Installation and Maintenance Manual

IOM 1319

Group: **Chiller**

Part Number: **IOM1319**

Date: **July 2021**

Templifier®
Heat Recovery Water Heaters

Model TGZ, B Vintage
600 to 3100 MBH
HFC-134a Refrigerant
60/50 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: _____

Cut Here

This manual provides installation, operation, and maintenance information for the Daikin TGZ Templifier® Heat Recovery Scroll Water Heater with the MicroTech® II 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. 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 situation which can result in property damage, personal injury, or death if not avoided.

⚠ CAUTION

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

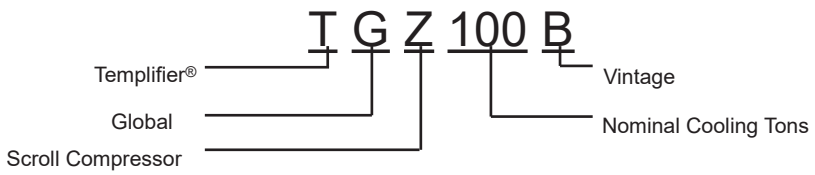
NOTE: Indicates important details or clarifying statements for information presented.

General Description

Daikin TGZ water heaters are scroll compressor refrigeration units that recover heat from warm fluid streams in the evaporator and deliver hot water, at a useful temperature, from the condenser to a heating load. They are designed for indoor installations only and are completely assembled, wired, charged and tested. Each unit consists of four or six (depending on unit size) scroll compressors, evaporator (brazed-plate on models 040 through 120 and shell-and-tube evaporators on models 150 to 190), shell-and-tube condenser/ heater, and complete refrigerant piping.

There are two refrigerant circuits, each with manual liquid line shutoff valves, charging valves, filter-driers, liquid line solenoid valves, sight glass/moisture indicators, and expansion valves. The electrical control center includes a MicroTech II® control system and other components necessary for dependable automatic operation.

NOMENCLATURE



TGZ Operating Limits

Templifier® units are designed to operate over a large range of temperatures so as to have wide application possibilities. The following operating limits are based on vessel and compressor limits. Figure 1 gives the operating envelope for TGZ units. The “OK” area is on the edge of the envelope and care should be exercised to not exceed the temperature limits during operation, N/A are not available operating points.

Table 1: Operating Limits

Description	Limit
Maximum allowable condenser water pressure	225 psig (1552 kPa)
Maximum allowable evaporator water pressure	175 psig (1207 kPa)
Maximum allowable water temperature to evaporator in a nonoperating cycle	105°F (40.5°C)
Maximum entering water temperature for operating cycle (for example, during system changeover from heating to cooling cycle)	90°F (32.2°C)

Table 2: TGZ Temperature Limits

Cooling Cycle	Min. Temp	Max Temp	Notes
Evap Leaving Water Temp.	40° F	60° F	In Cooling Cycle controlling Evap LWT - The Maximum Set point temp is 60°F
Cond Leaving Water Temp	70° F	160° F	With Evap LWT above 50°F, the Cond LWT must be 30°F above Evap. LWT
Evap Water Delta-T	6° F	16° F	
With Glycol in Evap - Evap LWT	15° F	60° F	With Evap LWT below 40°F, the Cond EWT must not exceed 120°F above Evap LWT.
Heating Cycle	**Min. Temp**	**Max Temp**	**Notes**
Evap Leaving Water Temp	40° F	85° F	With Evap LWT above 70°F, the Cond LWT must be 30°F above Evap LWT
Cond Leaving Water Temp	110° F	160° F	
Evap Water Delta-T	6° F	16° F	
Cond Water Delta - T			
with 2 Pass Cond Water Flow	10° F	15° F	Cond Water Temp Delta-T should be 10°F minimum for liquid subcooling
with 4 Pass Cond Water Flow	15° F	40° F	

Figure 1: TGZ Operating Envelope

Evap Leaving Temp.	Condenser Leaving Water Temperature									
	70°F (21°C)	80°F (27°C)	90°F (32°C)	100°F (38°C)	110°F (43°C)	120°F (49°C)	130°F (54°C)	140°F (60°C)	150°F (66°C)	160°F (71°C)
85°F ((29°C)	N/A	N/A	N/A	N/A	OK	OK	OK	OK	OK	OK
80°F (26°C)	N/A	N/A	N/A	N/A						OK
70°F (21°C)	N/A	N/A	N/A	OK						OK
60°F (15°C)	N/A	N/A	OK							OK
50°F (10°C)	N/A	OK								OK
45°F (7°C)	N/A									OK
40°F (4°C)	OK									OK
35°F (2°C)	OK								OK	N/A
30°F (-1°C)	OK							OK	N/A	N/A
25°F (-4°C)	OK						OK	N/A	N/A	N/A
20°F (-7°C)	OK	OK	OK	OK	OK	OK	N/A	N/A	N/A	N/A

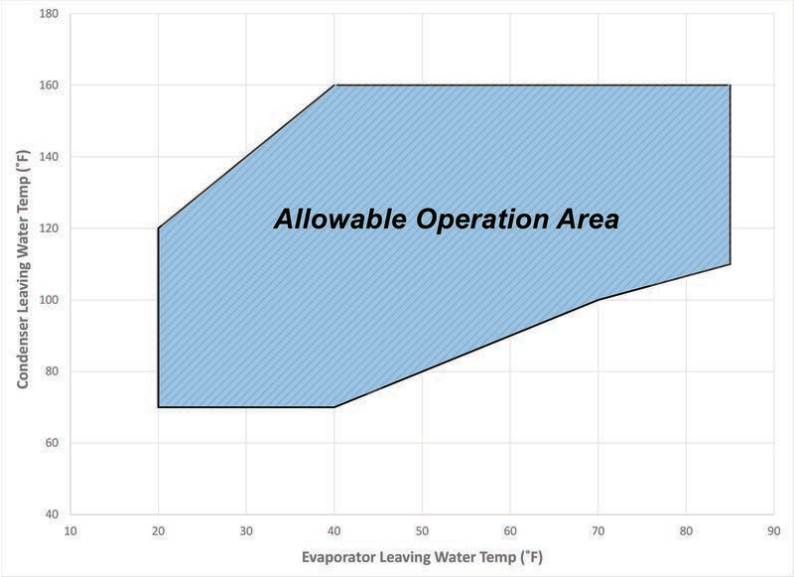


Table 3: TGZ Flow Limits

Unit Nominal Tons	40	50	60	80	100	110	120	150	170	190
	Flow Limit (gpm)									
Evaporator GPM										
10 F Water Temp Delta-T, 65ELWT/130CLWT	72	100	121	162	189	218	246	283	326	369
16-6 Water Temp Delta-T, 65ELWT/130LWT	45 - 120	62 - 167	75 - 202	101 - 270	118 - 315	136 - 363	154 - 410	177 - 472	204 - 543	231 - 615
10 Water Temp Delta-T, Full Unit Range	34 - 120	45 - 167	55 - 202	83 - 270	98 - 315	113 - 363	128 - 410	147 - 472	169 - 543	192 - 615
Condenser GPM - 4 Pass Cond										
20 F Water Temp Delta-T, 65ELWT/130CLWT	47	64	77	103	120	138	156	180	207	234
40-15 F Water Temp Delta-T, 65ELWT/130CLWT	23 - 63	32 - 86	38 - 103	51 - 138	60 - 160	69 - 184	78 - 208	90 - 240	103 - 276	117 - 312
Condenser GPM - 2 Pass Cond										
10 F Water Temp Delta-T, 65ELWT/130CLWT	94	128	154	206	240	276	312	360	414	468
15 F Water Temp Delta-T, 65ELWT/130CLWT	63	85	103	137	160	184	208	240	276	312

NOTE: ELWT = Evaporator Leaving Water Temperature, CLWT = Condenser Water Leaving Temperature.

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.

Inspection

When the equipment is received, all items should be carefully checked against the bill of lading to provide 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 number 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.

NOTE: Unit shipping and operating weights are given in the Physical Data Tables beginning on page 24

Handling

Every model TGZ water heater is shipped with a large percentage of its refrigerant charge isolated in the condenser section. The evaporator section will be under positive pressure containing a small isolated amount of the operating charge.

⚠ DANGER

If refrigerant leaks from the unit, there's 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.

⚠ 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.

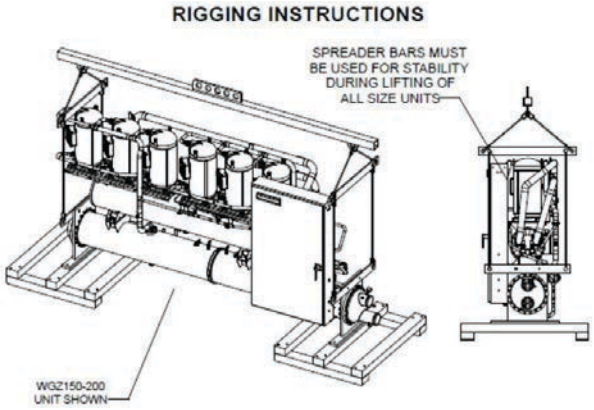
The skid option is strongly recommended for ease of handling and to help prevent damage during installation.

It is recommended that all moving and handling be performed with skids under the unit when possible and that the skids not be removed until the unit is in the final location. When moving the unit, dollies or simple rollers can be used under the skids. Never put the weight of the unit against the control box.

When moving, only apply pressure to the base on the skids, and not to the piping or shells. Avoid dropping the unit at the end of the roll.

If the unit must be hoisted, it is necessary to lift the unit by attaching cables or chains at the lifting holes located on the disposable lifting bars. Spreader bars must be used to protect the control cabinet and other areas of the unit. See Figure 2.

