determined by the LWT Reset Type set point.

Reset Type = NONE

The Active Leaving Water Temperature set point is set equal to the current LWT set point. IN cool mode, this will be Evap LWT and in heat mode this will be Heat LWT.

Reset Type = 4-20 mA

The Active Leaving Water set point is adjusted by the 4 to 20 mA reset analog input.

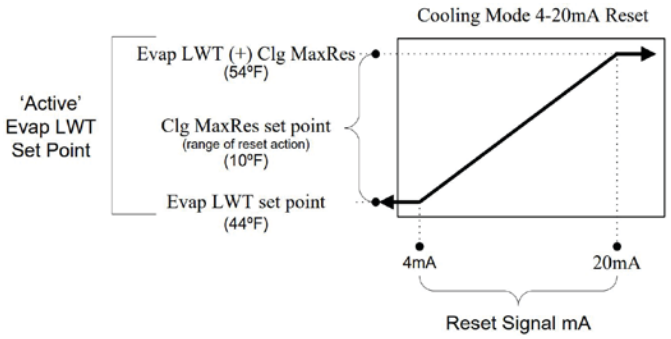
Cooling Mode

The Active Leaving Water set point is adjusted by the 4 to 20 mA reset analog input.

Parameters used:

1. Evaporator Leaving Water Temperature set point (Evap LWT)
2. Cooling Maximum Reset set point (Clg MaxRes)
3. LWT Reset signal 4-20 mA

Reset is 0ºF and the active leaving water set point is equal to the Evap LWT set point if the reset signal is less than or equal to 4 mA. Reset is equal to the Max Reset set point and the active leaving water set point is equal to the Evap LWT plus Max Reset set points 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. An example of the operation of 4-20 reset in Cool mode is shown below.



Active LWT Set Point

The active LWT set point represents the current control set point based on unit mode and reset. If unit mode is ice, then the active set point is equal to the ice set point. If the unit mode is cool, the active set point is the cool set point plus the leaving water reset value. If the unit mode is heat, the active set point is the heat set point minus the leaving water reset value.

LWT Error

LWT error compares the actual LWT to the active LWT set point.

The equation for cool mode is:

LWT error = LWT – active LWT set point

The equation for heat mode is:

LWT error = active LWT set point – LWT

LWT Slope

LWT slope is calculated such that the slope represents a time frame of one minute.

Every 12 seconds, the current LWT is subtracted from the value 12 seconds back. This value is added to a buffer containing values calculated at the last five intervals. The final result is a slope value that is an average over the past 60 seconds.

Pull Down Rate

The slope value calculated above will be a negative value as the water temperature is dropping. For use in some control functions, the negative slope is converted to a positive value by multiplying by –1.

Evaporator Saturated Temperature

Evaporator saturated temperature is calculated from the evaporator pressure for each circuit.

R410A Evaporator Saturated Temperatures

When R410A refrigerant is selected the refrigerant pressure will be fitted to a curve made up of 24 straight-line segments. The accuracy of calculated saturated temperatures are less than +/- 0.5°F when compared to standard look up tables for R410A.

R134a Evaporator Saturated Temperatures (Templifiers only)

When R134a refrigerant is selected the refrigerant pressure will be fitted to a curve made up of 12 straight-line segments. The accuracy of calculated saturated temperatures is +/- 0.5º F when compared to standard look up tables for R134a refrigerant.

Condenser Saturated Temperature

Condenser saturated temperature shall be calculated from the condenser pressure for each circuit.

R410A Evaporator Saturated Temperatures

When R410A refrigerant is selected the refrigerant pressure will be fitted to a curve made up of 24 straight-line segments. The accuracy of calculated saturated temperatures are less than +/- 0.5°F when compared to standard look up tables for R410A.

R134a Evaporator Saturated Temperatures (Templifiers only)

When R134a refrigerant is selected the refrigerant pressure will be fitted to a curve made up of 12 straight-line segments. The accuracy of calculated saturated temperatures is +/- 0.5º F when compared to standard look up tables for R134a refrigerant.

Evaporator Approach

The evaporator approach is calculated for each circuit. For R134a and R410A refrigerant the equation is:

Evaporator Approach = LWT – Evaporator Saturated Temperature

Suction Superheat

Suction superheat is calculated for each circuit using the following equation:

Suction superheat = Suction Temperature – Evaporator Saturated Temperature

Pump Down Pressure

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

Pumpdown pressure = Low evap pressure unload – 15 psi

The low limit for the calculated Pumpdown Pressure set point is 10.0 psi

Unit Enable

The Unit Enable Set Point controls enabling and disabling the unit. The Unit Enable Set Point has options of OFF and ON. The Unit OFF input, Remote input, keypad entry, and BAS request can alter this set point. The Control Source Set Point determines which sources can change the Unit Enable Set Point with options of SWITCHES, KEYPAD or NETWORK.

Changing the Unit Enable Set Point is accomplished according to the following table.

NOTE: An “x” indicates that the value is ignored.

Unit Off Input	Control Source Set Point	Remote Input	Keypad Entry	BAS Request	Unit Enable
OFF	X	X	X	X	OFF
X	SWITCHES	OFF	X	X	OFF
ON	SWITCHES	ON	X	X	ON
ON	KEYPAD	X	OFF	X	OFF
ON	KEYPAD	X	ON	X	ON
ON	NETWORK	X	X	OFF	OFF
ON	NETWORK	OFF	X	X	OFF
ON	NETWORK	ON	X	ON	ON

Unit Mode

The overall operating mode of the chiller is set by the Unit Mode Set Point with options of COOL, COOL w/Glycol, ICE w/ Glycol, and TEST. This set point can be altered by the keypad, BAS, and Mode input.

Changes to the Unit Mode Set Point are controlled by two additional set points.

- Available Modes Set Point: Determines the operational modes available at any time with options of COOL, COOL w/Glycol, COOL/ICE w/Glycol, ICE w/Glycol and TEST
- Control Source Set Point: Determines the source that can change the Unit Mode Set Point with options of KEYPAD, NETWORK, or SWITCHES.

When the Control source is set to KEYPAD, the Unit Mode shall stay at its previous setting until changed by the operator. When the Control source is set to BAS, the most recent BAS mode request shall go into effect even if it changed while the Control source was set to KEYPAD or DIGITAL INPUTS.

Changing the Unit Mode Set Point can be accomplished according to the following table.

NOTE: An “x” indicates that the value is ignored.

Control Source Set Point	Mode Input	Keypad Entry	BAS Request	Available Modes Set Point	Unit Mode
X	X	X	X	COOL	COOL
X	X	X	X	COOL w/ Glycol	COOL w/ Glycol
SWITCHES	OFF	X	X	COOL/ICE w/ Glycol	COOL w/ Glycol
SWITCHES	ON	X	X	COOL/ICE w/ Glycol	ICE w/Glycol
KEYPAD	X	COOL w/Glycol	X	COOL/ICE w/ Glycol	COOL w/ Glycol
KEYPAD	X	ICE w/ Glycol	X	COOL/ICE w/ Glycol	ICE w/Glycol
NETWORK	X	X	COOL	COOL/ICE w/ Glycol	COOL w/ Glycol
NETWORK	X	X	ICE	COOL/ICE w/ Glycol	ICE w/Glycol
X	X	X	X	ICE w/Glycol	ICE w/Glycol
X	X	X	X	TEST	TEST

Unit Test Mode

The unit test mode allows manual testing of controller outputs. Entering this mode requires the following conditions:

- Unit Switch = OFF
- Manager password active.
- Available Unit Mode set point = TEST

A test menu can then be selected to allow activation of the outputs. It shall be possible to switch each digital output ON or OFF and set the analog outputs to any value.

Circuit Available

A circuit is available if the circuit switch is in the on position and no circuit alarms are active. Timers that delay startup or staging of a circuit do not render it unavailable.

Power Up Start Delay

After powering up the unit, the motor protector modules may not reset for up to 150 seconds. After the control is powered up, no compressor can start for 150 seconds. Motor protect inputs are ignored during this time so as to avoid tripping a false alarm.

Ice Mode Start Delay

An adjustable start to start ice delay timer will limit the frequency with which the chiller may start in Ice mode. The timer starts when the first compressor starts while the unit is in ice mode. While this timer is active, the chiller cannot restart in Ice mode. The time delay is user adjustable. The ice delay timer may be manually cleared to force a restart in ice mode. A set point specifically for clearing the ice mode delay is available. In addition, cycling the power to the controller will clear the ice delay timer.

Low Ambient Lockout

This feature is only available on air cooled units (WaterCooled=Off).If the OAT drops below the low ambient lockout set point, then all running circuits will do a normal stop. Once the lockout has been triggered, no compressors will start until the OAT rises to the lockout set point plus 5°F.

Unit State

The Unit will always be in one of three states. These states are **Off, Auto,** and **Pumpdown**. Transitions between these states are shown in the diagram on the following page.

T1: Off to Auto

Unit Enable = True AND

No Unit Alarm AND

IF Unit Mode = Cir 1 Available OR Cir 2 Available

T2: Auto to Pumpdown

Keypad Enable = Off OR

BAS Enable = Off OR

Remote Switch = Off OR

T3: Pumpdown to Off

Unit Alarm OR

Unit Switch Off OR

No Compressors Running

T4: Auto to Off

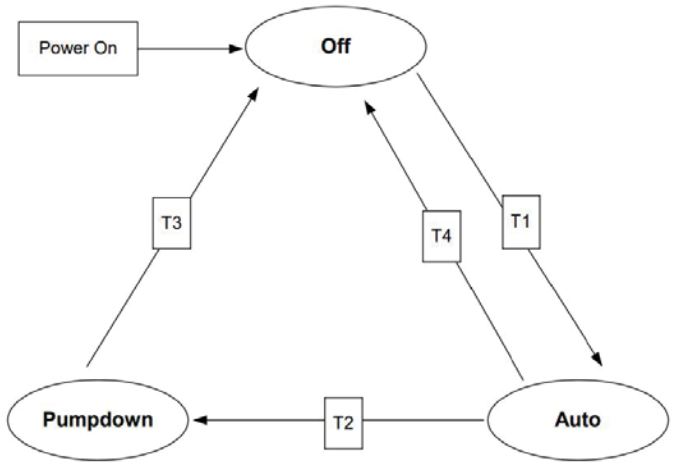
Unit Alarm OR

Unit Switch Off OR

No Compressors Running AND [Unit Mode = Ice AND Ice Delay Active] OR

No Compressors Running AND [No Circuit Available]

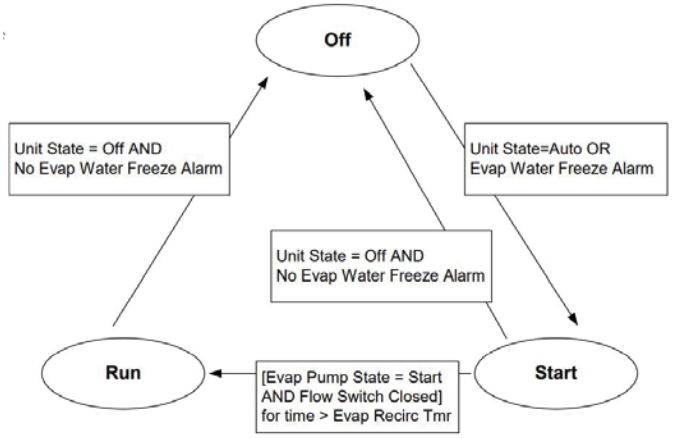
Figure 21: **Unit State Diagram**



Evaporator Water Pump State Control (Evap State)

The state-transition diagram shown below controls operation of the evaporator pump.

Figure 22: Evaporator Pump State Diagram



Pump Selection

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

#1 only – Pump 1 will always be used.

#2 only – Pump 2 will always be used.

Auto – The primary pump is the one with the least run hours, the other is used as a backup.

#1 Primary – Pump 1 is used normally, with pump 2 as a backup.

#2 Primary – Pump 2 is used normally, with pump 1 as a backup.

Primary/Standby Pump Staging

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

Auto Control

If auto pump control is selected, the primary/standby logic above is till 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.

Evaporator Water Flow Loss

The Evaporator Water Flow Loss logic allows the Unit to shutdown compressors on a loss of flow up to two times every twenty-four hours before locking the unit out on a Evaporator Flow Loss Alarm.

- If there are no compressors running when Evaporator Water Flow Loss is indicated the Unit Status changes to Auto: Wait for flow. The evaporator water pump state changes to Start and no alarms are indicated.
- If an Evaporator Water Flow Loss occurs while a compressor is running all of the running compressors will be shutdown. The alarm indicators are turned On and the Circuit Status for any circuit with running compressors becomes Off: Ready, the Unit Status becomes Auto: Wait For Flow and the evaporator water pump state changes to Start
- When flow is reestablished the Unit Status becomes Auto: Recirculate while the Evaporator Flow Recirculation Timer counts down. If there is continuous evaporator water flow while the Evaporator Recirculation Timer counts down the Alarm indicator is turned off, and the unit resumes normal startup procedures based on water temperature and cycle timers.
- If second Evaporator Water Flow Loss occurs within twenty-four hours the process described above is repeated.
- If a third loss of flow is indicated in a twenty-four hour time frame the unit will shut down on an Evaporator Water Flow Loss alarm and it will be locked out until this alarm is manually cleared.
- The twenty-four hour timer that limits the auto restart is reset when the control clock rolls over 00:00 each night.

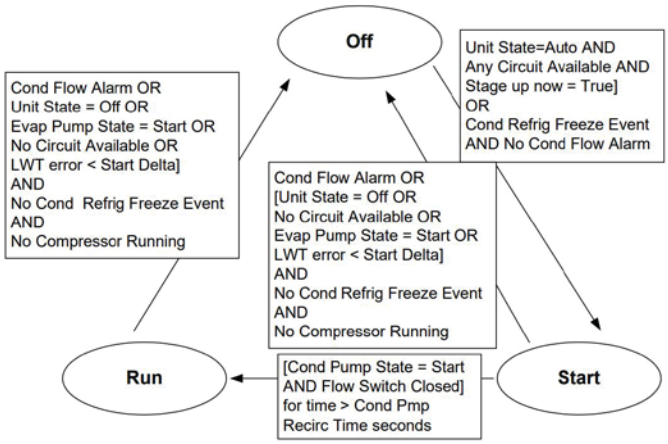
Condenser Pump and Tower Control – Water Cooled

Condenser pump and cooling tower control logic requires that the unit be configured as water-cooled in order to be active.

Condenser Water Pump State Control (Cond State)

If the unit is configured as water-cooled, then the state-transition diagram shown below defines the condenser pump control logic.

Figure 23: Condenser Pump State Diagram



Pump Selection

The pump output used will be determined by the Cond Pump Control set point. The 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 condenser state is start for a time greater than the re-circulate timeout set point and there is no flow, then the primary pump will shut off and the standby pump will start. When the condenser is in the run state, if flow is lost for more than half of the flow proof set point value, the primary pump will shut off and the standby pump will start. Once the standby pump is started, the flow loss alarm logic will apply if flow cannot be established in the condenser start state, or if the flow is lost in the condenser run state.

Auto Control

If auto pump control is selected, the primary/standby logic above is till used. When the condenser 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

Condenser Water Flow Loss

The Condenser Water Flow Loss logic allows the Unit to shutdown compressors on a loss of flow up to two times every twenty-four hours before locking the unit out on a Condenser Flow Loss Alarm.

- If there are no compressors running when Condenser Water Flow Loss is indicated the Unit Status changes to Auto: Wait for flow. The condenser water pump state changes to Start and no alarms are indicated.
- If a Condenser Water Flow Loss occurs while a compressor is running all of the running compressors will be shutdown. The Alarm indicators are turned On and the Circuit Status for any circuit with running compressors becomes Off: Ready, the Unit Status becomes Auto: Wait For Flow and the condenser water pump state changes to Start
- When flow is reestablished the Unit Status becomes Auto: Recirculate while the Condenser Flow Recirculation Timer counts down. If there is continuous evaporator water flow while the Condenser Recirculation Timer counts down the Alarm indicator is turned off, and the Unit resumes normal start up procedures based on water temperature and cycle timers.
- If second Condenser Water Flow Loss occurs within twenty-four hours the process described above is repeated.
- If a third loss of flow is indicated in twenty-four hour time frame the Unit will shut down on an Condenser Water Flow Loss alarm and it will be locked out until this alarm is manually cleared.
- The twenty-four hour timer that limits the auto restart is reset when the control clock rolls over 00:00 each night.

Cooling Tower Fans

Tower fan control is active when the unit is set up as water cooled (WaterCooled=On), Tower Control is set to Temperature, and the condenser pump is in the RUN state. Staging is based on Entering Condenser Water Temperature (ECWT). Operation depends on the following parameters.

Condenser pump state
ECWT
Stage up and stage down timer values
Tower set points (Tower Control, Tower Stages, Stage Up Time, Stage Down Time, Stage Differential ,Stage #1 ON, Stage #2 ON, Stage Down @, Stage Up @)

When the condenser pump starts, the stage up timer shall start. The first stage shall turn ON when the following conditions are met:
The stage up timer completes
The ECWT is > Stage #1 ON set point
Bypass valve position is > the Stage Up @ set point (only if Valve/VFD Control set point = Valve Stage

Additional stages can turn on (up to the number specified by the Tower Stages set point) when above conditions are met for the next stage plus the following condition:
VFD Speed is > the Stage Up @ set point (only if Valve/VFD Control set point = VFD Stage OR Valve SP/VFD Stage)

Down staging shall occur when the following conditions are met:
The stage down timer completes

The ECWT is < Stage #X ON (Temp) set point – Stage Differential (Temp) set point
Bypass valve position is < the Stage Down @ set point (only if Valve/VFD Control set point = Valve Stage)
VFD Speed is < the Stage Down @ set point (only if Valve/VFD Control set point = VFD Stage OR
Valve SP/VFD Stage)

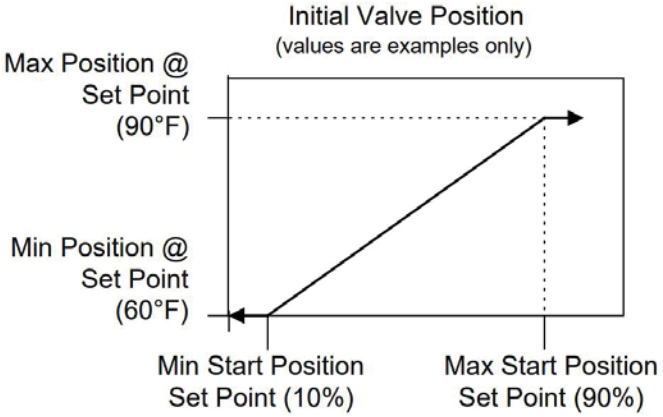
Each stage up or stage down event will restart both the stage up and stage down timers. Only one fan output will be switched at a time (except that all outputs switch OFF when the condenser pump state equals OFF).

Cooling Tower Bypass Valve

When the Valve/VFD Control set point is set to None OR VFD Stage, this output will be set to 0. Otherwise, it shall be controlled as described below.

Initial Valve Position

When the condenser pump is not in the RUN state, the valve output will be set as a function of entering condenser water temperature (ECWT)) per the following graph.



Operation After Start

When the condenser pump is in the RUN state, the valve output will be controlled in one of two modes as specified by the Valve/VFD Control set point. The controlled parameter will be the condenser entering water temperature. When the desired output signal varies from 0 to 100%, the output voltage will vary as shown below.

0 to 10 VDC (Valve Type = NC to tower)

10 to 0 VDC (Valve Type = NO to tower)

Valve Set Point Mode

This mode is operational when the Valve/VFD Control set point is set to Valve Set Point OR Valve SP/VFD Stage. In this mode the valve output is varied with a proportional-derivative (PD) algorithm (with dead band) in order to maintain the controlled parameter (CP) at the desired value. The output is always limited between the Valve Control Range (Min) set point and the Valve Control Range (Max) set point. A valve increment shall be computed once every 5 seconds according to the following equation.

Increment = [(Error) * (Error Gain set point)] + [(Slope) * (Slope Gain set point)]

Where: Error = ECWT – Valve Set Point Slope = (Present CP) – (Previous CP)

When the Error is > the Valve Deadband set point, the valve position analog output (% of full scale) is updated according to the following equation.

New %Position = Old %Position + Increment/10.

Valve Stage Mode

This mode is only operational when the Valve/VFD Control set point is set to Valve Stage. In this mode the valve output is controlled as for Valve Set Point mode (above) except that the active set point for the controlled parameter is selected according to the following table.

Number Of Fans ON	Active Set Point
0	Valve Set Point
1	Stage #1 ON
2	Stage #2 ON

Cooling Tower Fan VFD

When the Valve/VFD Control set point is set to None, Valve Set point, OR Valve Stage, this output will be set to 0. Otherwise, it will be controlled in a manner identical to Valve Stage Mode (above) except that (1) it will be kept at zero until the first fan stage is ON and (2) the following set points do not apply.

Valve Control Range (Min)
Valve Control Range (Max)
Valve Type

Compressor Start/Stop Timing

This section determines when to start or stop a compressor. There are two separate functions used, one for staging up and one for staging down.

Stage Up Now

The **Stage Up Now** flag is set based on the following tests:

If Unit mode = Cool AND
no compressors are running AND
LWT error > Start delta + 0.5 * Control Band AND
Motor Protect Timer expired AND
Stage up timer expired THEN
Stage Up Now = True

If Unit Mode = Cool AND
At least one compressor is running AND
LWT error > 0.5 * Control band AND
Pulldown rate <= Max pulldown rate AND
Compressors running < unit capacity limit AND
Stage up timer expired THEN
Stage Up Now = True

If Unit mode = Heat AND
no compressors are running AND
LWT error > Start delta + 0.5 * Control Band AND
Motor Protect Timer expired AND
Stage up timer expired THEN
Stage Up Now = True

If Unit Mode = Heat AND
At least one compressor is running AND
LWT error > 0.5 * Control band AND
Pulldown rate <= Max pulldown rate AND
Compressors running < unit capacity limit AND
Stage up timer expired THEN
Stage Up Now = True

Stage Down Now

The **Stage Down Now** flag is set based on the following tests:
If Unit Mode = Cool AND
LWT error < -0.5 * Control band AND
More than one compressor running AND
Stage down timer expired THEN
Stage Down Now = True

If Unit Mode = Cool AND
LWT error < (-0.5 * Control band - stop delta) AND
One compressor running AND
Stage down timer expired THEN
Stage Down Now = True

If Unit Mode = Cool AND
Number of compressors running > Demand limit AND
Stage down timer expired THEN
Stage Down Now = True

If Unit Mode = Heat AND
LWT error < -0.5 * Control band AND
More than one compressor running AND
Stage down timer expired THEN
Stage Down Now = True

If Unit Mode = Heat AND
LWT error < (-0.5 * Control band - stop delta) AND
One compressor running AND
Stage down timer expired THEN
Stage Down Now = True

Compressor Sequencing

Compressor staging is based primarily on compressor run hours and starts. Compressors that have less starts will normally start before those with more starts. Compressors that have more run hours will normally shut off before those with less run hours. In the event of a tie on number of starts, the lower numbered compressor starts first. In the event of a tie on run hours, the lower numbered compressor shuts off first. Run hours are compared in terms of tens of hours.

If possible, only one compressor per circuit will start before starting the second compressor on any circuit. If a circuit is unavailable for any reason, the other circuit shall be allowed to stage the second compressor on. When staging down, one compressor on each circuit shall be left on until each circuit has only one compressor running.

Low Ambient Start (WaterCooled = NO)

In order to avoid low evaporator pressure alarms at startup, low OAT start logic allows for running at low evaporator pressures for a longer time than normal as well allowing multiple compressor restart attempts before locking out the circuit.

Low Ambient Start Procedure

A low OAT start is initiated if the condenser refrigerant saturated temperature is less than 85.0°F when the first compressor starts. Once the compressor starts the circuit is in a low OAT start state for a time equal to the Low OAT Start Time set point. During Low OAT Starts, the freezestat logic and low evaporator pressure events are disabled. The absolute limit for low evaporator pressure is enforced and the compressor will shutdown if the evaporator pressure gets down to 5.0 psi. For R410A, the absolute limit for low evaporator pressure is 20.0 psi.

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

Three compressor restarts per circuit are allowed when a circuit fails to start a compressor in a Low Ambient Start attempt. On the third failed Low Ambient Start attempt the Restart Alarm is triggered and the circuit will not attempt to restart a compressor until the Restart alarm has been cleared.

Circuit Capacity Overrides

The following conditions shall override the automatic capacity control when the chiller is in cool mode only. These overrides keep a circuit from entering a condition in which it is not designed to run.

Low Evaporator Pressure

If a compressor in a circuit is running and the evaporator pressure drops below the Low Evaporator Pressure Hold set point, no more compressors will be allowed to start on that circuit. The limit shall be active until the evaporator pressure reaches the hold Low Evaporator Hold set point plus 8.0 psi for R134a or 13.0 psi for R410A. On that circuit's VIEW CIRCUIT n (1) screen is displayed the "Hold Clear @" value which is the limit by which the evaporator pressure must reach to allow for additional loading. A Low Evaporator Pressure Hold event will be recorded in the Event Log.

If two or more compressors are running in a circuit and the evaporator pressure drops below the Low Evaporator Pressure Unload set point, the circuit will begin reducing capacity. If two compressors are running, one of the compressors will be

stopped after a time delay has expired which is one-half the calculated freeze time (lower pressure then shorter time). If three compressors are running, one compressor will stop after a this time delay which is one-half the calculated freeze time and, ten seconds later, if the pressure has not risen above the unload set point an additional compressor will be stopped.

The last compressor on a circuit will not stop due to the unload condition. The low evaporator pressure unload event will clear when the evaporator pressure rises either 8.0 psi for R134a or 13.0 psi for R410A above the Low Evaporator Pressure Hold set point. A Low Evaporator Pressure Unload event will be recorded in the Event Log.

If the evaporator pressure drops below the Low Evaporator Pressure Unload set point and one compressor on the circuit is running then the following table applies.

Description	Low Evap Press Time	Requirement to continue
Check #1	15 seconds after start	Evap Press >(0.48*Low Evap Press SP)
Check #2	30 seconds after start	Evap Press >(0.66*Low Evap Press SP)
Check #3	45 seconds after start	Evap Press >(0.83*Low Evap Press SP)
Check #4	60 seconds after start	Evap Press > Low Evap Press SP

High Condenser Pressure – Unload Logic

If the discharge pressure rises above the High Condenser Pressure Unload set point and more than one compressor on the circuit is running, the circuit will stage down. One compressor will shut down as soon as the pressure rises above the unload set point and if two remain running then one more will shut down 10 seconds later if the pressure is still above the unload set point. On that circuit's VIEW CIRCUIT n (1) screen is displayed the "Hold Clear @" value which is the limit by which the condenser pressure must drop to allow for additional loading. A High Condenser Pressure Unload event will be recorded in the Event Log.

No stage up will be allowed on the circuit until the condenser pressure drops below the unload set point less an offset value which is calculated based on

1. Type refrigerant
2. Number of compressors
3. Condenser configuration
4. How many high pressure unload occurrences since the previous midnight. See below for initial offset value and step-increase for each additional occurrence.

Hold Clear Reset Value =

High Pressure Unload set point – ["Initial Offset" + ["Step-Increase" x ["number of occurrence"-1]]]

Initial Offset & Step Increase

Condeser Configuration	No. of Compressors	R410A	R134a	Stop Increase
Water-Cooled	4	40 psi	30 psi	10 psi
	6	32 psi	20 psi	10 psi
Air-Cooled	4	100 psi	N/A	15 psi
	6	80 psi	N/A	15 psi

Example of Operation: Assume a packaged water-cooled WGZ unit with 4 compressors using R410A as the refrigerant. Circuit number one is fully loaded (both compressors running) when that circuit's condenser pressure exceeds the High Condenser Pressure Unload set point. Circuit number one will unload by turning one of the two compressors off immediately.

This circuit will not be allowed to load back up until its condenser pressure decreases below the "Hold Clear @" value which is displayed on the "VIEW CIRCUIT 1 (1)" screen. Since this is the first High Condenser Pressure – Unload occurrence for that circuit, the circuit will be allowed to load once the condenser pressure drops below the High Condenser Pressure Unload set point minus 40 psi. If using default value (405 psi) this will be 365 psi. After some time, the condenser pressure is allowed to decrease below this value and circuit number one is again allowed to load up.

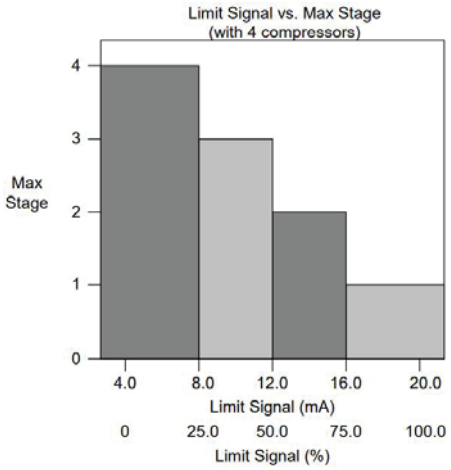
Again its condenser pressure exceeds the High Condenser Pressure Unload set point and it unloads. Because this is the second High Condenser Pressure – Unload occurrence for that circuit, the circuit will not be allowed to load until the condenser pressure drops below the High Condenser Pressure Unload set point minus 50 psig (40 psi plus step-increase 10 psi). If using default values, this will be 355 psi. As you can see, for each occurrence the discharge pressure must get lower and lower (based on Step-Increase value) before the circuit is allowed to again load. This logic is intended to prevent excessive cycling of compressors.

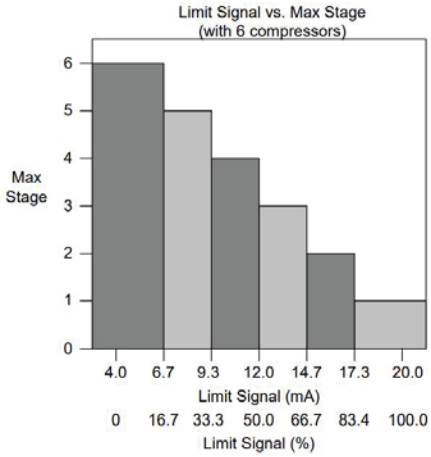
Unit Capacity Overrides

The following conditions override the automatic capacity control when the chiller is in cool mode only.