Figure 2: Lifting the Unit



Do not attach slings to piping or equipment. Move unit in the upright horizontal position at all times. Set unit down gently when lowering from the trucks or rollers. See Dimensional Drawing information beginning on page 16 for total and point weights.

⚠ CAUTION

Improper rigging, lifting, or moving of a unit can result in property damage, personal injury or death. Follow rigging and moving instructions carefully. Do not stand beneath the unit while it is lifted or being installed.

Location

The unit is designed for indoor application and must have equipment room temperature for operating and standby conditions between 40°F to 122°F (4.4°C to 50°C).

Because of the electronic 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 unit. If necessary, additional structural members should be provided to transfer the weight of the unit to the nearest beams.

NOTE: Unit shipping and operating weights are available in Dimensional Drawings starting on page 16.

Placing the Unit

The small amount of vibration normally encountered with the water chiller 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 nor will it transmit noise and vibration into the structure.

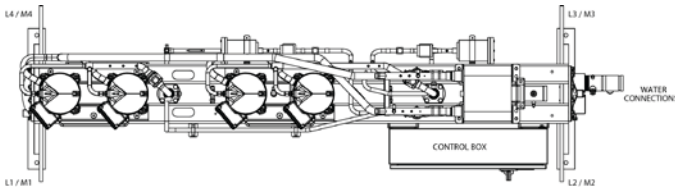
Mounting

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

Vibration Isolators

It is recommended that isolators be used on all upper level installations or in areas where vibration transmission is a consideration.

Figure 3: Isolator Locations



NOTE: Representative model for isolator location numbering only; unit configuration may be different than shown.

Once the unit has been located, set the unit in place and level with a spirit 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. Refer Dimensional Drawings beginning on page 16 for correct lifting and mounting locations.

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

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

Table 4: Vibration Mounting Location and Kit Number

TGZ MODEL	R-I-S MOUNTING LOCATION					SPRING-FLEX MOUNTING LOCATION				
	M1 (LEFT-FRONT)	M2 (RIGHT-FRONT)	M3 (RIGHT-REAR)	M4 (LEFT-REAR)	KIT PART NUMBER	M1 (LEFT-FRONT)	M2 (RIGHT-FRONT)	M3 (RIGHT-REAR)	M4 (LEFT-REAR)	KIT PART NUMBER
040B	RP-3 Gray-WR	RP-3 Gray-WR	RP-3 Gray-WR	RP-3 Gray-WR	332325701	CP1E-ID-900 Dk. Green	CP1E-ID-900 Dk. Green	CP1E-ID-900 Dk. Green	CP1E-ID-900 Dk. Green	332320701
050B	RP-3 Gray-WR	RP-3 Gray-WR	RP-3 Gray-WR	RP-3 Gray-WR	332325701	CP1E-ID-900 Dk. Green	CP1E-ID-900 Dk. Green	CP1E-ID-900 Dk. Green	CP1E-ID-900 Dk. Green	332320701
060B	RP-3 Gray-WR	RP-3 Gray-WR	RP-3 Gray-WR	RP-3 Gray-WR	332325701	CP1E-ID-900 Dk. Green	CP1E-ID-900 Dk. Green	CP1E-ID-900 Dk. Green	CP1E-ID-900 Dk. Green	332320701
080B	RP-4 Brown-WR	RP-4 Brown-WR	RP-4 Brown-WR	RP-4 Brown-WR	332325702	CP2E-ID-1350 Dk. Purple	CP2E-ID-1350 Dk. Purple	CP2E-ID-1350 Dk. Purple	CP2E-ID-1350 Dk. Purple	332320702
100B	RP-4 Brown-WR	RP-4 Brown-WR	RP-4 Brown-WR	RP-4 Brown-WR	332325702	CP2E-ID-1800 Dk. Green	CP2E-ID-1800 Dk. Green	CP2E-ID-1800 Dk. Green	CP2E-ID-1800 Dk. Green	332320703
110B	RP-4 Red-WR	RP-4 Red-WR	RP-4 Red-WR	RP-4 Red-WR	332325703	CP2E-ID-1800 Dk. Green	CP2E-ID-1800 Dk. Green	CP2E-ID-1800 Dk. Green	CP2E-ID-1800 Dk. Green	332320703
120B	RP-4 Red-WR	RP-4 Red-WR	RP-4 Red-WR	RP-4 Red-WR	332325703	CP2E-ID-1800 Dk. Green	CP2E-ID-1800 Dk. Green	CP2E-ID-1800 Dk. Green	CP2E-ID-1800 Dk. Green	332703703
150B	RP-4 Lime-WR	RP-4 Lime-WR	RP-4 Lime-WR	RP-4 Lime-WR	332325704	CP2E-ID-2400 Gray	CP2E-ID-2400 Gray	CP2E-ID-2400 Gray	CP2E-ID-2400 Gray	332320704
170B	RP-4 Lime-WR	RP-4 Lime-WR	RP-4 Lime-WR	RP-4 Lime-WR	332325704	CP2E-ID-2400 Gray	CP2E-ID-2400 Gray	CP2E-ID-2400 Gray	CP2E-ID-2400 Gray	332320704
190B	RP-4 Lime-WR	RP-4 Lime-WR	RP-4 Lime-WR	RP-4 Lime-WR	332325704	CP2E-ID-2400 Gray	CP2E-ID-2400 Gray	CP2E-ID-2400 Gray	CP2E-ID-2400 Gray	332320704

NOTE: Refer to Figure 3 for locating isolators. For spring-flex mountings, CP2E have two springs per isolator housing, CP1E have one spring per housing.

Figure 4: Spring Flex Mounting (CP-1) Isolator

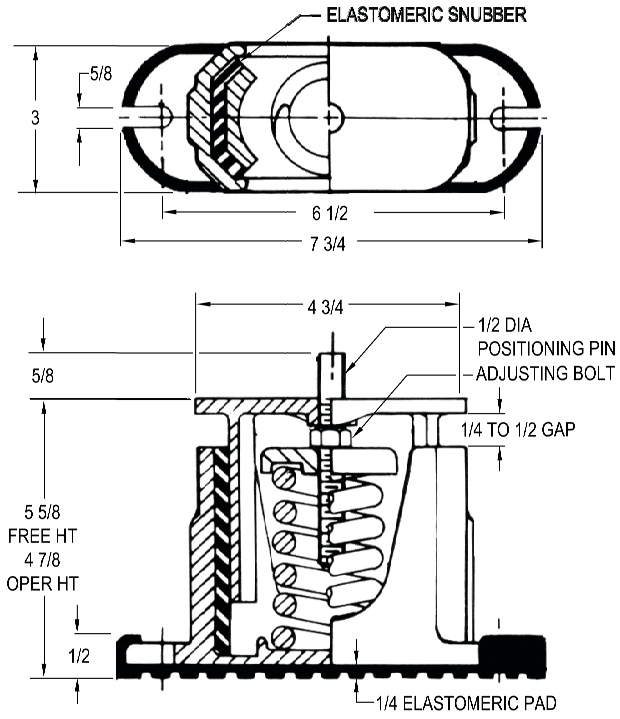
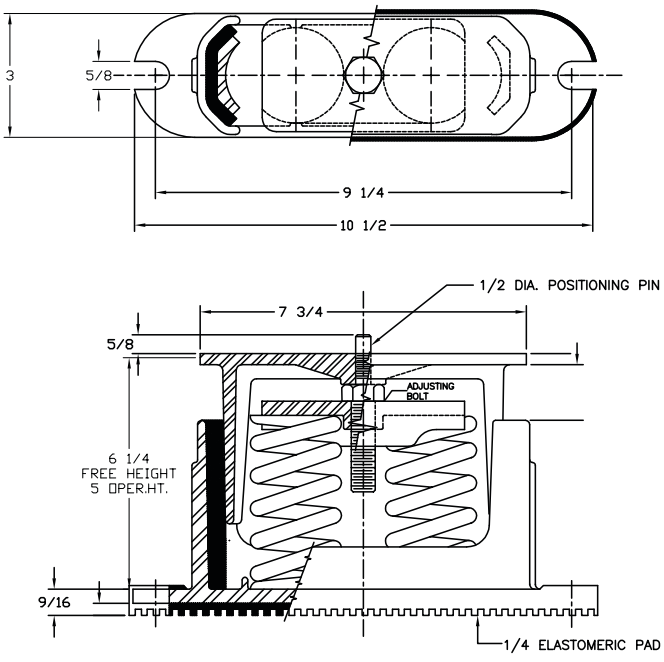


Figure 5: Spring Flex Mounting (CP-2) Isolator



NOTE: Adjust mounting so that upper housing clears lower housing by at least 1/4" (6.3 mm) and not more than 1/2" (12/7 mm)