Demand Limit

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

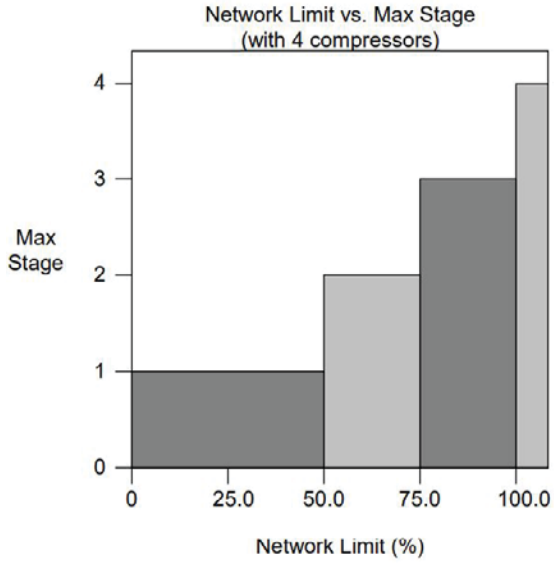


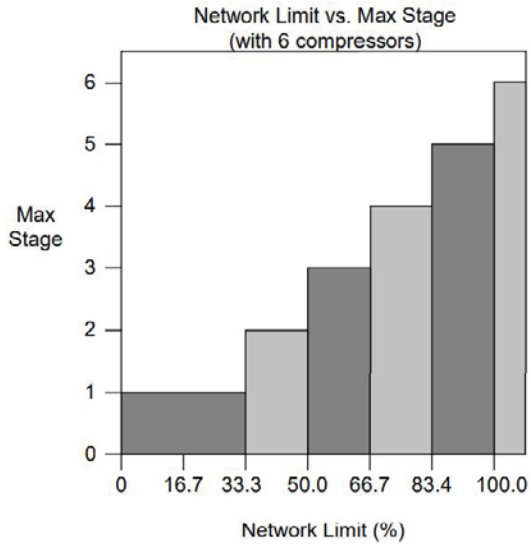


NOTE: Any signal less than 4 mA does not limit the chiller capacity

Network Limit

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





NOTE: In order to allow all stages to run, a signal of 100.0% is required.

Maximum LWT Rate

The maximum rate at which the leaving water temperature can drop is limited by the Maximum Pull Down Rate set point when the unit mode is cool. If the rate exceeds this set point, no more compressors shall be started until the pull down rate is less than the set point. Running compressors will not be stopped as a result of exceeding the maximum pull down rate.

Manual Compressor Control

The operator can manually enable and disable individual compressors. When a compressor has been disabled it is considered unavailable to start in the staging logic. With Manual Compressor control it is possible to take a damaged compressor offline while the remaining compressors on the circuit can still provide some cooling.

A running compressor cannot be disabled until it has been shutdown. If both of the compressors on a circuit have been disabled then the circuit is disabled. If both circuits have all of their compressors disabled, the Unit state will remain “Off”.

Normal Circuit Shutdown

If a condition arises that requires a circuit to shut down, but it is not an emergency situation, then the circuit will do a pump down. A normal circuit shutdown will be initiated when any of the following occur:

- Unit State = Pump Down
- Circuit Switch = Off
- Low Ambient Lockout
- A normal stage down occurs, and only one compressor on the circuit is running
- Unit mode = Ice AND the ice set point is reached

Pump Down Procedure

- If both compressors are running, shut off the appropriate compressor based on sequencing logic
- With one compressor left running, turn off hot gas output and liquid line output
- Keep running until evaporator pressure reaches the pump down pressure, then stop compressor
- If evaporator pressure does not reach pump down pressure within two minutes, stop compressor and record a Failed Pumpdown event in the Event Log.

Liquid Line Solenoid

The liquid line output shall be on any time a compressor on the circuit is running and the circuit is not performing a pump down. This output should be off at all other times.

Hot Gas Bypass Solenoid

This output shall be on when one compressor on the circuit is running and the circuit is not performing a pump down. The output should be off at all other times including the delay time described below.

The hot gas bypass valve opening will be delayed for Hot Gas Bypass Time set point seconds (the default is 30 seconds) when the first compressor starts on each circuit. This delay allows sufficient condenser pressure to build up.

EXV Control

The EXV control logic is active regardless of the expansion valve type setting. While a circuit is in the run state, the EXV controls suction superheat. The superheat target is 8°F. PID logic will be used to control the superheat to the target value.

Any time the circuit is not in the run state, the EXV position should be 0.

EXV Control Range

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

Number of Compressors	Valve Position	R410A	R134a	Stop Increase
		1	2	3
4	EXV Min	8%	8%	-
	EXV Max	60%	100%	-
6	EXV Min	8%	8%	8%
	EXV Max	35%	45%	65%

Manual EXV Control

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

When EXV control is set to auto, the manual EXV position setting follows the auto control position.

When EXV control is set to manual, the EXV position is equal to the manual EXV position setting.

Using the Controller

Getting Started

There are two basic procedures to learn in order to utilize the MicroTech II controller:

- Navigating through the menu matrix to reach a desired menu screen and knowing where a particular screen is located.
- Knowing what is contained in a menu screen and how to read that information or how to change a set point contained in the menu screen.

Navigating Through the Menus

The menus are arranged in a matrix of screens across a top horizontal row. Some of these top-level screens have sub-screens located under them. The general content of each screen and its location in the matrix are shown in Figure 10. (A detailed description of each menu begins on page 53.) There are two ways to navigate through the menu matrix to reach a desired menu screen.

One is to scroll through the matrix from one screen to another using the four ARROW keys. The other way is to use shortcuts to work through the matrix hierarchy. From any menu screen, pressing the MENU key will take you to the top level of the

hierarchy. The display will show ALARM, VIEW, and SET as shown in Figure 8. This corresponds to the second row of screens on Figure 10. One of these groups of screens can then be selected by pressing the key connected to it via the pathway shown in Figure 8 on page 18.

For example, selecting **ALARM** will go the next row of menus under **ALARM (ALARM LOG or ACTIVE ALARM)**. Selecting VIEW will go the next level of screens under **VIEW (VIEW UNIT STATUS or VIEW UNIT TEMP).** Selecting **SET** will go to a series of screens for looking at and changing set points.

After pressing the MENU button, the top-level menu screen will show:

```
                < ALARM
                < VIEW
                < SET
                <
```

After pressing the “VIEW” button, a menu screen will show:

```
VIEW        < COMPRESSOR
            <         UNIT
            < EVAPORATOR
            <         FANS
```

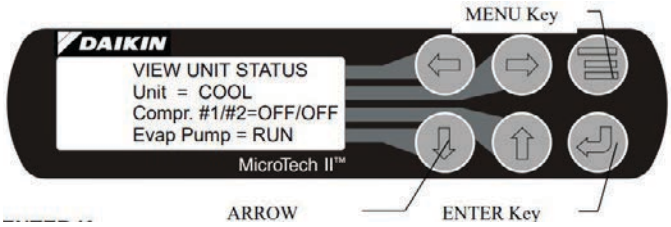
After pressing the “EVAPORATOR” button, the selected data screen will show:

The arrow keys will automatically return to the “scroll” mode at this time.

MENU Key

The MENU key is used to switch between the shortcut method (known as the MENU mode and as shown in Figure 8) and scrolling method (known as the SCROLL mode). The MENU mode is the shortcut to specific groups of menus used for checking ALARMS, for VIEWING information, or to SET set point values. The SCROLL mode allows the user to move about the matrix (from one menu to another, one at a time) by using the four ARROW keys. A typical menu screen is shown in the following figure. Pressing the MENU key from any menu screen will automatically return you to the MENU mode.

Figure 24: Display in the Shortcut (SCROLL) Mode and Keypad Layout



ENTER Key

Pressing the ENTER key changes the function of the ARROW keys to the editing function as shown below:

LEFT: Default, changes a value to the factory-set default value.

RIGHT: Cancel, cancels any change made to a value and returns to the original setting.

UP: Increment, increases the value of the setting

DOWN: Decrement decreases the value of a setting.

These four edit functions are indicated by one-character abbreviation on the right side of the display (this mode is entered by pressing the ENTER key).

Most menus containing set point values have several different set points shown on one menu. When in a set point menu, the ENTER key is used to proceed from the top line to the second line and on downward. The cursor will blink at the entry point for making a change. The ARROW keys (now in the edit mode) are used to change the set point as described above. When the change has been made, press the ENTER key to enter it. Nothing is changed until the ENTER key is pressed.

For example, to change the chilled water set point:

1. Press MENU key to go to the MENU mode.
2. Press SET (the UP Key) to go to the set point menus.
3. Press UNIT SPs (the Right key) to go to set points associated with unit operation.
4. Press the DOWN key to scroll down through the set point menus to the third menu which contains Evap LWT= XX.X°F.
5. Press the ENTER key to move the cursor down from the top line to the second line in order to make the change.
6. Use the ARROW keys (now in the edit mode as shown above) to change the setting.
7. When the desired value is achieved, press ENTER to enter it and also move the cursor down.

At this point, the following actions can be taken:

1. Change another set point in this menu by scrolling to it with the ENTER key.
2. Using the ENTER key, scroll to the first line in the menu. From there the ARROW keys can be used to scroll to different menus.

Security

Two four-digit passwords provide OPERATOR and MANAGER levels of access to changeable parameters. The passwords are pre-programmed into the controller. Either password can be entered using the ENTER PASSWORD screen which can be accessed either through the SET OTHER menu or by simply pressing the ENTER key while on one of the SET screens. The password can then be entered by pressing the ENTER key, scrolling to the correct value with the UP and DOWN arrow keys, and pressing ENTER again.

Either password must be entered before a protected setting can be changed. Once the correct password has been entered, the previously selected screen will reappear. Once a password has been entered, it will remain valid for 15 minutes after the last key-press.

SET UNIT SPs (17)
ENTER PASSWORD: XXXX
Active Password
Level: None

This screen can be accessed either through the SET OTHER menu or by simply pressing the ENTER key while on one of the SET screens. The controller will automatically go from the screen with the setting change to this screen.

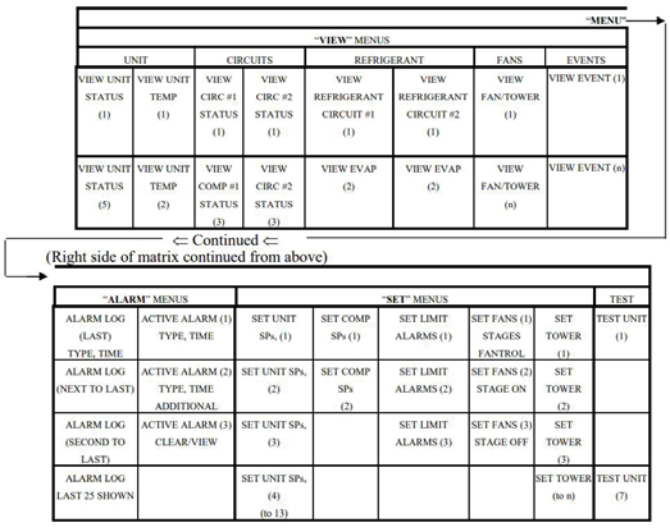
Menu Screens

Various menus are shown in the controller display. Each menu screen shows specific information, in some cases menus are only to view status of the unit, in some cases for checking alarms, and in some cases they are used to set set point values that can be changed.

The menus are arranged in a matrix of screens across a top horizontal row. Some of these top-level screens have sub-screens located under them. The content of each screen and its location in the matrix are shown in Figure 10. A description of each menu begins on page 53.

The arrow keys on the controller are used to navigate through the menus. The keys are also used to change numerical set point values contained in certain menus.

Figure 25: Menu Matrix



"MENU" →							
"VIEW" MENUS							
UNIT		CIRCUITS		REFRIGERANT		FANS	EVENTS
VIEW UNIT STATUS (1)	VIEW UNIT TEMP (1)	VIEW CIRC #1 STATUS (1)	VIEW CIRC #2 STATUS (1)	VIEW REFRIGERANT CIRCUIT #1 (1)	VIEW REFRIGERANT CIRCUIT #2 (1)	VIEW FAN/TOWER (1)	VIEW EVENT (1)
VIEW UNIT STATUS (5)	VIEW UNIT TEMP (2)	VIEW COMP #1 STATUS (3)	VIEW CIRC #2 STATUS (3)	VIEW EVAP (2)	VIEW EVAP (2)	VIEW FAN/TOWER (n)	VIEW EVENT (n)

⇐ Continued ⇐

(Right side of matrix continued from above)

"ALARM" MENUS		"SET" MENUS					TEST
ALARM LOG (LAST) TYPE, TIME	ACTIVE ALARM (1) TYPE, TIME	SET UNIT SPs, (1)	SET COMP SPs (1)	SET LIMIT ALARMS (1)	SET FANS (1) STAGES FANTROL	SET TOWER (1)	TEST UNIT (1)
ALARM LOG (NEXT TO LAST)	ACTIVE ALARM (2) TYPE, TIME ADDITIONAL	SET UNIT SPs, (2)	SET COMP SPs (2)	SET LIMIT ALARMS (2)	SET FANS (2) STAGE ON	SET TOWER (2)	
ALARM LOG (SECOND TO LAST)	ACTIVE ALARM (3) CLEAR/VIEW	SET UNIT SPs, (3)		SET LIMIT ALARMS (3)	SET FANS (3) STAGE OFF	SET TOWER (3)	
ALARM LOG LAST 25 SHOWN		SET UNIT SPs, (4) (to 13)				SET TOWER (to n)	TEST UNIT (7)

Selection can be made within the matrix by using the LEFT/RIGHT keys to move between columns and the UP/DOWN keys to move between rows.

Editing shall be accomplished by pressing the ENTER key until the desired field is selected. This field shall be indicated by a blinking cursor under it. The arrow keys shall then operate as defined below.

CANCEL (Right) Reset the current field to the value it had when editing began.

DEFAULT (Left) Set value to original factory setting.

INCREMENT (Up) Increase the value or select the next item in a list.

DECREMENT (Down) Decrease the value or select the previous item in a list.

During edit mode, the display shall show a two-character wide menu pane on the right as shown below

SET UNIT SPs (X) <D	
(data)	**<C**
(data)	**<+**
(data)	**<-**

Additional fields can be edited by pressing the ENTER key until the desired field is selected. When the last field is selected, pressing the ENTER key switches the display out of “edit” mode and returns the arrow keys to “scroll” mode.

Menu Descriptions

This section contains information on each screen. The menu screens are in order of the matrix in Figure 10 going from left to right and down when there are sub-menus. Many menus are self-explanatory.

Screen Definitions – MENU

Top level menu:

	< ALARM
	< VIEW
	< SET
	<

ALARM menu:

ALARM	< ACTIVE
	< LOG
	<
	<

VIEW menu:

```
VIEW    <  COMPRESSOR
        <        UNIT
        <  EVAPORATOR
        <  FANS/TOWER
```

VIEW UNIT menu:

```
VIEW    <        TEMP
UNIT    <      STATUS
        < REFRIGERANT
```

SET menu:

```
SET <   ALARM LIMITS
    <        UNIT SPs
    < COMPRESSOR SPs
    < FANS/TOWER SPs
```

Screen Definitions – VIEW

View Unit Status

```
VIEW UNIT STATUS (1)
Auto
Cooling Stage = 0
Evap Pump = RUN
```

Unit states can be OFF, COOL, GYLCOL, ICE, or ALARM as determined from the Unit Mode set point, the Unit Enable, and the presence of an alarm. Circuit states can be OFF/OFF, ON/OFF, OFF/ON, and ON/ON. Evaporator Pump States can be OFF, STRT, or RUN.

When more than one screen are stacked (i.e., relate to each other on the same subject), they are numbered sequentially with the numbers appearing in the upper-right corner. This menu gives the status of digital outputs (D.O.), 1=ON, 0=OFF. Numbers are 1 through 18. See Table 6 on page 19 for number reference

```
VIEW UNIT STATUS (2)
Demand Limit=Stg 4
Network Limit=Stg 4
```

```
VIEW UNIT STATUS (3)
Stg Up Delay=XXX sec
Stg Dn Delay=XXX sec
Ice Delay=XXh  XXm
```

```
VIEW UNIT STATUS (4)
D.O.     111111111
123456789012345678
000000000000000000
```

This menu gives the status of digital inputs (D.I.), 1=ON, 0=OFF. Numbers are 1 through 18. See Table 5 on page 19 for number reference.

```
VIEW UNIT STATUS (5)
D.I.     111111111
123456789012345678
000000000000000000
```

Water Cooled = Y Only

```
VIEW TOWER (2)
Bypass Valve = XXX%
VFD Speed = XXX%
```

The Bypass Valve value shall be “None” (in place of XXX%) if the Valve/VFD Control set point = None or VFD Stage. The VFD Speed value shall be “None” if the Valve/VFD Control set point = None, Valve Set point, or Valve Stage.

Screen Definitions – SET

Set Unit Set points

```
SET UNIT SPs (1)
Unit Enable = OFF
Unit Mode = COOL
Source = KEYPAD
```

Unit Enable settings can be OFF and ON as determined from the Unit Enable set point.

Unit Enable is an external signal or a keypad setting that keeps the unit off when the setting is OFF and allows it to run if there is a call for cooling when the setting is ON. The source for the signal is selected in the 4th line and can be:

- KEYPAD, in which case the selection is made in line 2 and would be normally selected as ON. This is the normal setting when no external signals are controlling the unit.
- SWITCHES, in which an external switch is wired across terminals #40 and #53. (See wiring diagram page 8 or 9.)
- NETWORK, used with BAS signal, which is wired to the three communication ports.
- Unit Mode settings can be
- COOL, normal setting used with chilled water air-condition applications.
- COOL w/GLYCOL, used with low temperature, glycol applications. It allows a lower LWT set point to be used.
- ICE w/GLYCOL, used with ice storage systems, allows changing from chilled glycol operation to lower temperature ICE operation. In ICE, the unit runs at full load until the ICE set point is reached, at which time the unit shuts off. A three-position switch wired to terminals #28 and #38 initiates the change from glycol cooling to making ice. (See wiring diagrams on page 8 or 9.)

Unit Mode settings can be COOL, COOL w/Glycol, or ICE w/ Glycol, as determined from the Unit Mode set point.

Source settings can be KEYPAD, SWITCHES, or NETWORK as determined from the Mode Source set point.

SET UNIT SPs (8)
CLOCK
dd/mmm/yyyy
hh:mm:ss

SET UNIT SPs (9)	**SET UNIT SPs (9)**
Units = °F/psi	**Units = °F/psi**
Lang = ENGLISH	**Lang = ENGLISH**
Refrig = R410A	**Refrig = R134a**

Refrigerant type is factory-set.

SET UNIT SPs (10)
Protocol = Modbus
Ident Number=001
Baud Rate=9600

BAS interface settings.

Set Compressor Set points

SET COMP SPs (1)
# of Compressors = X
Stop-Start =XX min
Start-Start =XX min

This menu sets the anti-recycle timers. Stop-Start is the time required before starting a compressor after it has *stopped*. Start-Start is the time required before starting a compressor after the last time it has *started*.

It is recommended that the default values of 5 minutes and 15 minutes not be changed.

SET COMP SPs (2)
InterStgUp =XXX sec
InterStgDown= XX sec
Clear Cycle Tmr = NO

InterStageUp is the time delay since the last stage change before a compressor can stage on, default is 120 sec. InterStageDn is the time delay since the last stage change before a compressor can stage off normally (not by an alarm). Default is 30 sec. It is recommended that these settings not be changed.

# of Compressors = 4

SET COMP SPs (3)
Comp 1 = Enable
Comp 3 = Enable

# of Compressors = 6

SET COMP SPs (3)
Comp 1 = Enable
Comp 3 = Enable
Comp 5 = Enable

# of Compressors = 4

SET COMP SPs (4)
Comp 2 = Enable
Comp 4 = Enable

# of Compressors = 6

SET COMP SPs (4)
Comp 2 = Enable
Comp 4 = Enable
Comp 6 = Enable

Enable screens #3 and #4 require the manager password to change.

SET COMP SPs (5)
Expansion Valve
Type = Thermal

WaterCooled=ON

SET ALARM LIMITS (5)
Cond Freeze= XX.X °F
CondFlowProof= XX sec

Set Cooling Tower Control

The MicroTech II controller is capable of controlling cooling tower water temperature on chillers using water-cooled condensers. Output wiring connection points are shown on the field wiring diagrams.

[Water Cooled = Y] - Condenser Pump on with first Compressor on. Tower fan control is active when the

Tower Control set point is set to Temperature and the condenser pump is in the RUN state. Staging is based on Entering Condenser Water Temperature (ECWT). Operation depends on the following.

Condenser pump state
ECWT OR Lift pressure
Stage up and stage down timer values
Tower set points (Tower Control, Tower Stages, Stage Up Time, Stage Down Time, Stage Differential,
Stage #1 ON, Stage #2 ON, Stage Down @, Stage Up @)

When the condenser pump starts, the stage up timer shall start. The first stage shall turn ON when the following

conditions are met:
The stage up timer completes
The ECWT is > Stage #1 ON set point

Bypass valve position is > the Stage Up @ set point (only if Valve/VFD Control set point = Valve Stage) Additional stages can turn on (up to the number specified by the Tower Stages set point) when above conditions are met for the next stage plus the following condition: VFD Speed is > the Stage Up @ set point (only if Valve/VFD Control set point = VFD Stage OR Valve SP/VFD Stage)

Down staging shall occur when the following conditions are met:
The stage down timer completes
The ECWT is < Stage #X ON (Temp) set point – Stage Differential (Temp) set point point Bypass valve position is < the Stage Down @ set point (only if Valve/VFD Control set point = Valve Stage)
VFD Speed is < the Stage Down @ set point (only if Valve/VFD Control set point = VFD Stage OR Valve
SP/VFD Stage)

Each stage up or stage down event shall restart both the stage up and stage down timers. Only one fan output shall be switched at a time (except that all outputs switch OFF when the condenser pump state equals OFF).

Water-cooled On

SET TOWER SPs (1)
Tower Control= None
Tower Stages = X
StageUP/DN=XXX/XXX%

When Tower Control is None the control of condenser water temperature is not by the MicroTech II
controller and assumed to be furnished elsewhere.

Tower Stages is the number of tower fans to be staged by the controller, choices are 0, 1, or 2. “0” indicates control will be by a bypass valve or variable speed pump controlled by the MicroTech II controller.

StageUP/DN imposes a time delay between fan stages when turning on or turning off.

Water-cooled On

SET TOWER SPs (2)
Stage ON (Temp)°F
#1 #2
XXX XXX

Stage ON Temp is the entering condenser water temperature (ECWT) that will turn on tower fan #1 and #2. Default settings are 70°F and 75°F. Cold condenser water will improve unit efficiency but too cold can cause erratic operation. Settings below 60°F are not recommended.

Water-cooled On

SET TOWER SPs (3)
StageDiff = XX.X°F
Stage Up Tmr=XX min
StageDn Tmr=XX min

StageDiff is the number of degrees below the Stage ON that will turn off the tower fans. For example, if Stage ON #1 is 70°F and StageDiff is 5°F, tower fan #1 will stage off when the ECWT drops to 65°F and stage the fan on when the ECWT rises to 70°F. The same is true for fan #2.

Stage Up timer is the number of minutes that must elapse between the condenser pump starting (it starts with the unit) and fan #1 starting or the time between fan #1 starting and fan #2 starting.

StageDown is the elapsed time between staging down the fan motors.

Water-cooled = Y

SET TOWER SPs (4)
Valve/VFD Control=
ValveSP/VFDStage
Valve Type=NC to Twr

Valve/VFD Control settings are None, Valve Set point, Valve Stage, VFD Stage, or ValveSP/VFDStage. Default is None which results in no control of the tower from the MicroTech II controller.

Valve Set point, the valve will control (bypass tower) to hold the minimum temperature as established by the Set Tower SPs in screen (5) below.

This mode is operational when the Valve/VFD Control set point is set to Valve Set point OR Valve SP/VFD Stage. In this mode the valve output is varied with a proportional-derivative (PD) algorithm (with deadband) in order to maintain the controlled parameter (CP) at the desired value. The output is always limited between the Valve Control Range (Min) set point and the Valve Control Range (Max) set point. A valve increment shall be computed once every 5 seconds according to the following equation. (Error Gain and Slope Gain are set in menu screen #8.)

Increment = [(Error) * (Error Gain set point)] + [(Slope) * (Slope Gain set point)]

Where: Error = ECWT – Valve Set point

Slope = (Present CP) – (Previous CP)

When the Error is > the Valve Deadband set point, the valve position analog output (% of full scale) is updated according to

VIEW EVAP
(screen data)
(screen data)
(screen data)

the following equation.

New %Position = Old %Position + Increment/10

Valve Stage, controls from the fan stage set point in use. It is recommended that the Valve Set point method explained above be used rather than this mode.

This mode is only operational when the Valve/VFD Control set point is set to Valve Stage. In this mode the valve output is controlled as for Valve Set point mode (above), except that the active set point for the controlled parameter is selected according to the following table.

# Of Fans ON	Active Set point
0	Valve Set point
1	Stage #1 ON
2	Stage #2 ON
3	Stage #3 ON
4	Stage #4 ON

VFD Stage, ValveSP/VFDStage, When the Valve/VFD Control set point is set to None, Valve Set point, OR Valve Stage, this output is set to 0. Otherwise, it will be controlled in a manner identical to Valve Stage Mode (above) except that (1) it shall be kept at zero until the first fan stage is ON, and (2) the following set points do not apply.

Valve Control Range (Min)

Valve Control Range (Max)

Valve Type

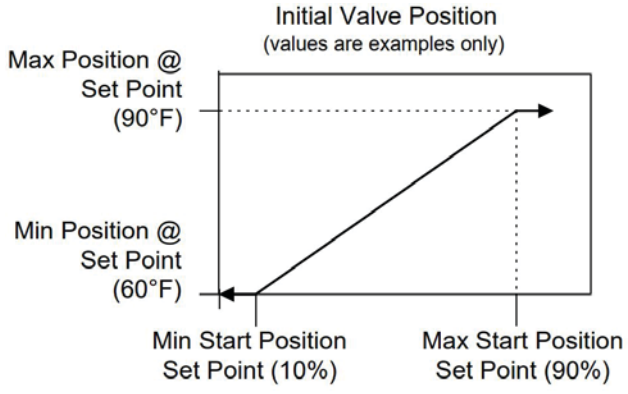
Valve Type settings are NC (normally closed to tower) or NO (normally open).

These settings establish the operation of a tower bypass valve (must be a 3-way valve).

Initial Valve Position

When the condenser pump is not in the RUN state, the valve output shall be set as a function of entering condenser water temperature (ECWT) per the following graph.

Figure 26: Initial Valve Position



Operation After Start

When the condenser pump is in the RUN state, the valve output shall be controlled in one of two modes as specified by the Valve/VFD Control set point. The controlled parameter shall be the condenser entering water temperature. When the desired output signal varies from 0 to 100%, the output voltage shall vary as shown below.

0 to 10 VDC (Valve Type = NC)

10 to 0 VDC (Valve Type = NO)

Water-cooled = Y

SET TOWER SPs (5)
Valve SP = XXX °F
Valve DB = XX.X °F

Valve SP is the minimum tower water temperature acceptable, default is 65°F.

Valve DB is the dead-band in degrees, default is 2.0°F.

Water-cooled = Y

SET TOWER SPs (6)
ValveStartPosition
Min = XXX% @XXX°F
Max = XXX% @XXX°F

The ValveStartposition is the position of the valve when the unit starts. Default for minimum start position is 0%, and 100% for maximum position.

Water-cooled = Y

SET TOWER SPs (7)
Valve Control Range
Min = XXX%
Max = XXX%

Defaults are 10% minimum and 90% maximum.

Water-cooled = Y

SET TOWER SPs (8)
PD Control Loop
Error Gain = XX
Slope Gain = XX

Defaults are 25 for both error and slope.

Alarms

When an alarm occurs, the alarm type, limit value (if any), date, and time are stored in the active alarm buffer corresponding to that alarm (viewed on the Alarm Active screens) and also in the alarm history buffer (viewed on the Alarm Log screens). The active alarm buffers hold a record of the last occurrence of each alarm and whether or not it has been cleared. The alarm can be cleared by pressing the Edit key. A separate buffer is available for each alarm (High Cond Pressure, Evaporator Freeze Protect, etc.). The alarm history buffer holds a chronological account of the last 25 alarms of any type.

Screen Definitions – ALARM

ALARM ACTIVE (X)
Time Date
Alarm Description

OR

ALARM ACTIVE (X)
No more alarms
Press ENTER to clear all active alarms

If the unit is off on a shutdown alarm or running, but in a limit alarm condition, the cause and date will appear in the upper screen. If there is a simultaneous occurrence of more than one alarm, the others will appear in additional screens below the first one, accessed by the DOWN ARROW.

Either type alarm will light a red light in back of the LEFT-ARROW KEY. The light will go out when the fault is cleared. To clear the fault, scroll down to the last screen and press ENTER. If other faults have appeared, they will all be cleared at the same time. It is not necessary to have a password open to clear alarms.

ALARM LOG (X)
Alarm Description
Time Date
Data Edit and scroll

The last 25 alarms, either shutdown or limit, are shown in this menu and subsequent menus located under it. ARROW DOWN from this menu will go to the next-to-last alarm, ARROW DOWN again will go to the second from last, and so on through the last 25 occurrences. The screens are numbered (1), (2), (3), etc.

Screen Definitions – EVENT LOG

EVENT LOG (X)
Event Description
Time Date

SET ALARM LIMITS

SET ALARM LMTS (1)
Low EVAP Pressure
Hold=XXXpsi
Unload=XXXpsi

The Hold and Unload have the same default value of 59 psi. If two compressors are running, the LowEvPrUnld is in effect and the lag compressor will be shut off to unload the unit. If one compressor is running, the LowEvPrHold is in effect and the lag compressor is prevented from starting, thereby holding the unit capacity

The last action to take place is the shutoff of all compressors running when the LowEvPrStop setting is reached (default is 58 psi). Reducing these time intervals will increase detrimental compressor cycling. It is recommended that these settings not be changed.

SET ALARM LMTS (2)
High Cond Pressure
Unload= XX.X°F
Stop=XXX sec

Unload is a limit alarm that unloads the unit at 370 psi in an attempt to prevent total shutdown from the HighCondPr at 380 psi. The stage down is set at 370 psi. It is recommended that these settings not be changed.