Figure 6: Rubber-in-Shear Mounting (RP-3) Isolator

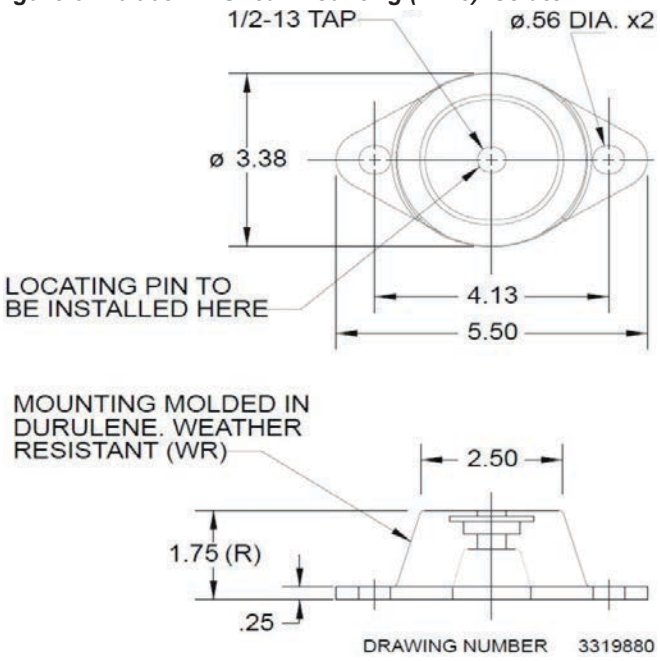
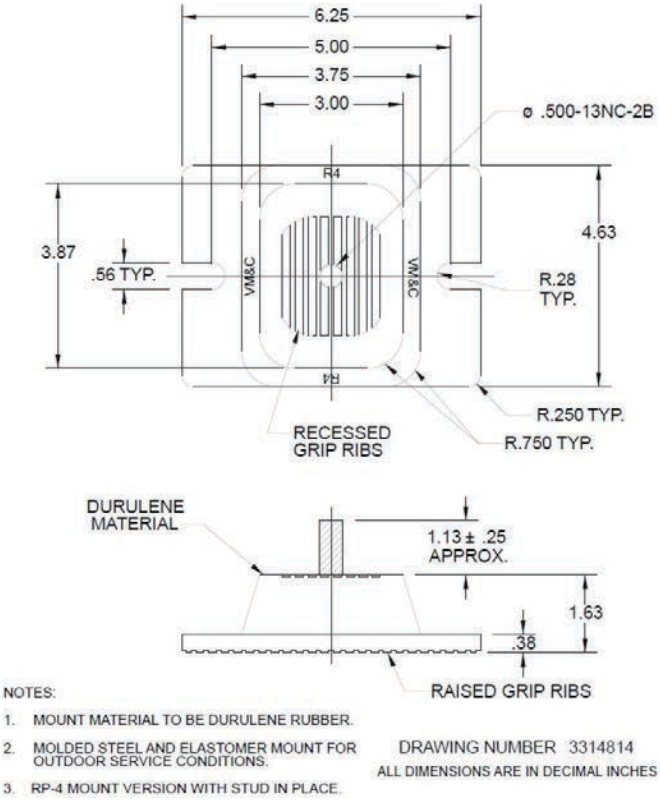


Figure 7: Rubber-in-Sheer Mounting (RP-4) Isolator



Water Piping

⚠ CAUTION

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

NOTE: Since the Templifier® evaporator and/or condenser may have to be valved off for cleaning or repair, it may be desirable to pipe a bypass around them so that system source and hot water flow is not interrupted.

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). See the Inlet Strainer Guidelines on Table 5 on page 12 for more information.
- A water flow switch must be installed in the horizontal piping of the supply (evaporator outlet) water line to avoid evaporator freeze-up under low or no flow conditions. The flow switch may be ordered as a factory-installed option, a field-installed kit, or may be supplied and installed in the field. See page 13 for further information.
- Piping for units with brazed-plate evaporators must have a drain and vent connection provided in the bottom of the lower connection pipe and to the top of the upper connection pipe, respectively. See Figure 8. These evaporators do not have drain or vent connections due to their construction.
- Purge air from the water system before unit start-up to provide adequate flow through the evaporator.
- Adequate piping support, independent from the unit, to eliminate weight and strain on the fittings and connections.

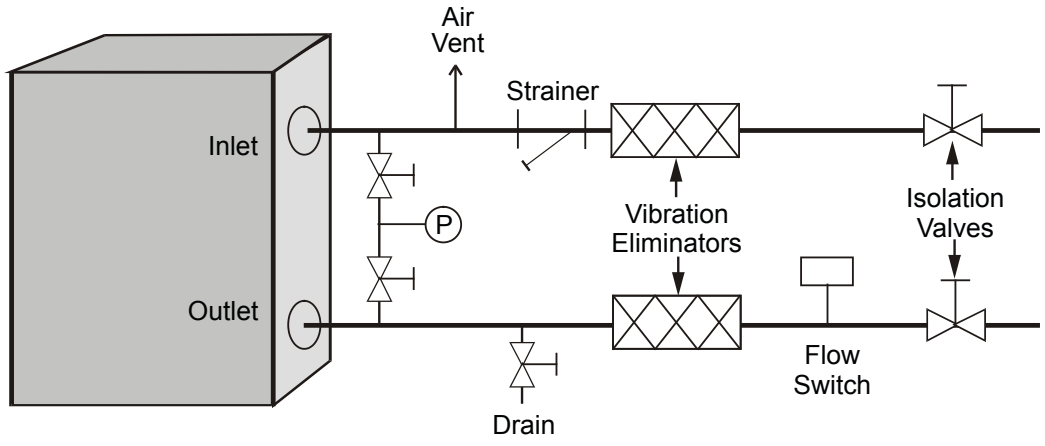
It is **recommended** that the field installed water piping to the chiller include:

- Thermometers at the inlet and outlet connections of the evaporator.
- Water pressure gauge connection taps and gauges at the inlet and outlet connections of the evaporator for measuring water pressure drop.
- Shutoff valves are necessary to isolate the unit from the piping during unit servicing.
- Minimum bends and changes in elevation to minimize pressure drop.
- An expansion tank and regulating valve to maintain adequate water pressure. Tank becomes required for closed loop systems based on water volume and temperature ranges.
- Vibration eliminators in both the supply and return water lines to reduce transmissions to the building.
- Flush the system water piping thoroughly before making connections to the unit evaporator.
- Piping insulation, including a vapor barrier, helps prevent condensation and reduces heat loss.
- Regular water analysis and chemical water treatment for the evaporator loop is recommended immediately at equipment start-up.

⚠ CAUTION

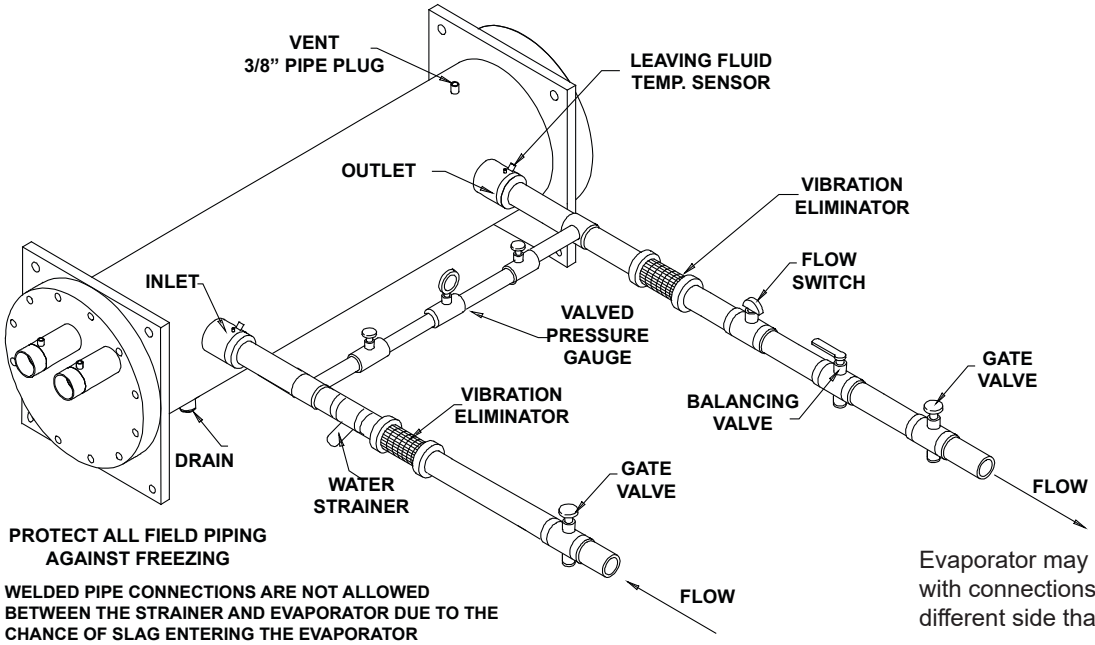
Polyolester Oil, commonly known as POE oil is a synthetic oil used in many refrigeration systems, and may be present in this Daikin product. POE oil, if ever in contact with PVC/CPVC, will coat the inside wall of PVC/CPVC pipe causing environmental stress fractures. Although there is no PVC/CPVC piping 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.

Figure 8: Typical Piping for Brazed-Plate Evaporator



WELDED PIPE CONNECTIONS ARE NOT ALLOWED BETWEEN THE STRAINER AND EVAPORATOR DUE TO THE CHANCE OF SLAG ENTERING THE EVAPORATOR

Figure 9: Typical Piping for Shell and Tube Evaporator



Evaporator may be oriented with connections on a different side than shown.

Source Water Piping

The system water piping must be flushed thoroughly prior to making connections to the unit evaporator. Lay out the water piping so the source water circulating pump discharges into the evaporator inlet.

⚠ CAUTION

Templifier® Models TGZ 040 - TGZ 120 must have clean source water from a closed and treated loop going to the brazed-plate evaporator. For open water loop applications, an intermediate heat exchanger between the source water and evaporator is required. Failure to provide a clean, closed water loop can cause equipment failure and possible revocation of the unit warranty.

Templifier® evaporator water can come from various sources and care must be exercised to avoid sources that can cause corrosion, fouling, or accumulation of debris in the heat exchanger. Borderline cases will require a careful and rigorously performed maintenance schedule.

Inlet Strainer Guidelines

An inlet water strainer must be installed in the chilled water piping before the evaporator inlet. Two paths are available to meet this requirement:

1. A field-installed kit shipped loose with the unit that consists of:

- Y-type area strainer with 304 stainless steel perforated basket, groove pipe connections and strainer cap. Refer to Table 5
- Extension pipe with two Schrader fittings that can be used for a pressure gauge and thermal dispersion flow switch. The pipe provides sufficient clearance from the evaporator for strainer basket removal.
- ½-inch blowdown valve
- Two grooved clamps

The strainer is sized per Table 5. Connection sizes are given in Dimensions beginning on page 16.

2. A field-supplied strainer that meets specification and installation requirements of this manual on www.DaikinApplied.com.

Table 5: Evaporator Characteristics

Unit Size	040B-120B	150B-190B
Evaporator Design	Brazed Plate	Shell-and tube
Material	Stainless Steel, Copper	Carbon Steel, Copper
Strainer Size	no larger than 0.063" dia.	no larger than 0.125" dia.

Inlet and outlet connections are clearly marked on the unit and also appear on the dimension drawings, beginning with . Drain connections should be provided at all low points in the system to permit complete drainage. Air vents should be located at the high points in the system to purge out air. A vent connection, located on top of the evaporator vessel, permits the purging of air out of the evaporator. Air purged from the water system prior to unit start-up provides adequate flow through the vessel and prevents safety cutouts on the freeze protection. System pressure should be maintained by using a properly sized expansion tank.

Pressure gauges should be installed in the inlet and outlet water lines to the evaporator. Pressure drop through the evaporator should be measured to calculate proper gpm (L/s) as specified in the Pressure Drop tables starting with page 21.

Source water piping may have to be insulated (depending on its temperature) to reduce heat loss and prevent condensation if cold water is used. If cooling tower water is used, insulation may not be necessary. Complete unit and system leak tests should be performed prior to insulating the water piping. Insulation with a vapor barrier is recommended. If the vessel is insulated, the vent and drain connections must extend beyond the proposed insulation thickness for accessibility. If the unit operates year-round, or if the system is not drained for the winter, the chilled water piping exposed to outdoor ambient should be protected against freezing by wrapping the lines with a heater cable.

Heating and Cooling Units

Templifier® units can be arranged and controlled to act as either a water chiller or a water heater. These systems vary considerably in the specifics of the piping arrangement. Care must be exercised when changeover occurs to avoid mixing water streams that could possibly contaminate a water system. For example, a unit can have chilled water in the evaporator and tower water in the condenser when in the cooling mode. Changeover to heating could put tower water through the evaporator and hot water (possibly potable water) through the condenser. This could introduce tower water into the chilled water system and into the hot water system and should be avoided.

Source/Hot Water Thermostat

The source water temperature sensor is factory installed in the leaving water connection on the evaporator. The controlling hot water sensor is in the leaving condenser connection. A sensor is also located in the entering water connection in order to measure the condenser Delta-T. Care should be taken not to damage the sensor cable or lead wires when working around the unit. It is also advisable to check the lead wire before running the unit to be sure that it is firmly anchored and not rubbing on the frame or any other component.

If the sensor is ever removed from the well for servicing, care must be taken as not to wipe off the heat conducting compound supplied in the well.

The units can be switched from heating to cooling. In the cooling mode they are controlled by a thermistor in the leaving evaporator connection, in the heating mode by the leaving condenser thermistor.

Flow Switch

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

A flow switch options is available from Daikin Applied. It is a “paddle” type switch and adaptable to any pipe size from 1” (25mm) to 6” (152mm) nominal. Certain minimum flow rates are required to close the switch. See Flow Switch Installation and Calibration on page 51 for full instructions. See Figure 26 on page 30 for terminal locations. The normally open contacts of the flow switch should be wired between these two terminals. There is also a set of normally closed contacts on the switch that could be used for an indicator light or an alarm to indicate when a “no flow” condition exists.

NOTE: Install per the vendor instructions and calibrate to a safe setting based on the application design flow.

Groove Coupling / Flow Switch Warning

All evaporators and condensers have OGS-type grooved water connections (adhering to Standard AWWA C606) or optional flange connections. The installing contractor must provide matching mechanical connections. PVC piping should not be used.

On units utilizing shell-and-tube evaporator vessels and factory-mounted flow switches and flange connections (groove-to-flange adaptors or weld-on flanges), relocating the flow switch is required to allow for possible future replacement. The flange will interfere with unscrewing the switch. The following procedure is recommended before installing a flange to avoid interference:

1. Remove the flow switch and plug the opening in the nozzle.
2. Install the groove-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.

Glycol Solutions

The use of glycol in Templifier® systems is uncommon, but if used, the system performance will result in lower refrigerant suction pressure, cooling performance less, and water side pressure drop will be higher.

Daikin Applied encourages a minimum glycol concentration of 25% be provided on all glycol applications. Glycol concentrations below 25% have too little inhibitor content for long-term corrosion protection of ferrous metals.

NOTE: The effect of glycol in the condenser is negligible and there is no capacity derate.

⚠ CAUTION

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

Condenser Water Piping

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

Filed 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 from pressure drop curves starting on page 22.

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

- Vibration eliminators are recommended in both the supply and return water lines.
- 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.

Templifier® hot water systems usually have a supplementary heater located after (downstream) of the Templifier® condenser to either boost the hot water temperature or to function as a standby heater.

Care should be exercised to avoid overly warm water coming back to the Templifier® from the system and causing a relief valve discharge. This is true whether the unit is running or off. Maximum temperature is 160°F.

Some jurisdictions require double heat exchange walls between refrigerant and potable water. Potable water run directly through a condenser has only one heat exchange wall (the condenser tube), and certain jurisdictions may require an intermediate heat exchanger.

Water Pressure Drop

The vessel flow rates must fall between the minimum and maximum values shown on the appropriate evaporator and condenser curves beginning on page 21. Flow rates below the minimum values shown will result in laminar flow that will reduce efficiency, cause erratic operation of the expansion valve, and could cause low temperature cutoffs. On the other hand, flow rates exceeding the maximum values shown can cause erosion on the evaporator water tubes.

Measure the water pressure drop through the vessels at field installed pressure taps. It is important not to include valves or strainers in these readings.

The condenser flow rate should determine whether 2-pass or 4-pass condensers are used, according to Table 6. Note that the condensers are shipped as either two-pass (10 to 15-degree F Delta-T) or four-pass (15 to 40-degree F Delta-T). For 2-pass, the connections are on the vertical centerline of the condenser. For 4-pass, they are off to one side.

Table 6: Condenser Flow Rate

Condenser ∆-T	No. of Passes	Flow Rate
10 - 15° F	2-Pass	High
15 - 40° F	4-Pass	Low

Refrigerant Relief Valve Piping

Relief valves are located in the following location and require piping per code, usually to the outside of the building. All valve connections are 5/8-inch flare. There is:

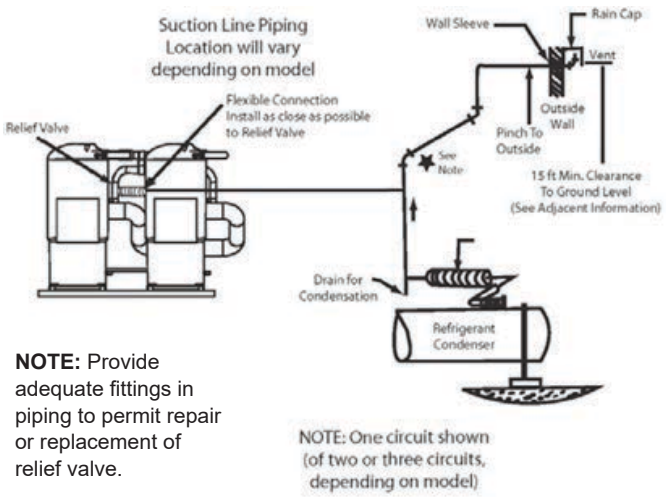
- One relief valve in suction piping of each of 2 circuits
- One relief valve on shell of each of 2 condenser circuits
- One additional valve in the discharge piping of circuits with 30 HP compressors

Table 7: Relief Valve Piping

Model Size	Suction Line Total	Cond. Shell Total	30 HP Disch. Line Total	Total per Unit
040B, 050B, 060B, 080B, 100B, 150B	2	2	0	4
110B, 170B	2	2	1	5
120B, 190B	2	2	2	6

The current ANSI/ASHRAE Standard 15 specifies that pressure relief valves on vessels containing Group 1 refrigerant (R-134a) “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 a drain at the low point on the vent piping to prevent water buildup on the atmospheric side of the relief valve. In addition, a flexible pipe section should be installed in the line to eliminate any piping stress on the relief valve(s).

Figure 10: Relief Valve Piping



NOTE: Provide adequate fittings in piping to permit repair or replacement of relief valve.

The size of the discharge pipe from the pressure relief valve shall not be less than the size of the pressure relief outlet. When two or more vessels are piped together, the common header and piping to the atmosphere shall not be less than the sum of the area of the relief valve outlets connected to the header. Fittings should be provided to permit vent piping to be easily disconnected for inspection or replacement of the relief valve.

Unit Refrigerant Piping

TGZ 040 to 120 models 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 TGZ 150 to 190 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.

NOTE: Unit has two independent circuits but piping shown for one circuit below.