Stop (the unit high-discharge-pressure shutdown) is a stop alarm that shuts off the unit when the discharge pressure reaches the setting. The default setting is 380 psi.

LowEvPrDelay is a time delay on the low pressure trip that reduces nuisance low-pressure trips. The default setting is 30 seconds.

SET ALARM LMTS (3)
GroundFault = N
PhaseVoltage = N

Evap Freeze (the unit freeze protection shutdown) is actually a stop alarm and shuts off the unit when the LWT reaches 36°F. It is cleared by going to the CLEAR ALARM menu in the ACTIVE ALARM hierarchy.

EvapFlowProof is the flow switch interlock. Closing the flow switch and therefore proving the existence of chilled water flow resets this trip. It is recommended that these settings not be changed.

BAS Interface

The BAS interface will use the supervisor port on the controller as a connection point.

Protocols Supported

The following building automation system (BAS) protocols are supported. It is possible to change the building automation interface without loading different software.

BACnet®

When protocol is set to BACnet, the baud rate and ident set points are not accessible. The ident setting is locked at 1 for BACnet, and the baud rate is locked to 19200.

LONworks®

With protocol set to LON, the baud rate and ident set points are not accessible. The ident setting is locked at 1 for LON, and the baud rate is locked to 4800.

Modbus®

With the protocol set to Modbus, the baud rate and ident set points are accessible.

Parameter Details

Units of Measure

Parameters will be expressed in different units dependant on the protocol selected.

Parameter Type	Modbus Units	BACnet Units	LONworks Units
Temperature	**°F** X 10	**°F** X 10	**°C** X 100
Pressure	PSI X 10	PSI X 10	KPa X 10
Percentage	% X 10	% X 10	% X 200

Available Parameters

Types: A = Analog, I= Integer, D= Digital;

I/O: I = Input only, O = Output only , I/O = Input/Output

Type	Index	I/O	Description	LONWORKS	BACnet	Modbus
A	1	I/O	Network Cool LWT set point	x	x	x
A	2	O	Active LWT set point	x	x	x
A	3	I/O	Network limit set point	x	x	x
A	6	O	Evap LWT	x	x	x
A	7	O	Cond EWT	x	x	x
A	10	O	Unit capacity (%)	x	x	x
A	11	I/O	Network Cool LWT set point default	x		
A	15	O	Suction temp	x	x	x
A	16	O	Evap sat temp	x	x	x
A	17	O	Evap pressure	x	x	x
A	20	O	Cond sat temp	x	x	x
A	21	O	Cond pressure	x	x	x
A	39	O	OAT	x	x	x
A	42	O	Active Capacity Limit	x	x	x
A	50	I/O	Network Ice LWT set point	x	x	x
I	1	O	Active alarms 1	x	x	x
I	2	O	Active alarms 2	x	x	x
I	3	O	Active alarms 3	x	x	x
I	4	O	Active alarms 4	x	x	x
I	5	O	Active alarms 5	x	x	x
I	6	O	Active alarms 6	x	x	x
I	7	O	Active alarms 7	x	x	x
I	8	O	Active alarms 8	x	x	x
I	9	O	Active alarms 9	x	x	x
I	10	O	Active alarms 10	x	x	x

Type	Index	I/O	Description	LONWORKS	BACnet	Modbus
I	11	O	Active alarm 11	x	x	x
I	12	O	Active alarm 12	x	x	x
I	13	O	Active alarm 13	x	x	x
I	14	O	Active alarm 14	x	x	x
I	15	O	Active alarm 15	x	x	x
I	16	O	Active alarm 16	x	x	x
I	17	I	Network chiller mode set point	x	x	x
I	18	O	LON Chiller run mode	x		x
I	19	O	Active chiller mode	x	x	x
I	20	I	Network demand limit default set point	x		
I	21	I	Network chiller mode default set point	x		
I	22	O	Sequence Status	x	x	x
			Bit 1 - Unit Full Load Flag			
			Bit 2 - Circuit One Available Flag			
			Bit 3 - Circuit Two Available Flag			
I	28	O	Unit model type, refrigerant	x	x	x
I	29	O	Unit language	x	x	x
I	30	O	Unit software version	x	x	x
I	32	I	Compressor select	x	x	x
I	35	I/O	Clock year		x	x
I	36	I/O	Clock month		x	x
I	37	I/O	Clock day of month		x	x
I	38	I/O	Clock day of week		x	x
I	39	I/O	Clock hours		x	x
I	40	I/O	Clock minutes		x	x
I	45	O	Compressor starts		x	x
I	46	O	Compressor run hours		x	x
D	1	I/O	Network chiller enable set point	x	x	x
D	2	O	Chiller enable status	x	x	x
D	3	O	Active alarm indicator	x	x	x
D	4	O	Chiller run enabled	x	x	x
D	5	O	Chiller local control	x	x	x
D	6	O	Chiller capacity limit	x	x	x
D	7	O	Evap flow	x	x	x
D	8	O	Cond flow	x	x	x
D	9	I	Network chiller enable default set point	x		
D	10	I	Ignore network default	x		
D	24	I	Network clear alarm signal	x	x	x

Chiller Mode - Applies to Integer 17 and Integer 19. Network

Chiller Mode Set Point and Active Chiller Mode use the same numbering scheme to represent ice mode or cool mode. The output representing the mode is shown below for each protocol.

Mode	LONworks	BACnet	Modbus
Heat	1	3	3
Cool	3	2	2
Ice	11	1	1

Any time the chiller is not in Ice mode, Cool mode will be assumed.

LON Chiller Run Mode - Applies to Integer 18. The LON Chiller Run Mode parameter indicates the unit state as:

State	LONworks	BACnet	Modbus
Off	0	1	1
Run	2	3	3
Service	4	5	5

State = Off any time the state is not Run or Service

State = Run when the unit state is Auto

State = Service when the unit is in Test mode

Unit Identification - Integer 28 indicates the unit model type and refrigerant. For WGZD with R410A and TGZ with R134a, the refrigerant output is 3.

Integer 29 indicates the unit language. For the WGZD the language can only be English, so output is 1.

Integer 30 indicates the software version and revision. The hundreds digit represents the version, and the remaining part represents the revision letter.

Compressor Select

Compressor Select is used to select the compressor for which the associated parameters will be sent to the BAS interface. The input should equal the number of the compressors for the desired data. If 0 is sent from the BAS, this will also select compressor 1.

Timeclock Setting

The chiller time and date may be changed through the BAS interface. Time and date are updated by first setting the values for the time and date inputs on the BAS. When the BAS sets digital index 12 high, the time and date in the controller is set to the values supplied bythe BAS. The values used are as follows:

Year: Integer # 35 (00 to 99)

Month: Integer # 36 (1 to 12)

Day of Month: Integer # 37 (1 to 31)

Day of Week: Integer # 38 (1 to 7)

Hour: Integer # 39 (0 to 23)

Minute: Integer # 40 (0 to 59)

Network Defaults

The network set point default values are used only for the LONworks protocol. Digital index 10 determines whether the network defaults should be loaded at startup. The startup process is as follows.

Immediately after the controller powers up, the protocol is checked. If the protocol is LONworks, then the current status of the BAS unit enable set point, digital 1, is stored in a temporary location and the BAS enabled set point is set to disable. A ten second timer should lapse, then the “ignore network defaults” setting is checked. If this is set low, then the defaults for BAS cool set point, network limit, unit enable, and unit mode will be loaded. If the setting is set high, then no defaults are loaded and the status of the BAS enable set point is restored to the original value.

Other Digital Output Parameters

Type	Index	I/O	Description	Details
D	2	O	Chiller enable status	Set whenever the chiller is enabled by all settings and switches
D	3	O	Active alarm indicator	Set when any alarm is active. Active events do not set this output
D	4	O	Chiller run enabled	Set when the unit state is auto
D	5	O	Chiller local control	Set when the unit control source is set to keypad or switches.
D	6	O	Chiller capacity limited	Set when a unit capacity limit is active, any circuit is disabled, or any circuit is limited in capacity.
D	7	O	Evap flow	Set when evap flow switch is closed
D	8	O	Cond flow	Set when cond flow switch is closed and watercooled = yes

More information on the BAS installation and operation can be found in manuals shipped with the unit and also available on www.DaikinApplied.com:

Compressor Motor Protection Module

The 20, 26, and 30 HP compressors are equipped with an module that provides protection against:

- High motor temperature
- High scroll temperature
- Phase missing
- Phase reversal
- Low control circuit voltage

The module also has a LED display in the upper righthand corner that gives information on compressor operation.

The module is accessible by removing the compressor motor cover. Additional information can be downloaded by authorized service technicians using special equipment.

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

⚠ 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.

⚠ WARNING

Disconnect the compressor three-phase power before removing the terminal box cover. Removal of the terminal box cover will expose the three-phase power connections. Contact with them can cause serious injury or death. Servicing should be done by technicians familiar with this equipment.

Warning Codes (Green LED Flash Code)

- Code 1 – Loss of Communication: The module will flash the green **Warning** LED one timeindicating the module has not communicated with the master controller for longer than 5 minutes. Once communication is reinitiated, the **Warning** will be cleared.
- Code 2 – Reserved For Future Use
- Code 3 – Short Cycling: The module will fl ash the green **Warning** LED three times indicating thecompressor has short cycled more than 48 times in 24 hours. A short cycle is defined as compressor runtime of less than 1 minute. The **Warning** will be activated when the “Short Cycling” dipswitch (#10) is “off” or in the “down” position. When fewer than 48 short cycles are accumulated in 24 hours the **Warning** code will be cleared.
- Code 4 – Open/Shorted Scroll Thermistor. The module will flash the green **Warning** LED four times indicating the scroll NTC thermistor has a resistance value that indicates an open/shorted thermistor (see **Table 2**). The **Warning** will be cleared when the resistance value is in the normal range.

Alert/Lockout Codes (Red LED Flash Code)

Code 1 – Motor High Temperature: The module will flash the red **Alert** LED one time indicating the motor PTC circuit has exceeded 4.5K Ohms. A code 1 **Alert** will open the M2-M1 contacts. The **Alert** will reset after 30 minutes and the M2-M1 contacts will close if the resistance of the motor PTC circuit is below 2.75K Ohms. Five consecutive Code 1 **Alerts** will lockout the compressor. Once the module has locked out the compressor, a power cycle or Modbus reset command will be required for the lockout to be cleared.

Code 2 – Open/Shorted Motor Thermistor: The module will flash the red **Alert** LED two times indicating the motor PTC thermistor circuit has a resistance value that indicates an open/shorted thermistor chain (see **Table 2**). A Code 2 **Alert** will open the M2-M1 contacts. The **Alert** will reset after 30 minutes and the M2-M1 contacts will close if the resistance of the motor PTC circuit is back in the normal range. The module will lockout the compressor if the trip condition exists for longer than 6 hours. Once the module has locked out the compressor, a power cycle or Modbus reset command will be required to clear the lockout.

Code 3 – Short Cycling: The module will flash the red **Alert** LED three times indicating the compressor is locked out due to short cycling. A Code 3 **Alert** will open the M2-M1 contacts. Code 3 will be enabled when the “Short Cycling” dipswitch (#10) is “on” or in the “up” position and the compressor has exceeded the number of short cycles configured by the user in a 24 hour period. Once the module has locked out the compressor, a power cycle or Modbus reset command will be required to clear the lockout.

Code 4 – Scroll High Temperature: The module will flash the red Alert LED four times indicating the scroll NTC circuit is less than 2.4K Ohms. A Code 4 Alert will open the M2-M1 contacts. The Alert will reset after 30 minutes and the M2-M1 contacts will close if the resistance of the scroll NTC circuit is higher than 5.1K Ohms. The module will lockout the compressor if the number of Code 4 Alerts exceeds the user configurable number of Code 4 events within a 24 hour period. Once the module has locked out the compressor, a power cycle or Modbus reset command will be required to clear the lockout.

Code 5 – Reserved for Future Use

Code 6 – Missing Phase: The module will flash the red Alert LED six times indicating a missing phase in one of the three leads to the compressor. A Code 6 Alert will open the M2-M1 contacts. The Alert will reset after 5 minutes and the M2-M1 contacts will close if the missing phase condition is not present. The module will lockout the compressor after 10 consecutive Code 6 Alerts. Once the module has locked out the compressor, a power cycle or Modbus reset command will be required to clear the lockout.

Code 7 – Reverse Phase: The module will fl ash the red Alert LED seven times indicating a reverse phase in two of the three leads to the compressor. A Code 7 Alert will open the M2-M1 contacts. The module will lockout the compressor after one Code 7 Alert. A power cycle or Modbus reset command will be required to clear the lockout.

Code 8 – Reserved For Future Use

Code 9 – Module Low Voltage

The module will fl ash the red Alert LED nine times indicating low module voltage (see Table 2) on the T2-T1 terminals for more than 5 seconds. A Code 9 Alert will open the M2-M1 contacts. The Alert will reset after 5 minutes and the M2-M1 contacts will close if the T2-T1 voltage is above the reset value

Resetting Alert Codes

Resetting **Alert** codes can be accomplished in two different ways. First, **Alert** codes can be reset manually by cycling power to the module (disconnect T2 or T1 for 5 seconds). The second way to reset **Alert** codes is to send a Modbus reset command from the master controller. If the fault that initiated the **Alert** code is absent after one of the above resets is performed, the **Alert** code will be cleared and CoreSense will allow normal operation. If the fault is still present after the reset is performed the fault code will continue to be displayed via the green or red flashing LED.

Optional Controls

Phase/Voltage Monitor (Optional)

The phase/voltage monitor is a device that provides protection against three-phase electrical motor loss due to power failure conditions, phase loss, and phase reversal. Whenever any of these conditions occur, an input relay is deactivated, disconnecting power to the thermostatic control circuit. The compressor does a rapid shutdown including a pump down cycle.

The input relay remains deactivated until power line conditions return to an acceptable level. Trip and reset delays have been provided to prevent nuisance tripping due to rapid power fluctuations.

When three-phase power has been applied, the input relay should close and the “run light” should come on. If the relay does not close, perform the following tests.

1. 1. Check the voltages between L1-L2, L1-L3, and L2-L3. These voltages should be approximately equal and within +10% of the rated three-phase line-to-line voltage.
2. 2. If these voltages are extremely low or widely unbalanced, check the power system to determine thecause of the problem.
3. 3. If the voltages are good, turn off the power and inter-change any two of the supply power leads at the disconnect switch.

This may be necessary, as the phase/voltage monitor is sensitive to phase reversal. Turn on the power. The relay should now close after the appropriate delay.

Factory settings are as follows:

Voltage Setting, set at nameplate voltage.

Trip Delay Time, 2 seconds

Restart Delay Time, 60 seconds

Hot Gas Bypass (Optional)

This option allows passage of discharge gas to the evaporator, permitting operation at lower loads than available with compressor unloading. It also keeps the velocity of refrigerant gas high enough for proper oil return at light load conditions.