Figure 11: Piping Schematic, Models TGZ 040 – 120

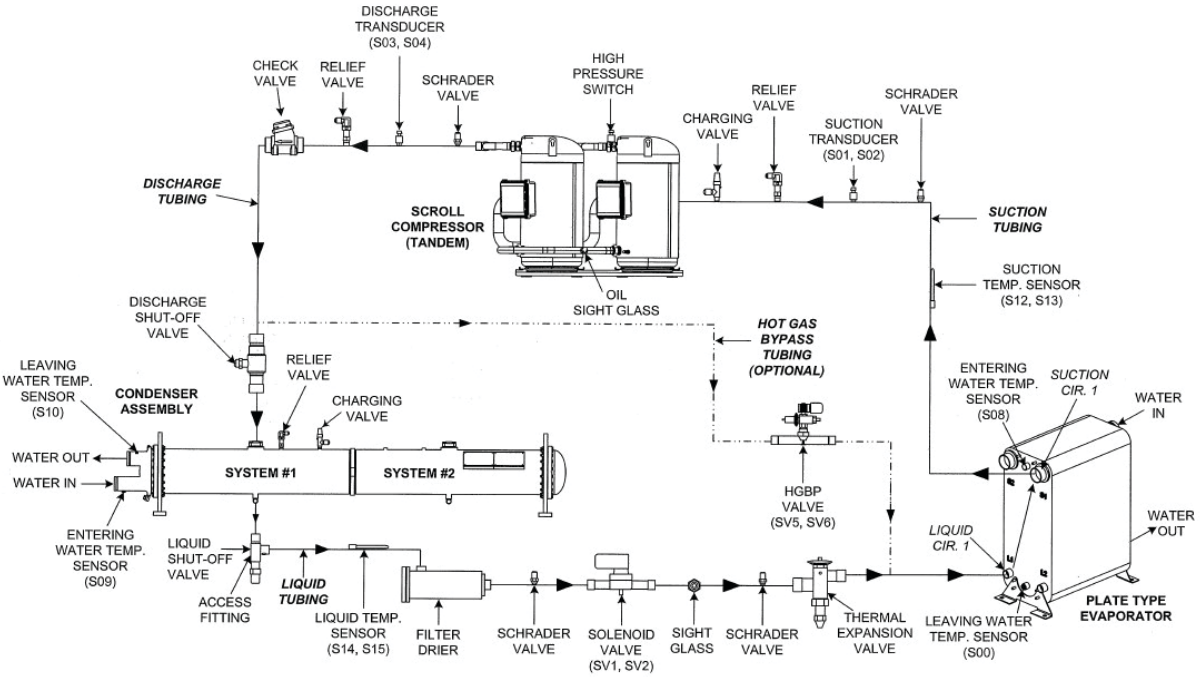


Figure 12: Piping Schematic, Models TGZ 150 – 190

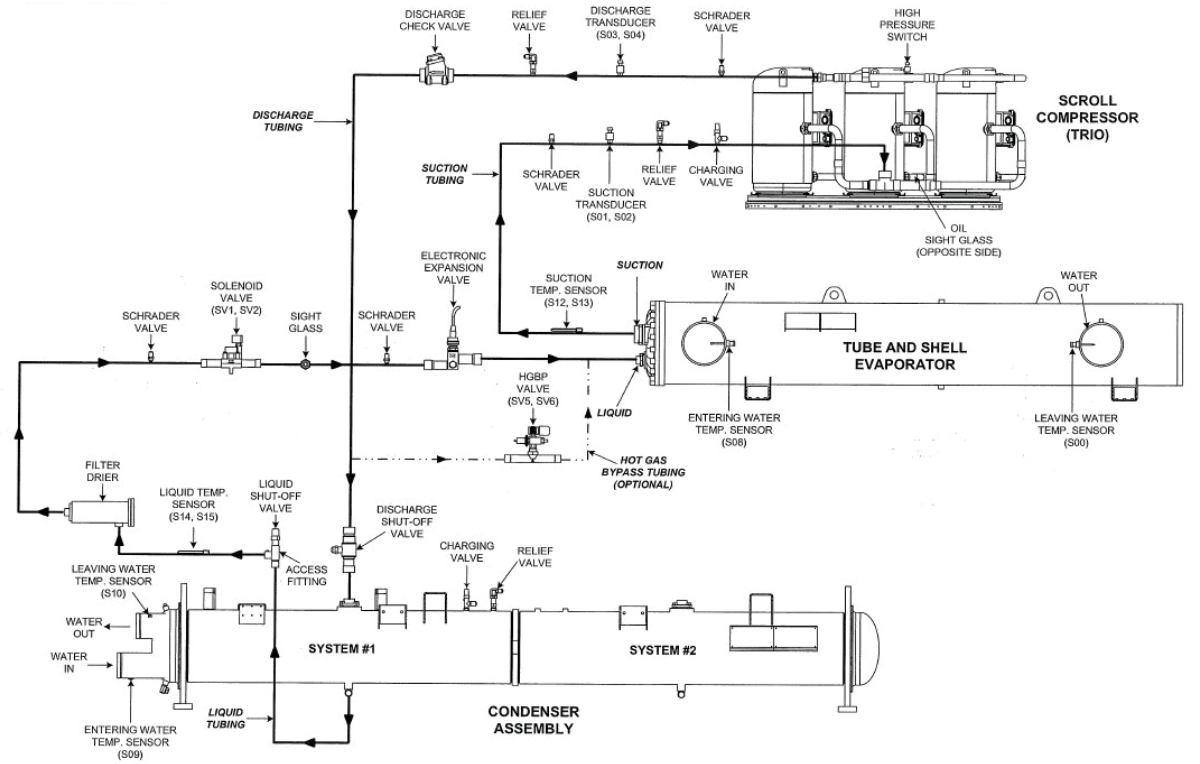
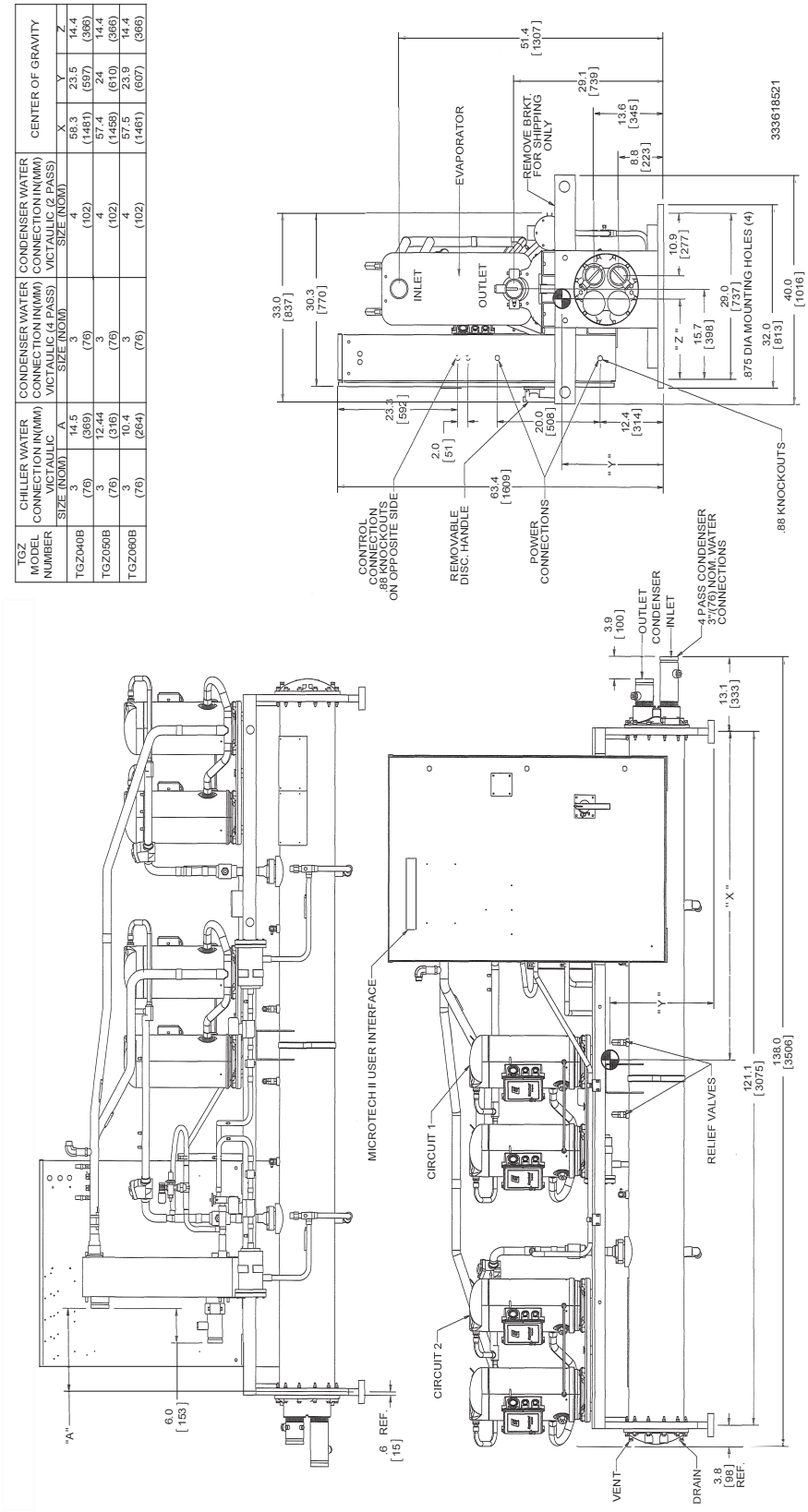


Figure 13: Dimensions, TGZ040B – TGZ060B, Standard 4-pass Condenser

TGZ MODEL NUMBER	CHILLER WATER CONNECTION IN(MM) VICTAULIC SIZE (NOM)		CONDENSER WATER CONNECTION IN(MM) VICTAULIC (4 PASS) SIZE (NOM)		CONDENSER WATER CONNECTION IN(MM) VICTAULIC (2 PASS) SIZE (NOM)		CENTER OF GRAVITY		
		A					X	Y	Z
TGZ040B	3 (76)	14.5 (369)	3 (76)		4 (102)		58.3 (1481)	23.5 (597)	14.4 (366)
TGZ050B	3 (76)	12.44 (316)	3 (76)		4 (102)		57.4 (1458)	24 (610)	14.4 (366)
TGZ060B	3 (76)	10.4 (264)	3 (76)		4 (102)		57.5 (1461)	23.9 (607)	14.4 (366)



MODEL	LIFTING WEIGHT FOR EACH POINT (LBS)				MOUNTING LOADS FOR EACH POINT (LBS)				SHIPPING	OPERATING
	L1	L2	L3	L4	M1	M2	M3	M4	WEIGHT	WEIGHT
TGZ080B	1034	947	1021	1115	1111	1017	1097	1198	4116	4422
TGZ100B	1126	952	1072	1268	1211	1023	1152	1363	4418	4749

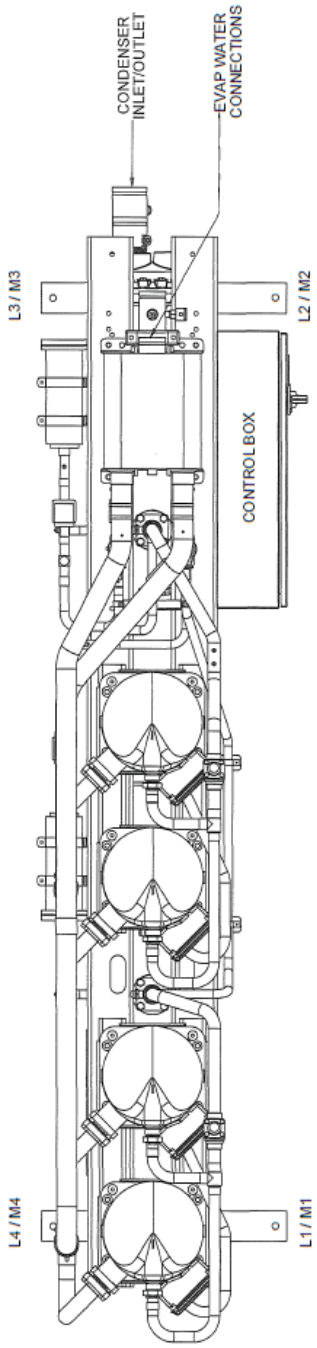
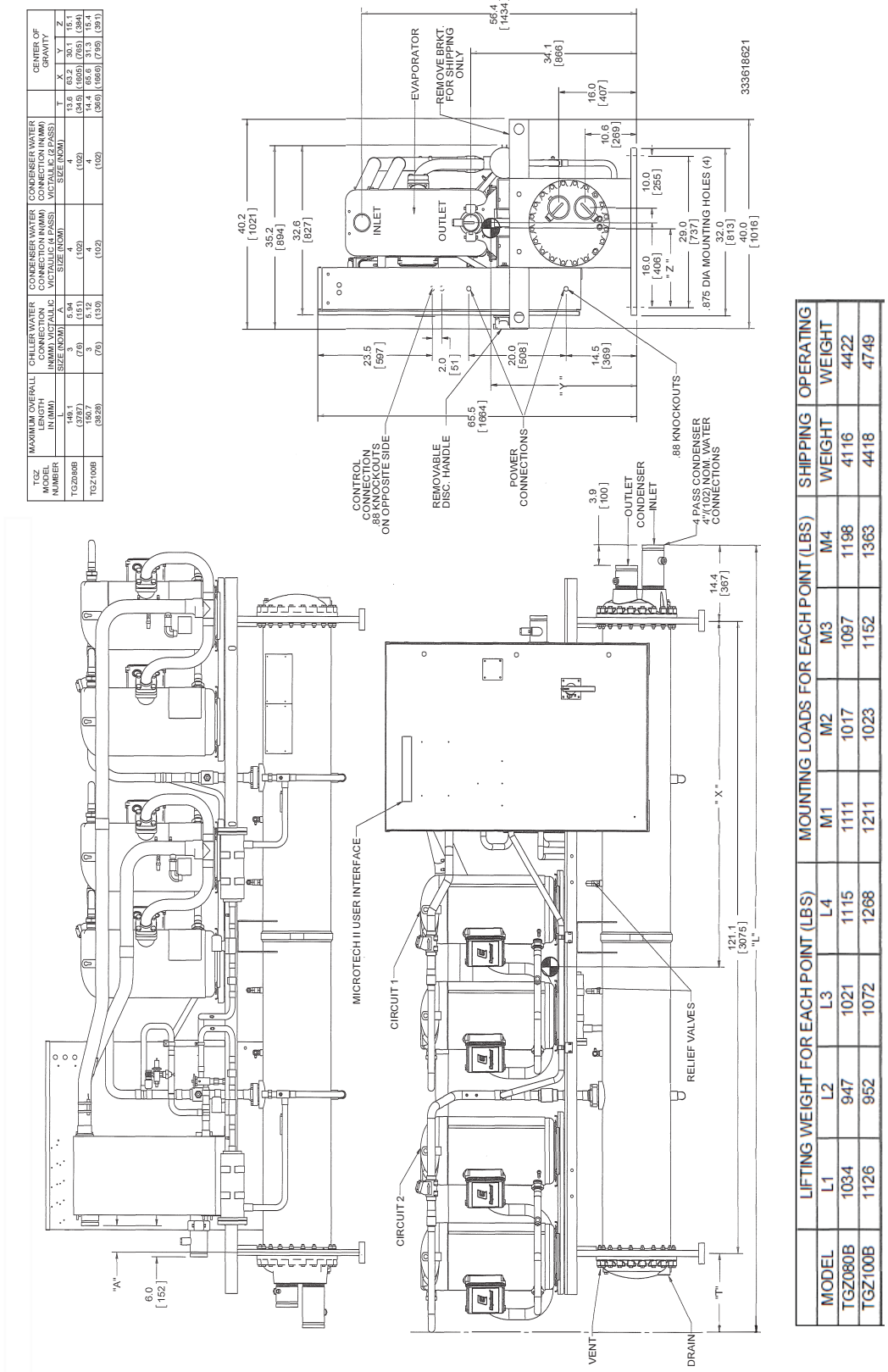


Figure 14: Dimensions, TGZ080B – TGZ100B, Standard 4-Pass Condenser

TGZ MODEL NUMBER	MAXIMUM OVERALL LENGTH IN (MM) L	CHILLER WATER CONNECTION IN(MM) VICTAULIC FOR PIPE SIZE (NOM) A	CONDENSER WATER CONNECTION IN(MM) VICTAULIC FOR PIPE SIZE (NOM)	CONDENSER WATER CONNECTION IN(MM) VICTAULIC FOR PIPE SIZE (NOM)	CENTER OF GRAVITY		
					X	Y	Z
TGZ080B	149.1 (3787)	3 (76)	5.94 (151)	4 (102)	13.6 (34.6)	63.2 (1606)	30.1 (765)
	150.7 (3829)	3 (76)	5.12 (130)	4 (102)	14.4 (366)	65.6 (1665)	31.3 (795)
TGZ100B							



MODEL	LIFTING WEIGHT FOR EACH POINT (LBS)				MOUNTING LOADS FOR EACH POINT (LBS)				SHIPPING	OPERATING
	L1	L2	L3	L4	M1	M2	M3	M4	WEIGHT	WEIGHT
TGZ080B	1034	947	1021	1115	1111	1017	1097	1198	4116	4422
TGZ100B	1126	952	1072	1268	1211	1023	1152	1363	4418	4749

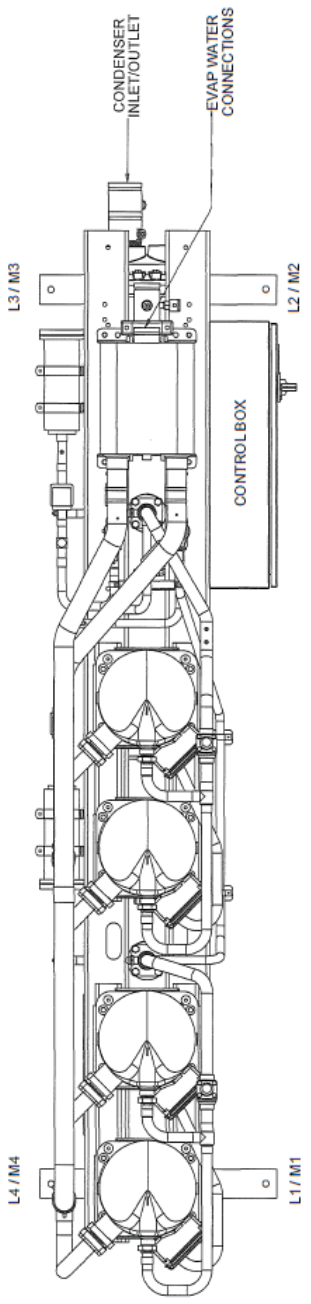
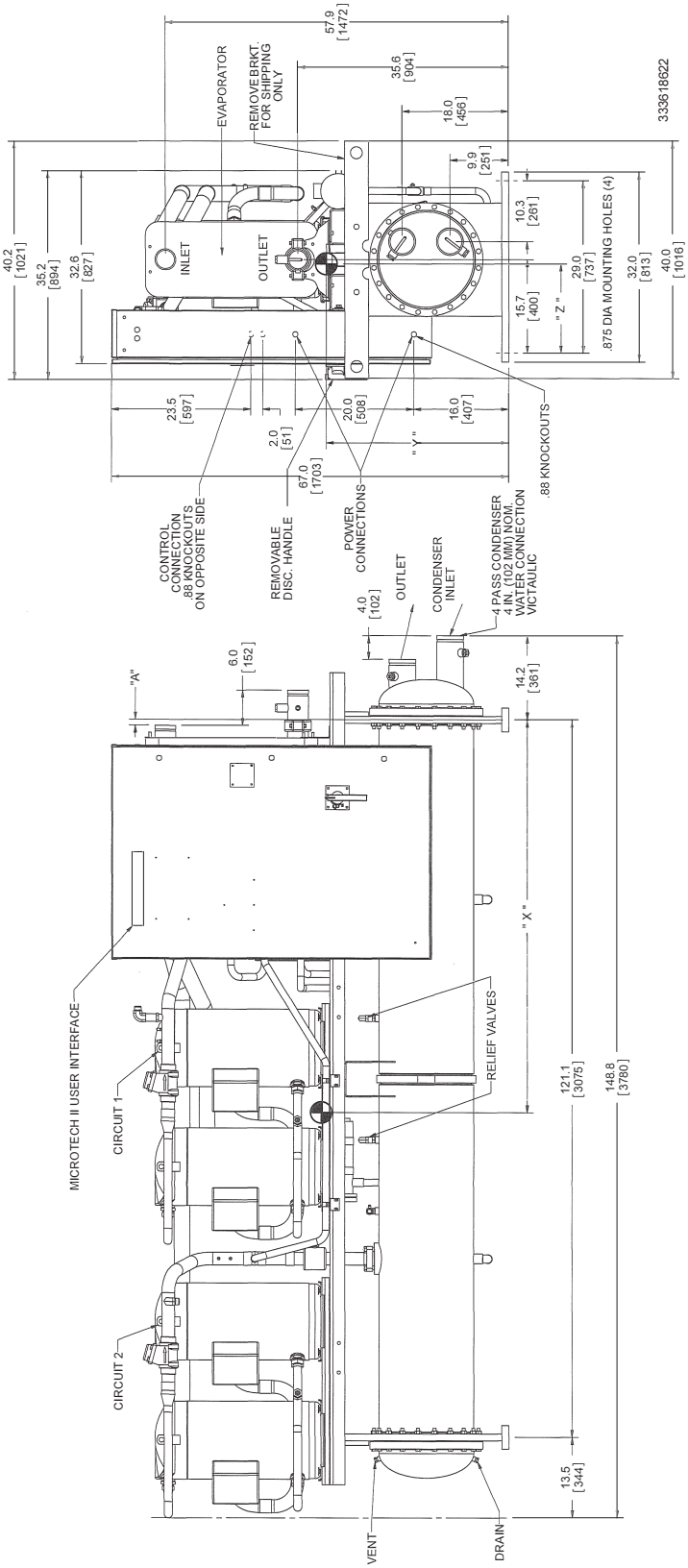