The pressure regulating valve is a Sporlan SHGBE-8 and factory set to begin opening at 69 psig and can be changed by changing the pressure setting. The adjustment range is 0 to 100 psig. To raise the pressure setting, remove the cap on the bulb and turn the adjustment screw clockwise. To lower the setting, turn the screw counterclockwise. Do not force the adjustment beyond the range it is designed for, as this will damage the adjustment assembly. The regulating valve opening point can be determined by slowly reducing the system load while observing the suction pressure. When the bypass valve starts to open, the refrigerant line on the evaporator side of the valve will begin to feel warm to the touch.

⚠ WARNING

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

Complete operating instructions are contained in the current version of Operating & Maintenance Manual found on www.DaikinApplied.com.

⚠ 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.

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.

NOTE: Return the "Scroll Compressor Equipment Warranty Form" on page 74 within 10 working days to Daikin Applied as instructed on the form to obtain full warranty benefits.

⚠ CAUTION

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

Pre Start-up

1. The chilled-water system should be flushed and cleaned Proper water treatment is required to prevent corrosion and organic growth.
2. With main disconnect open, check all electrical connections in control panel and starter to be sure they are tight and provide good electrical contact. Although connections are tightened at the factory, they can loosen enough in shipment to cause a malfunction.
3. Check and inspect all water piping. Make sure flow direction is correct and piping is made to correct connection on evaporator and condenser.
4. Open all water flow valves to the condenser and evaporator.
5. Flush the cooling tower and system piping to be sure the system is clean. Start evaporator pump and manually start condenser pump and cooling tower. Check all piping for leaks. Vent the air from the evaporator and condenser water circuit, as well as from the entire water system. The cooler circuit should contain clean, treated, non-corrosive water.
6. Check to see that the evaporator water thermostat sensor is securely installed.
7. Making sure control stop switch S1 is open (off) and pumpdown switches PS1 and PS2 are on "manual pumpdown," place the main power and control disconnect switches to "on." This will energize the crankcase heaters. Wait a minimum of 12 hours before starting the unit.
8. Check compressor oil level. Prior to start-up, the oil level should cover at least one-third of the oil sight glass located in the equalizing line between the compressors or on the compressor.
9. Check water pressure drop across evaporator and condenser, and see that water flow is correct (beginning on page 12) per the design flow rates.
10. Check the actual line voltage to the unit to make sure it is the same as called for on the compressor nameplate, within +/- 10%, and that phase voltage unbalance does not exceed 2%. Verify that adequate power supply and capacity is available to handle load.
11. Make sure all wiring and fuses are of the proper size. Also make sure that all interlock wiring is completed per Daikin Applied diagrams.
12. Verify that all mechanical and electrical inspections by code authorities have been completed.
13. Make sure all auxiliary load and control equipment is operative and that an adequate cooling load is available for initial start-up.

14. Start-up

1. Open the compressor discharge shutoff valves until backseated. Always replace valve seal caps.
2. Open the two manual liquid line shutoff valves.
3. Leak test the unit.
4. Check to see that the unit circuit breakers are in the "off" position.
5. Check to see that the pumpdown switches, PS1 and PS2, are in the "manual pumpdown" position and the control system switch S1 is in the "off" position.
6. Put the main power and control circuit disconnects to the "on" position.
7. Verify crankcase heaters have operated for at least 12 hours prior to start-up. Crankcase should be warm to the touch.
8. Check that the MicroTech II controller is set to the desired chilled water temperature.
9. Start the system auxiliary equipment for the installation by turning on the time clock, ambient thermostat and/or remote on/off switch and water pumps.
10. Check resets of all equipment protection controls.
11. Switch on the unit circuit breakers.
12. Set pumpdown switches PS1 and PS2 to "auto" for restart and normal operation.
13. Start the system by setting the system switch S1 to on.
14. After running the unit for a short time, check the oil level in each compressor crankcase, rotation of condenser fans (if any), and check for flashing in the refrigerant sight glass.
15. After system performance has stabilized, it is necessary that the "Compressorized Equipment Warranty Form" (Form # SF-990007) be completed to establish commencement of the warranty period. Be sure to list the pressure drop across both vessels. This form is shipped with the unit and after completion should be

returned to the Daikin Applied service through your sales representative.

Weekend or Temporary Shutdown

Move pumpdown switches PS1 and PS2 to the “manual pumpdown” position. After the compressors have pumped down, turn off the chilled water pump. Note: With the unit in this condition, it will not restart until these switches are turned back on. The unit has one-time pumpdown. It is important that the compressors pump down before the water flow to the unit is interrupted to avoid freeze-up in the evaporator.

Leave S1 on and power to the unit so that the crankcase heaters will remain energized.

Start-up after Temporary Shutdown

1. Start the water pumps.
2. With the control system switch S1 in the “on” position,move the pumpdown switches PS1 and PS2 to the “auto pumpdown” position.
3. Observe the unit operation for a short time, noting unusual sounds or possible cycling of compressors.
4. Check compressor crankcase heaters.

Extended Shutdown

1. Close the manual liquid line shutoff valves.
2. After the compressors have pumped down, turn off the water pumps.
3. Turn off all power to the unit.
4. Move the control service switch S1 to the “off” position.
5. Close the discharge shutoff valves on the compressor(s) and the liquid outlet valves at the condenser.
6. Tag all opened disconnect switches to warn against startup before opening the compressor suction and discharge valves.
7. Drain all water from the unit evaporator, condenser, and chilled water piping if the unit is to be shut down during the winter and exposed to below freezing temperatures. Do not leave the vessels or piping open to the atmosphere over the shutdown period.

Start-up after Extended Shutdown

1. Inspect all equipment to see that it is in satisfactory operating condition.
2. Remove all debris that has collected on the surface of the cooling tower.
3. Open the compressor discharge valves until backseated. Always replace valve seal caps.
4. Open the manual liquid line shutoff valves.
5. 5 Check circuit breakers. They must be in the “off” position.
6. Check to see that the pumpdown switches PS1 and PS2 are in the “manual shutdown” position and the control system switch S1 is in the “off” position.
7. Put the main power and control circuit disconnects to the “on” position.
8. Leak test the unit.
9. Allow the crankcase heaters to operate for at least 12 hours prior to start-up.
10. Start the chilled water pump and purge the water piping as well as the evaporator in the unit.
11. Start the system auxiliary equipment for the installation by turning on the time clock, ambient thermostat and/or remote on/off switch.
12. Check that the MicroTech II controller is set to the desired chilled water temperature.
13. Check resets of all equipment protection controls.
14. Switch the unit circuit breakers to “on.”
15. Start the system by setting the system switch S1 to “on.”

⚠ CAUTION

Most relays and terminals in the control center are powered when S1 is closed and the control circuit disconnect is on. Therefore, do not close S1 until ready for start-up or serious equipment damage can occur.

16. Set pumpdown switches PS1 and PS2 to the “auto pumpdown” position for restart and normal operation.
17. After running the unit for a short time, check the oil level in the compressor oil sight glass or in the compressor’s equalizing lines for flashing indicating possible refrigerant in the oil (see System Maintenance section beginning on page 64).

Flow Switch Installation and Calibration

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

The thermal dispersion flow switch supplied by Daikin Applied, shown in Figure 27, comes as a 2 part unit consisting of a flow switch and an adapter labeled E40242 by the supplier.

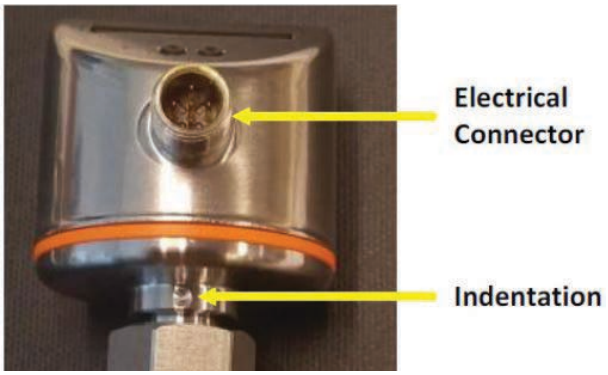
Figure 27: Thermal Dispersion Flow Switch and Adapter

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

Mounting

Figure 28 highlights the position of the electrical connector and indentation 'mark' on flow switch.

Figure 28: Flow Switch Details

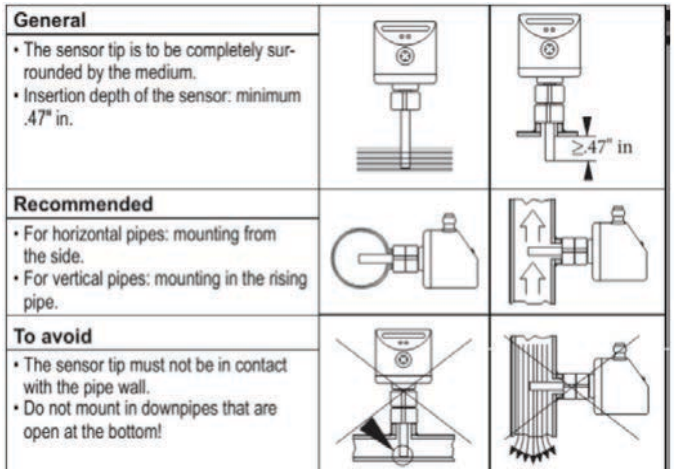


It is required that the flow switch be mounted such that the electrical connection and indentation 'mark' are oriented as recommended in Figure 29. It is important that the flow switch be mounted so that the probe is sufficiently inserted into the fluid stream. It may not be mounted directly on top or directly on the bottom of a horizontal pipe.

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

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

Figure 29: Remote Mounting Guidelines for Flow Switch



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

Wiring

Refer to wiring diagram in the unit control panel.

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

Flow Switch Setup

The flow switch comes from the factory set at a default velocity of 20 cm/s. This value is typically well below the minimum water flow specified for the unit's evaporator and condenser so field adjustment is required for adequate low flow protection. "Table 26: Flow Volume Calculation" on page 65 are the calculated gallons per minute (gpm) for Schedule 40 steel pipe for various fluid velocities from 20 cm/s to 300 cm/s. The flow switch has an overall range of adjustment from 3 cm/s to 300 cm/s.

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

Step 2: Once steady state minimum desired operating flow is obtained, perform the 'Teach' function on the flow switch. The 'Teach' function is initiated by holding down the minus '-' button on the face of the flow switch for 15 seconds. During this 15 second period, LEDs '0' and '9' will be lit green. Once the 'Teach' function is completed, the outer LEDs will flash green as shown in Figure 30.

Figure 30: Automatic Teach of Set point

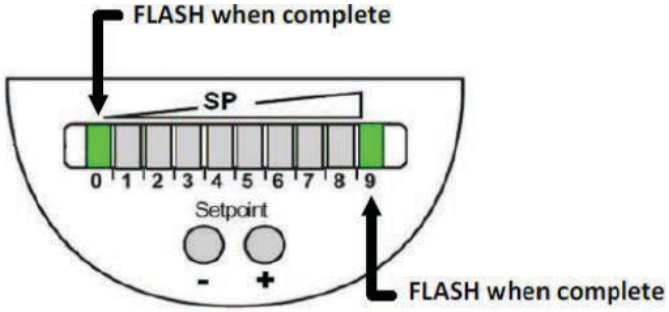
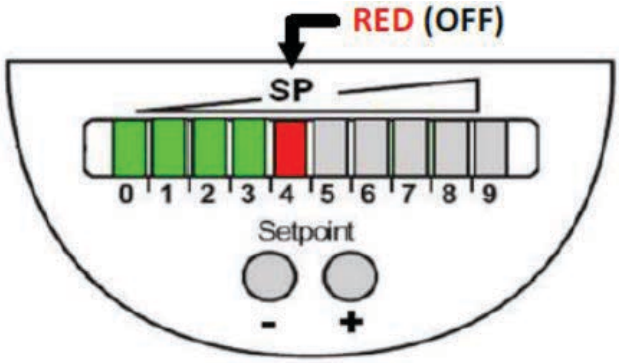


Table 26: Flow Volume Calculation

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

Step 3: After the 'Teach' function is completed and the outer LEDs flashed, the flow switch will indicate a new set point based upon the current flow which should still be at the steady state minimum desired operating flow.Figure 31 shows a typical display for this condition. All LEDs to the left of the SP LED are lit green. The SP LED is lit RED (or may toggle amber) which indicates that the flow switch is OPEN. Typically, an increase in fluid flow is between 15% to 30% above the 'Teach' function flow is required for the SP LED to turn AMBER and the flow switch to CLOSE indicating acceptable flow.

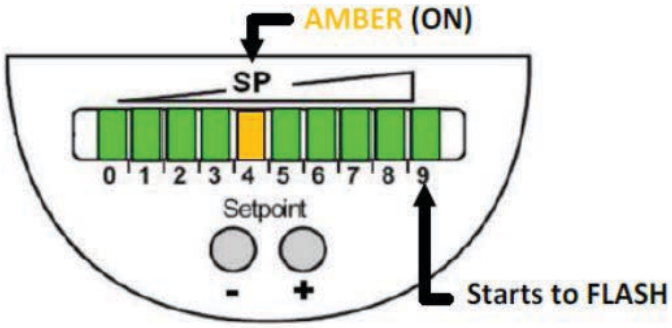
Figure 31: Teach Adjustment Complete



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

Step 4: Press the '+' button until LED '9' begins to flash, as shown in Figure 77. Opening of flow switch should now occur at approximately 80% to 90% of minimum flow.

Figure 32: Upper Range of Minimum Flow



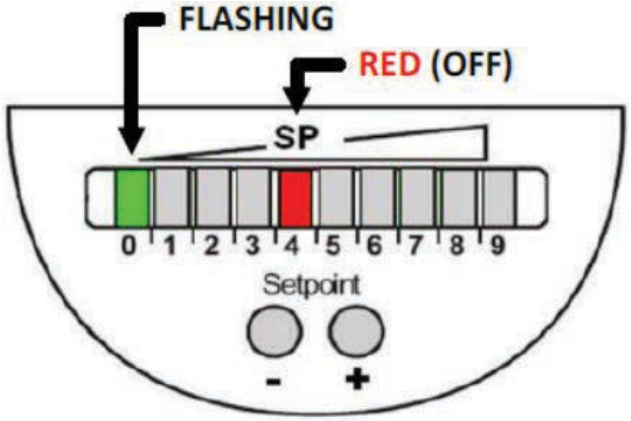
Step 5: Once the SP is set, it is recommended that the sensor be locked to avoid inadvertent readjustment. This can be performed by pressing both the '+' and '-' buttons simultaneously for 10 seconds. The indication goes out momentarily indicating the unit is locked. To unlock, the same procedure is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

NOTE:

18. The LED window display on flow switch represents a velocity range of 50 cm/s. The window centers on the set point (SP). For example, if the SP was set to 200 cm/s, then the LED labeled '0' would represent a velocity of 180 cm/s when lit and the LED labeled 9 would represent a velocity of 230 cm/s when lit.
19. Each LED represents 5 cm/s, or two presses of the '+' or '-' buttons.
20. When power is initially applied to the flow switch, all green LEDs light and go out step by step. During this time, the output is closed. The unit is in the operating mode.
4. When making manual adjustments to the set point (SP), if no button is pressed for 2 seconds, the unit returns to the operating mode with the newly set value.