Figure 15: Dimensions, TGZ110B – TGZ120B, Standard 4-Pass Condenser

TGZ MODEL NUMBER	CHILLER WATER CONNECTION IN(MM) VICTAULIC SIZE (NOM)	A	CENTER OF GRAVITY (IN) X	Y	Z
TGZ110B	3 (76)	3.1 (78)	64.3 (1633)	30.6 (777)	15 (381)
TGZ120B	3 (76)	1.0 (25)	64 (1626)	30.1 (765)	15 (381)



MODEL	LIFTING WEIGHT FOR EACH POINT (LBS) L1	L2	L3	L4	MOUNTING LOADS FOR EACH POINT (LBS) M1	M2	M3	M4	SHIPPING WEIGHT	OPERATING WEIGHT
TGZ110B	1271	1123	1207	1366	1375	1215	1305	1478	4967	5373
TGZ120B	1257	1122	1195	1339	1361	1214	1294	1450	4913	5319

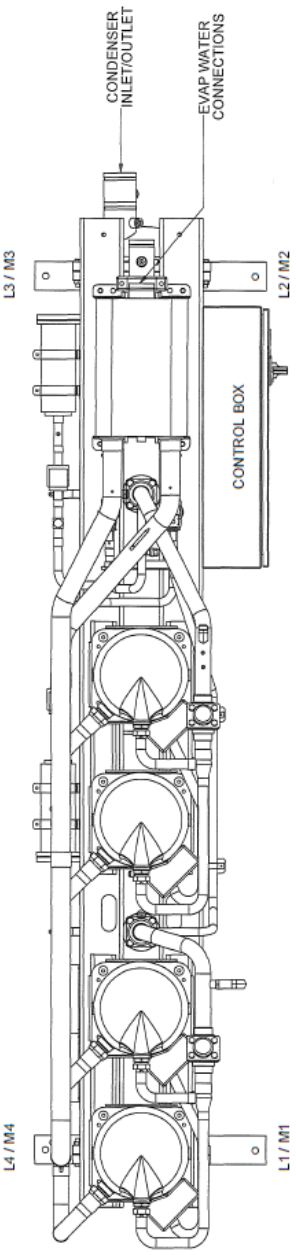
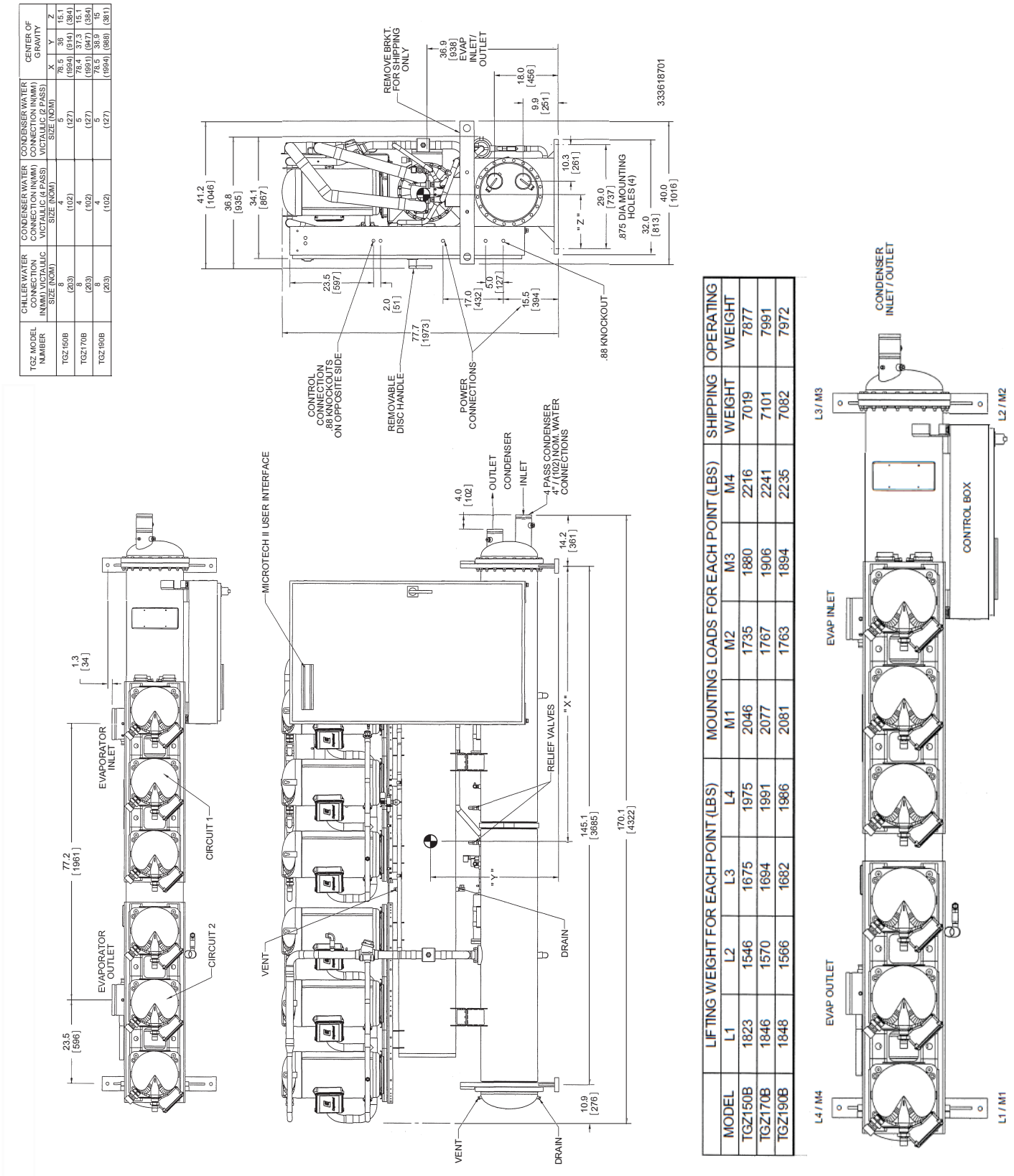


Figure 16: Dimensions, TGZ150B –TGZ190B, Standard 4-Pass Condenser

TGZ MODEL NUMBER	CHILLER WATER CONNECTION IN(MM) VICTAULIC SIZE (NOM)	CONDENSER WATER CONNECTION IN(MM) VICTAULIC (4 PASS) SIZE (NOM)	CONDENSER WATER CONNECTION IN(MM) VICTAULIC (2 PASS) SIZE (NOM)	CENTER OF GRAVITY X	CENTER OF GRAVITY Y	CENTER OF GRAVITY Z
TGZ150B	8 (203)	4 (102)	5 (127)	78.5 (1994)	39 (994)	15.1 (384)
TGZ170B	8 (203)	4 (102)	5 (127)	78.4 (1991)	37.3 (947)	15.1 (384)
TGZ190B	8 (203)	4 (102)	5 (127)	78.5 (1994)	38.9 (988)	15 (381)



MODEL	LIFTING WEIGHT FOR EACH POINT (LBS) L1	L2	L3	L4	MOUNTING LOADS FOR EACH POINT (LBS) M1	M2	M3	M4	SHIPPING WEIGHT	OPERATING WEIGHT
TGZ150B	1823	1546	1675	1975	2046	1735	1880	2216	7019	7877
TGZ170B	1846	1570	1694	1991	2077	1767	1906	2241	7101	7991
TGZ190B	1848	1566	1682	1986	2081	1763	1894	2235	7082	7972