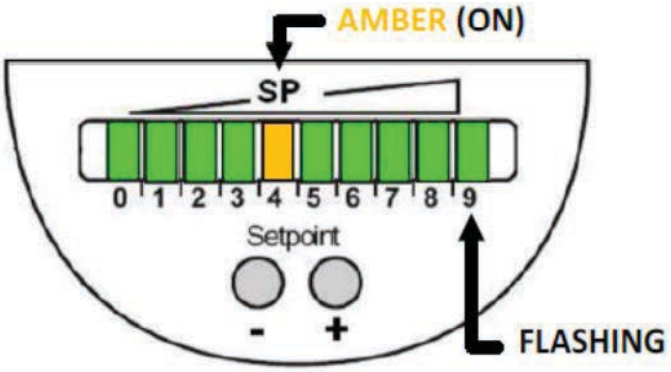
Flow <u>below</u> display range: The SP LED will be lit red and the leftmost LED will be flashing green. For example, if the SP was set to 200 cm/s, the flashing labeled '0' would indicate that the flow was below 180 cm/s. This would be shown if no flow through chiller or lowered than desired flow.

Figure 33: Display for Flow Below Range



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

Figure 34: : Display for Flow Above Range Sequence of Operation



The following sequence of operation is typical for WGZ water chiller models. The sequence can vary slightly depending upon options.

Compressor Heaters

With the control circuit power on and the control stop switch S1 off, 115V power is applied through the control circuit fuse FI to the compressor crankcase heaters HTR1, HTR2, HTR3, and HTR4.

Start-up/Compressor Staging

When compressors start and stop.

Stage Up Temp is the LWT temperature at which the next compressor to start will stage up (start) after at least one compressor on the unit has started and is running.

Start Up Temp is the LWT at which the first compressor starts. The start up temperature equals the stage up temperature plus the Start Delta temperature. A high Start Delta will keep the unit off longer and reduce unit cycling at low loads. However, this high Start Delta will cause a larger excursion from the LWT set point before the unit starts.

Stated another way, the Start Delta is the number of degrees above the Evap LWT set point, plus ½ the Dead Band, that determines when the first compressor starts. The Start Delta is in effect for only the first start after all compressors have been off. Additional compressor starts and stops are determined by the LWT in respect to the dead band only. The dead band is automatically set at 30% of the EvapDeltaT selected in menu 3. The following sequence would occur for the settings shown below:

EvapDelta T=10.0°F

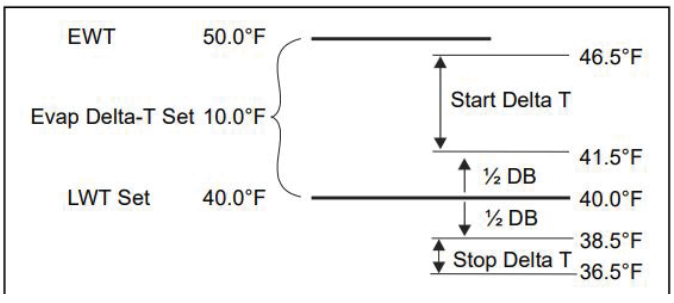
Dead Band=3.0°F

StartDelta=5.0°F

StopDelta=2.0°F

LWT=40.0°F

Figure 35: Staging/Starting Temperatures



For a warm start-up (no compressors running), the first compressor will start at any temperature above 46.5°F. Each subsequent compressor will start after the Stage Up Timer has timed out and if the temperature is above the dead band, 41.5°F in this case.
If the LWT stays above 41.5°F, all of three (or 5) remaining compressors will eventually stage on after the Stage Up Timer times out between each stage.

At some point, the chilled water temperature will be dropping and begin to approach the point when compressors should begin staging off, which is the LWT set point minus ½ of the Dead Band, 38.5°F in this case. If the LWT remains below LWT set point minus ½ Dead Band and the Stage Down Timer times out, additional compressors will stage off. The last compressor will stage off when the LWT falls below the LWT Set point minus ½ the Dead Band minus the Stop Delta T. The stop Delta T is in effect for only the last compressor running.

If the temperature climbs above 38.5°F all running compressors will remain on. No compressor staging occurs within the Dead Band. The next-on compressor will start when the chilled water temperature reaches 41.5°F and the Stage Up Timer times out.

However, in some circumstances this methodology can cause the LWT to drop to dangerously low levels, with the evaporating temperature below the freeze point, before stopping. In the example shown in Figure 7, the Shutdown Temp (last compressor off) would be 36°F.

This would result in a refrigerant evaporating temperature approaching freezing, so the rule is amended to read:

If the Cool Leaving Water Temperature (LWT) set point is less than half the Control Band

above 39.0° F the Stage Down temperature is calculated as:

Stage Down Temperature = Cool LWT – (Cool LWT - 39.0° F), and the

Shutdown Temperature = Cool LWT – (Cool LWT - 39.0° F) – Stop Delta T

This keeps the Stage Down Temp above 39°F and the Shutdown Temp above 36°F, as the maximum Stop Delta T allowed is 3-degrees.

Which compressor starts and stops. One compressor per circuit will start before starting the second compressor (or third) on any circuit. In other words, the compressor with the lowest number of starts will start first. The compressor with the lowest number of starts on the other circuit will start next, so that one compressor on each circuit will be running. The third compressor on will be the compressor on either circuit with the fewest starts. The remaining compressor will be the last on. If a circuit is unavailable for any reason, the second compressor on the operating circuit will stage on. Only two (or three) compressors (on the one circuit) will be operating.

There is a 150 second delay after power-up before any compressor is allowed to start. When staging down, one compressor on each circuit will be left on until each circuit has only one compressor running. In other words, the compressor, on either circuit, with the most run-hours will stop first. The compressor with the most run-hours on the other circuit will stop next. One compressor on each circuit will be running. The third compressor off will be the one, on either circuit, with the most run-hours. The remaining compressor will be the last off. See the following description of pumpdown.

Figure 36: Staging in Cool and Glycol Mode

Description	Occurs When:	Action Taken
Stage #1 ON (See Notes Below)	Lvg Evap T > Evap LWT SP + (DB/2) + Startup Delta T	Available compressor with least starts, ON
Stage #2 ON	After Stage Up Delay times out then, LVG Evap T > Evap LWT SP + (DB/2)	Available compressor on the other circuit with least starts, ON
Stage #3 ON	After Stage Up Delay times out, then LVG Evap T > Evap LWT SP + (DB/2)	Available compressor on either circuit with least starts, ON
Stage #4 ON	After Stage Up Delay times out then, LVG Evap T > Evap LWT SP + (DB/2)	Remaining compressor, ON
Stage #4 OFF	After Stage Down Delay times out then, LVG Evap T < Evap LWT SP – (CB/2)	Compressor with most run hours, OFF
Stage #3 OFF	After Stage Down Delay times out then, LVG Evap T < Evap LWT SP – (DB/2)	Compressor on the other circuit with most run hours, OFF
Stage #2 OFF	After Stage Down Delay times out then, LVG Evap T < Evap LWT SP – (DB/2)	Compressor on either circuit with most run hours, OFF
Stage #1 OFF	After Stage Down Delay times out then, LVG Evap T < Evap LWT SP – (DB/2)-StopDelta T	Remaining compressor, OFF

NOTE: DB (Dead Band) = Evap Water Delta T x .3

Manual Compressor Disable Logic

Logic is available that allows the operator to manually enable and disable compressors. When a compressor is disabled, it is considered unavailable to start in the staging logic. This allows a damaged compressor to be taken offline while the remaining compressor can still provide some cooling

- The Compressor Disable set points are found on Compressor Set Points screens three and four.
- A running compressor cannot be disabled until it has been shutdown.
- If all of the compressors on a circuit are disabled, then the circuit will be disabled.
- If both circuits have all of their compressors disabled, then the Unit State will remain Off

Automatic Pump Down

WGZ units are equipped with single pumpdown control. When the last compressor running on either circuit is ready to shut off, the liquid line solenoid valve (LLSV) is closed first and the compressor continues to run until the pump down pressure is reached, at which time the compressor shuts off. The shut off pressure is set at 15 psi below the Low Evaporator pressure Unload set point.

When the first compressor on a circuit starts, the LLSV opens simultaneously

Manual Pump Down

When the Pump Down Switch is in the pump down position, all compressors except #1 and #2 will shut off. Then the Liquid Line and Hot Gas Bypass Valves will close. The operating compressor will pump out the refrigerant. When the Suction Pressure is at 40 psig, the compressors will stop.

Chilled Water and Condenser Water Pumps

The chiller MicroTech II controller can be programmed to start and stop the system chilled water and condenser water pumps. They may also be controlled by the BAS or manually.

Cooling Tower Control

The cooling tower fans and/or the tower bypass valve can be controlled by the MicroTech II controller. This provides a simple and direct method to control the unit's discharge pressure. Some means of discharge pressure control must be installed if the condenser water temperature can fall below 60°F (16°C).

ICE Mode

In ICE mode, the compressors stage to 100% load until the LWT is less than the ICE LWT SP. Then Compressors #3 and #4 shut down. Following that, Compressors #1 and #2 shut down after going through normal pumpdown on both circuits. There is a programmable, start-to-start, Ice Mode Start Delay that limits the frequency of starts when in the ice mode. The timer can be manually cleared to force a restart.

System Maintenance

To provide smooth operation at peak capacity and to avoid damage to package components, a program of periodic inspections should be set up and followed. The following items are intended as a guide to be used during inspection and must be combined with sound refrigeration and electrical practices to provide trouble-free performance.

The liquid line sight glass/moisture indicator on all circuits must be checked to be sure that the glass is full and clear and that the moisture indicator indicates a dry condition. If the indicator shows that a wet condition exists or if bubbles show in the glass, even with a full refrigerant charge, the filter-drier element must be changed.

Water supplies in some areas can tend to foul the water-cooled condenser to the point where cleaning is necessary. The fouled condenser will be indicated by an abnormally high condenser approach temperature (saturated discharge temperature minus leaving condenser water temperature) and can result in nuisance trip-outs. To clean the condenser, mechanical cleaning or a chemical descaling solution should be used according to the manufacturer's directions. The condenser flow sensor should be cleaned anytime the condenser is opened. This should typically be performed at the annual inspection; however, more frequent cleaning may be required depending on the conditions of the jobsite.

Recommended condenser flow sensor maintenance includes the following:

- Check the sensor tip for buildup.
- Clean the tip using a soft cloth. Stubborn buildup - such as lime - can be removed using a common vinegar cleaning agent.

The compressor oil level must be checked periodically to be sure that the level is at the center of the oil sightglass located in the compressor's equalizing line or on the compressor itself Low oil level can cause inadequate lubrication and if oil must be added, use oils referred to in the following Compressor Lubrication section.

A pressure tap has been provided on the liquid line downstream of the filter-drier and solenoid valve but before the expansion valve. An accurate subcooled liquid pressure and temperature can be taken here. The pressure read here could also provide an indication of excessive pressure drop through the filter-drier and solenoid valve due to a clogging filter-drier. Note: A normal pressure drop through the solenoid valve is approximately 3 psig (20.7 kPa) at full load condition.

⚠ DANGER

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

⚠ CAUTION

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

All power electrical terminals should be checked for proper torque every six months, as they tend to loosen due to normal heating and cooling of the wire.

Compressor Lubrication

The oil level should be watched carefully upon initial start-up and regularly thereafter.

All tandem and trio compressors on WGZ units come equipped with oil equalization lines connecting the crankcase of each set of compressors in each refrigerant circuit. This allows the oil to move from one compressor crankcase to the other during normal operation, and balance between the two when the compressors are off. The oil sight glass is located in the equalization line on or on the compressor body depending on model size. In either case, the oil level should be 1/4 to 1/3 of the glass.

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 may form acids that can be harmful to the chiller. Avoid prolonged exposure of POE oil to the atmosphere to prevent this problem. For more details on acceptable oil types, contact your Daikin Applied service representative.

The units are factory-charged with lubricant. It is important that only the manufacturer's recommended oils be used Acceptable POE oil types are:

- CPI/Lubrizol Emkarate RL32-3 MAF
- Copeland Ultra 32-3 MAF
- Parker Emkarate RL32-3MAF
- Virginia LE323MAF
- Nu Calgon 4314-66
- Exxon/Mobil EAL Arctic 22 CC*
- Hatcol 22CC*
- Everest 22CC*

NOTE: These types of oils can only be used as "Top Off" oils. Oil can be added to the compressor through the oil fill hole in the crankcase. Special equipment is required to add oil and the work should be done by qualified refrigeration technicians with the proper training and equipment.

⚠ WARNING

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

Sight Glass and Moisture Indicator

The refrigerant sight glasses should be observed periodically. A monthly observation should be adequate. A clear glass of liquid indicates that there is adequate refrigerant charge in the system to provide proper feed through the expansion valve.

The sight glass should be clear when:

- Ambient temperature is above 75°F (23°C)
- Both compressors on a circuit are running
- All fans on a circuit are running

Bubbling refrigerant in the sight glass may occur at other conditions and may indicate that the system is short of refrigerant charge. Refrigerant gas flashing in the sight glass could also indicate an excessive pressure drop in the line, possibly due to a clogged filter-drier or a restriction elsewhere in the system. An element inside the sight glass indicates what moisture condition corresponds to a given element color. If the sight glass does not indicate a dry condition after about 12 hours of operation, the unit should be pumped down, the filter driers changed, and oil sample should be tested for acid.

If the system is suspected of being short of refrigerant, a qualified service technician with EPA certification should be contacted to thoroughly check out the unit and add refrigerant if necessary.

Crankcase Heaters

The compressors are equipped with crankcase heaters. The function of the heater is to keep the temperature in the crankcase high enough to prevent refrigerant from migrating to the crankcase and condensing in the oil during off-cycle. When a system is to be started up initially, the power to the heaters should be turned on for at least 12 hours before the compressors are started. The crankcase should be up to about 80°F (26.7°C) before the system is started, to minimize lubrication problems or liquid slugging of compressor. If the crankcase is cool (below 80°F) (26.7°C) and the oil level in the sight glass is full to top, allow more time for oil to warm before starting the compressor. The crankcase heaters are on whenever power is supplied to the unit and the compressor is not running.

Phase/Voltage Monitor (Optional)

The phase/voltage monitor is a device that provides protection against three-phase electrical motor loss due to power failure conditions, phase loss, under/over voltage, and phase reversal. Whenever any of these conditions occur, an input relay is deactivated, disconnecting power to the thermostatic control circuit. The compressor does a rapid shutdown pump down.

The input relay remains deactivated until power line conditions return to an acceptable level. Trip and reset delays prevent nuisance tripping due to rapid power fluctuations.

When three-phase power has been applied, the input relay should close and the “run light” should come on. If the relay does not close, perform the following tests.

1. 1 Check the voltages between L1-L2, L1-L3, and L2-L3. Voltages should be approximately equal and within +10% of the rated three-phase line-to-line voltage.
2. If these voltages are extremely low or widely unbalanced, check the power system to determine the cause of the problem.
3. Verify phasing with a phase sequence meter before changing any leads.

Factory settings are as follows:

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

Hot Gas Bypass (Optional)

This option allows passage of discharge gas to the evaporator, permitting operation at lower loads than available with compressor unloading. It also keeps the velocity of refrigerant gas high enough for proper oil return at light load conditions

The pressure regulating valve is set to begin opening at 97 psig (665 kPa) and can be changed by changing the pressure setting. The adjustment range is 75 to 150 psig. To raise the pressure setting, remove the cap on the bulb and turn the adjustment screw clockwise. To lower the setting, turn the screw counterclockwise. Do not force the adjustment beyond the range it is designed for, as this will damage the adjustment assembly. The regulating valve opening point can be determined by slowly reducing the system load while observing the suction pressure. When the bypass valve starts to open, the refrigerant line on the evaporator side of the valve will begin to feel warm to the touch.

⚠ CAUTION

The hot gas line can become hot enough to cause personal injury in a very short time. Avoid contact when it is operating or during cool-down period.

⚠ DANGER

LOCKOUT/TAGOUT all power sources prior to servicing the unit. Disconnect all power before performing any service inside the unit or serious personal injury or death can occur. Service on this equipment is to be performed only by qualified refrigeration personnel. Causes for repeated tripping of equipment protection controls must be investigated and corrected. Gas condition can cause serious injury or death. Close gas connections/valves before servicing equipment.

NOTE: Anyone servicing this equipment must comply with all applicable industry related published standards and local, state and federal, statutes, regulations and codes concerning refrigerant reclamation and venting.

Filter-Driers

To change the filter-drier, pump the unit down (with the compressor running) by closing the manual liquid line shutoff valve(s). The unit will start pumping down until it reaches the low-pressure cutoff setting of 85 psi (585 kPa).

Close the discharge valve. Remove the refrigerant in the liquid line with a recovery unit to EPA required pressure. Remove and replace the filter-drier(s). Evacuate the lines through the liquid line manual shutoff valve(s) to remove noncondensables that may have entered during filter replacement. A leak check is recommended before returning the unit to operation.

Liquid Line Solenoid Valve

The liquid line solenoid valve(s), which are responsible for automatic pumpdown during normal unit operation, do not normally require any maintenance. However, in the event of failure they can require replacement of the solenoid coil or of the entire valve assembly.

The solenoid coil can be removed from the valve body without opening the refrigerant piping by moving pumpdown switch PS1 or PS2 to the “manual” position.

The coil can then be removed from the valve body by simply removing a nut or snap-ring located at the top of the coil. The coil can then be slipped off its mounting stud for replacement. Be sure to replace the coil on its mounting stud before returning the pumpdown switch to the “auto pumpdown” position.

To replace the entire solenoid valve, follow the steps for changing a filter-drier.

Thermostatic Expansion Valve

The expansion valve is responsible for allowing the proper amount of refrigerant to enter the evaporator regardless of cooling load. It does this by maintaining a constant superheat (Superheat is the difference between refrigerant temperature as it leaves the evaporator and the saturation temperature corresponding to the evaporator pressure). All WGZ chillers are factory set for between 8°F and 12°F (4.4°C to 6.7°C) superheat at full load.

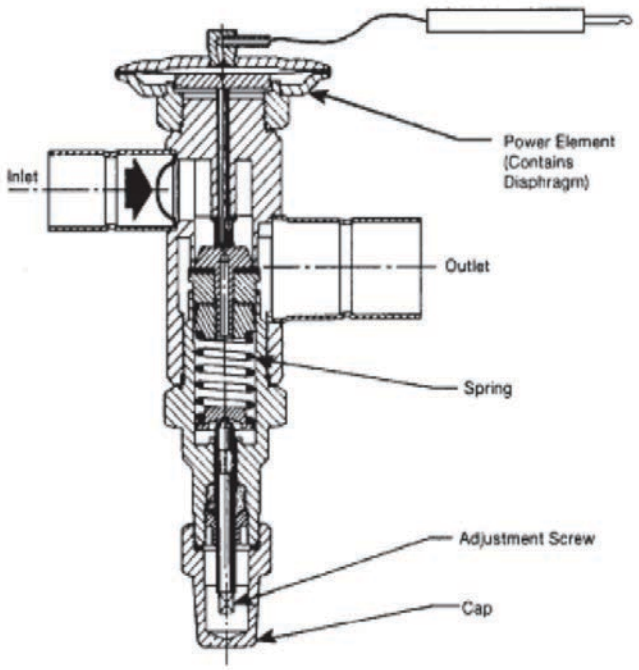
To increase the superheat setting of the valve, remove the cap at the bottom of the valve to expose the adjustment screw.

Turn the screw clockwise (when viewed from the adjustment screw end) to increase the superheat and counterclockwise to reduce superheat. Allow time for system rebalance after each superheat adjustment.

The expansion valve, like the solenoid valve, should not normally require replacement, but if it does, the unit must be pumped down by following the steps involved when changing a filter-drier.

If the problem can be traced to the power element only, it can be unscrewed from the valve body without removing the valve, but only after pumping the unit down.

Figure 37: Thermostatic Expansion Valve



⚠ CAUTION

Adjustment of expansion valve should only be performed by a qualified service technician. Failure to do so can result in improper unit operation..

NOTE: Superheat will vary with compressor unloading, but should be between 8°F and 12°F (4.4°C and 6.7°C) with stable operation.

Water-cooled Condenser

The condenser is of the shell-and-tube type with water flowing through the tubes and refrigerant in the shell. Integral subcoolers are incorporated on all units. All condensers are equipped with 500 psig (3450 kPa) relief valves. Normal tube cleaning procedures can be followed.

Evaporator

The evaporators are sealed, brazed-stainless steel plate unit or DX shell-and-tube. Normally no service work is required on the evaporator.

	Monthly	Quarterly	Semi-Annually	Annually	As Required by Performance
I. Compressor					
A. Performance evaluation (log & analysis)*	O				
B. Motor					
• Meg. windings			X		
• Ampere balance (within 10%)		X			
• Terminal check (tight connections, porcelain clean)				X	
• Motor cooling (check tempurature)		X			
C. Lubrication system					
• Oil level	O			X	
• Oil appearance (clear color, quality)	O				
• Oil change if indicated by oil analysis					X
II. Controls					
A. Operating controls					
• Check settings and operation			X		
B. Protective controls					
• Test operations of:					
Alarm rely		X			
Pump interlocks		X			
High and low pressure alarms		X			
III. Condenser					
B. Test water quality		X			
C. Clean condenser tubes (or as required)				X	
D. Clean condenser flow sensor (or as required)				X	
E. Eddycurrent test					X
F. Seasonal protection					X
IV. Evaporator					
B. Test water quality		X			
C. Clean evaportaor tubes or plates (or as required)					X
D. Eddycurrent test (or as required)					X
E. Seasonal protection					X
V. Expansion Values					
A. Performansce evaluation (superheat control)		X			
VI. Compressor - Chiller Unit					
A. Performance evaluation	O				
B. Leak test:					
• Compressor fittings and terminal		X			
• Piping fittings		X			
• Vessel relief valvues		X			
C. Vibration isolation test		X			
D. General Appearance					
• Paint				X	
• Insulation				X	
VII. Starter(s)					
A. Examine contractors (hardware and operation)		X			
B. Verify overload settings and trip		X			
C. Test electrical connections		X			
VIII. Optional Controls					
A. Hot gas bypass (verify operation)		X			

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
Compressor Will Not Run	Main switch, circuit breakers open.	Close switch
	Fuse blown.	Check electrical circuits and motor winding for shorts or grounds. Investigate for possible overloading. Replace fuse or reset breakers after fault is corrected.
	Thermal overloads tripped or fuses blown.	Overloads are auto reset. Check unit closely when unit comes back on line.
	Defective contactor or coil.	Repair or replace.
	System shut down by equipment protection devices.	Determine type and cause of shutdown and correct it before resetting protection switch.
	No cooling required.	None. Wait until unit calls for cooling.
	Liquid line solenoid will not open.	Repair or replace coil.
	Motor electrical trouble.	Check motor for opens, short circuit, or burnout.
	Loose wiring.	Check all wire junctions. Tighten all terminal screws.
Compressor Noisy or Vibrating	Flooding of refrigerant into crankcase.	Check superheat setting of expansion valve.
	Improper piping support on suction or liquid line.	Relocate, add or remove hangers.
	Worn compressor.	Replace.
High Discharge Pressure	Condenser water insufficient or temperature too high.	Readjust temperature control or water regulating valve. Investigate ways to increase water supply.
	Fouled condenser tubes (water-cooled condenser). Clogged spray nozzles (evaporative condenser). Dirty tube and fin surface (air cooled condenser).	Clean.
	Noncondensables in system.	EPA purge the noncondensables.
	System overcharge with refrigerant.	Remove excess refrigerant.
	Discharge shutoff valve partially closed.	Open valve.
	Condenser undersized (air-cooled).	Check condenser rating tables against the operation.
	High ambient conditions.	Check condenser rating tables against the operation.
Low Discharge Pressure	Faulty condenser temp. regulation.	Check condenser control operation.
	Insufficient refrigerant in system.	Check for leaks. Repair and add charge.
	Low suction pressure.	See corrective steps for low suction pressure below.
	Condenser too large.	Check condenser rating table against the operation.
	Low ambient conditions.	Check condenser rating tables against the operation.
High Suction Pressure	Excessive load.	Reduce load or add additional equipment.
	Expansion valve overfeeding.	Check remote bulb. Regulate superheat.
Low Suction Pressure	Lack of refrigerant.	Check for leaks. Repair and add charge.
	Evaporator dirty.	Clean chemically.
	Clogged liquid line filter-drier.	Replace cartridge(s).
	Clogged suction line or compressor suction gas strainers.	Clean strainers.
	Expansion valve malfunctioning.	Check and reset for proper superheat. Replace if necessary.
	Condensing temperature too low.	Check means for regulating condensing temperature.
	Compressor will not unload.	See corrective steps for failure of compressor to unload.
	Insufficient water flow.	Adjust flow.
Little or No Oil Pressure	Clogged suction oil strainer.	Clean.
	Excessive liquid in crankcase.	Check crankcase heater. Reset expansion valve for higher superheat. Check liquid line solenoid valve operation.
	Low oil level.	Add oil.
	Flooding of refrigerant into crankcase.	Adjust thermal expansion valve.
Compressor Loses Oil	Lack of refrigerant.	Check for leaks and repair. Add refrigerant.
	Velocity in risers too low (A-C only).	Check riser sizes.
	Oil trapped in line.	Check pitch of lines and refrigerant velocities.
Motor Overload Relays or Circuit Breakers Open	Low voltage during high load conditions.	Check supply voltage for excessive line drop.
	Defective or grounded wiring in motor or power circuits.	Replace compressor-motor.
	Loose power wiring.	Check all connections and tighten.
	High condensing temperature.	See corrective steps for high discharge pressure.
	Power line fault causing unbalanced voltage.	Check Supply voltage. Notify power company. Do not start until fault is corrected.
	High ambient temperature around the overload relay	Provide ventilation to reduce heat.
Compressor Thermal Switch Open	Operating beyond design conditions.	Add facilities so that conditions are within allowable limits.
	Discharge valve partially shut.	Open valve.
Freeze Protection Opens	Thermostat set too low.	Reset to 42°F (6°C) or above.
	Low water flow.	Adjust flow.
	Low suction pressure.	See “Low Suction Pressure.”

DAIKIN

New Chiller Start-Up Form - Scroll Compressor Equipment

WGZ and TGZ

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

JOB INFORMATION

Job Name: _____ **Daikin G.O.:** _____

Start-Up Date: _____ **No. of units at site:** ____ **Daikin S.O.:** _____

Installation Address: **Purchasing Contractor Information:**

UNIT INFORMATION

Unit Model No.: _____ **Serial No.:** _____

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

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

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

PRE START-UP CHECKLIST

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

	YES	NO
A. Is the unit free of visible shipping damage, corrosion or paint problems?	☐	☐
B. Is unit installed level?	☐	☐
C. Does the unit meet all location, installation and service clearances per IOM Bulletin?	☐	☐
D. Has sensor bulb been properly installed in the well? TXV used? Yes ☐ No ☐	☐	☐
E. Does electrical service correspond to unit nameplate?	☐	☐
Nameplate: Volts _____ Hertz _____ Phase_____		
F. Has electrical service been checked for proper phasing at each circuit power terminal block?	☐	☐
G. Has unit been properly grounded?	☐	☐
H. Has a fused disconnect and fuses or breaker been sized per product manual and installed per local code?	☐	☐
Number of conduits _____ Number of Wires _____ Wire Size _____		
I. Are all electrical power connections tight?	☐	☐
J. Been operating for 24 hours prior to start-up?	☐	☐
K. Does all field wiring conform to unit electrical specifications?	☐	☐
L. Are all service and liquid line valves in correct position?	☐	☐
M. Water Strainer installed? Brazed Plate Evaporator 0.063" (1.6mm) or smaller perforations	☐	☐
N. Condenser Strainer installed?	☐	☐
O. Has a flow switch been installed per the IOM manual?	☐	☐
P. Has the chill water and condenser water piping circuit been cleaned, flushed, and water treatment confirmed?	☐	☐
Q. Does the chiller and condenser water piping conform to the IOM manual?	☐	☐
R. If remote condenser, are fans properly aligned and turn freely?	☐	☐
S. If remote condenser, is wind impingement against the air cooled condenser a consideration?	☐	☐
T. If remote condenser, describe unit location with respect to building structures. Include measured distances.	☐	☐
U. If remote evaporator, are all set screws on all fans tight?	☐	☐

Description:

REFRIGERATION SYSTEM

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

DESIGN CONTROLS

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

B. CONDENSER
Water Pressure Drop: _____ psig(kPa) _____ Ft. (kPa) _____ gpm (lps)
Water Temperatures: Entering _____ °F (°C) Leaving _____ °F (°C)

If remote condenser: Ambient Air Temperature _____ °F (°C)

START-UP

	Yes	No
A. Does unit start and perform per sequence of operation as stated in the IO Manual?	☐	☐
B. If remote evaporator, do condenser fans rotate in the proper directions?	☐	☐

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

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

G. Circuit #2 Refrigerant Temperatures:

Saturated Evaporator Temperature	____ °F (°C)	____ °F (°C)
Suction Line Temperature	____ °F (°C)	____ °F (°C)
Suction Superheat	____ °F (°C)	____ °F (°C)
Saturated Condenser Temperature	____ °F (°C)	
Liquid Line Temperature		____ °F (°C)
Subcooling		____ °F (°C)
Discharge Temperature		____ °F (°C)

H. Outdoor Air Temperature: ____ °F (°C) ____ °F (°C)

NON-MICROTECH READINGS

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

J. If the chilled water system include glycol, have the freeze protection, low pressure devices and settings been adjusted for the actual job requirements? ☐ Yes ☐ No **Detail these settings on page 6 - Remarks section**
Note: See operation manual for low temperature on ice bank applications.

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

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

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

VI. MICROTECH SETPOINTS

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

ALARM SETPOINTS MUST BE VERIFIED WITH INSTRUMENTS OF KNOWN ACCURACY

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

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

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

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

VIII. GENERAL

	YES	NO
A. Are all control lines secure to prevent excess vibration and wear?	☐	☐
B. Are all gauges shut off, valve caps, and packings tight after startup?	☐	☐
C. Has the chiller been leak tested? Detail refrigerant leaks and repairs below	☐	☐

Refrigerant Leaks:

Repairs Made

Items not installed per IOM Manual and/or recommended corrective actions

Performed By: Title:

Company Name:

Address:

City/State/Zip Code: Telephone:

Mobile Number:

Signature: Date:

Contractor's Signature

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

Remarks: (Include any system or control information pertaining to this job.)

DAIKIN

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 equipment, its care should be a high priority. For training information on all Daikin 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 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.