Figure 17: Dimensions, TGZ040B – TGZ060B, Optional 2-Pass condenser

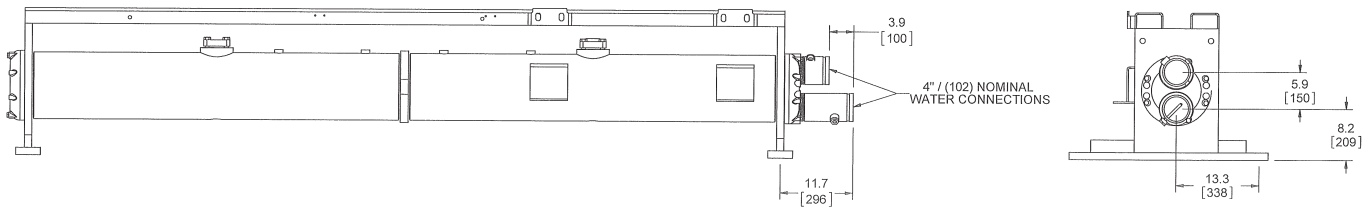


Figure 18: Dimensions, TGZ080B –TGZ100B, Optional 2-Pass Condenser

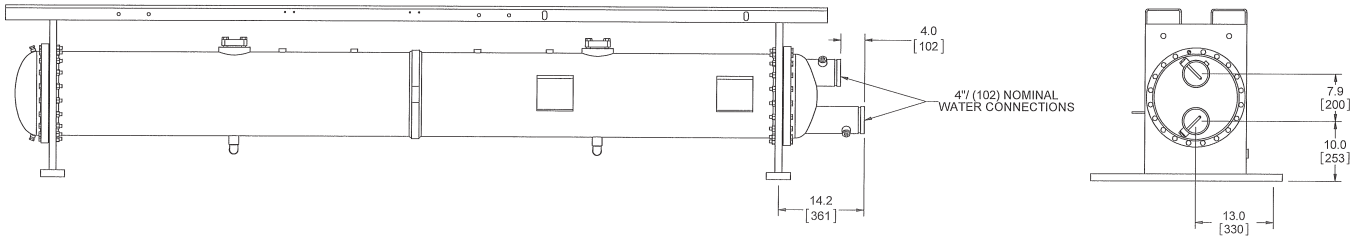


Figure 19: Dimensions, TGZ110B – TGZ120B, Optional 2-Pass Condenser

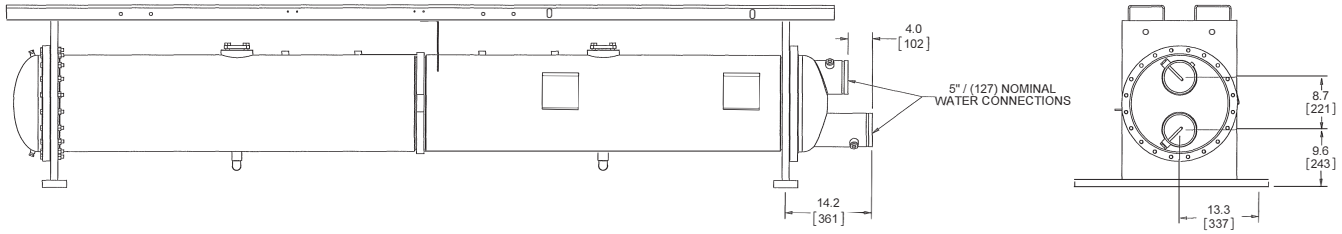
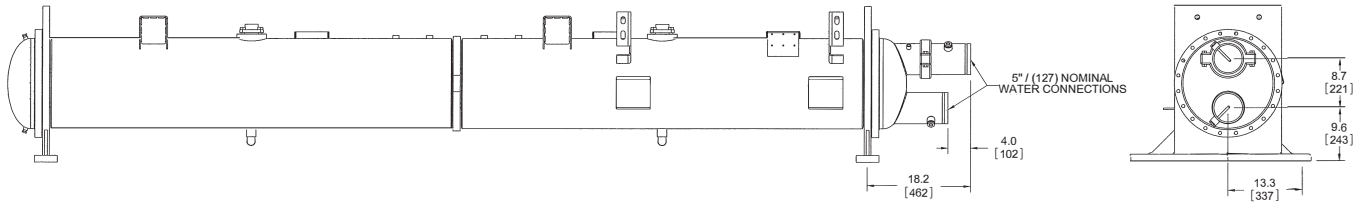


Figure 20: Dimensions, TGZ150B – TGZ190B, Optional 2-Pass Condenser



NOTE: Tube sheet-to-tube sheet dimensions are the same for a 4-pass condenser.
For optional left-hand connections, reverse the images below.

Figure 21: Evaporator Pressure Drop

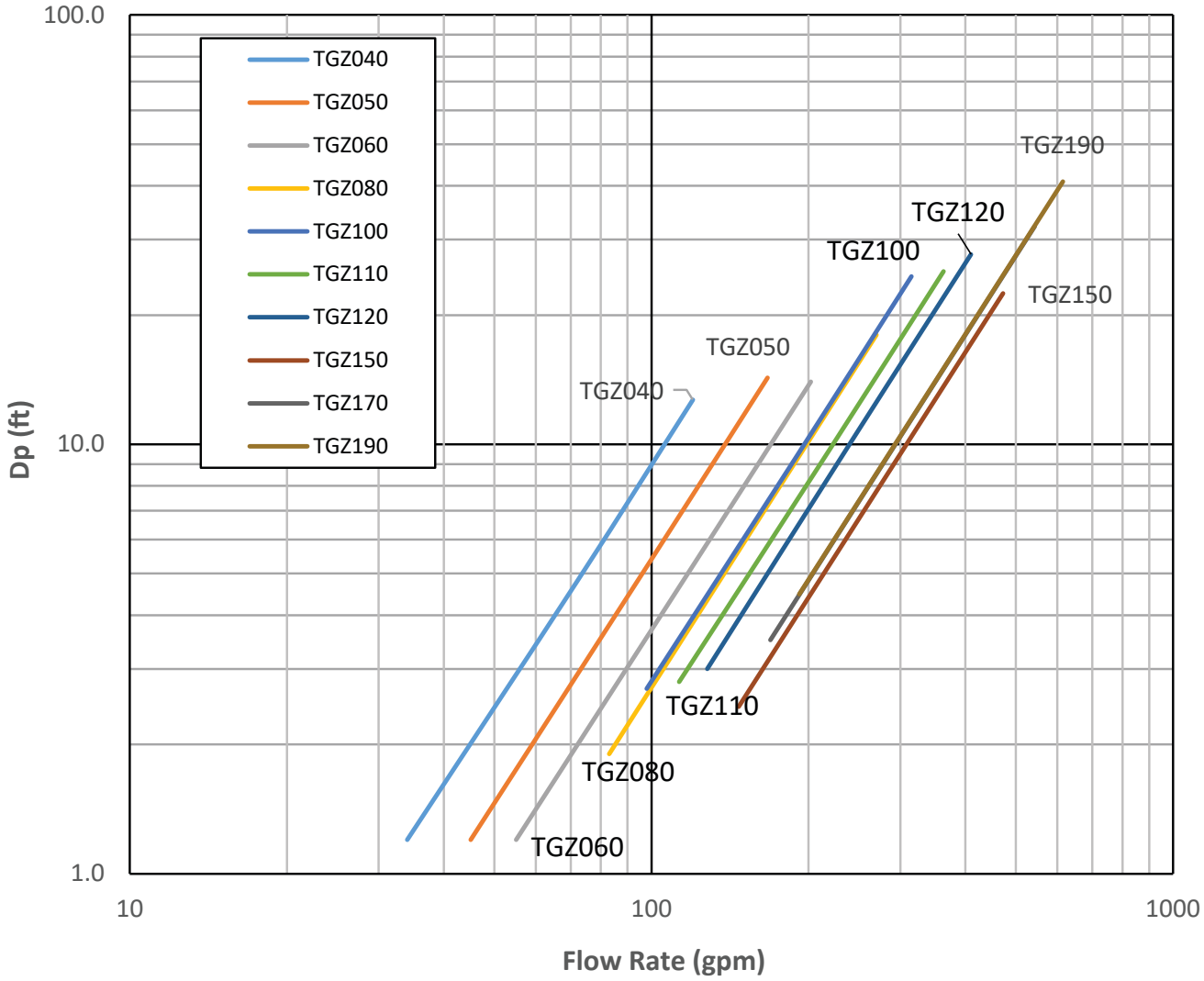


Table 8: Evaporator Pressure Drop

UNIT MODEL	EVAP MODEL	Minimum Flow Rate				Nominal Flow Rate				Maximum Flow Rate			
		Inch-Pound		S.I.		Inch-Pound		S.I.		Inch-Pound		S.I.	
		GPM	DP ft.	lps	DP kpa	GPM	DP ft.	lps	DP kpa	GPM	DP ft.	lps	DP kpa
040	AC500DQ-62H	34	1.2	2.1	3.4	72	4.8	4.5	14.4	120	12.7	7.6	37.9
050	AC500DQ-82H	45	1.2	2.8	3.5	100	5.4	6.3	16.1	167	14.3	10.5	42.8
060	AC500DQ-102H	55	1.2	3.5	3.5	121	5.3	7.6	15.8	202	14.0	12.7	42.0
080	AC500DQ-122H	83	1.9	5.2	5.7	162	6.8	10.2	20.3	270	18.0	17.0	53.7
100	AC500DQ-142H	98	2.7	6.2	8.0	189	9.3	11.9	27.8	315	24.6	19.9	73.4
110	AC500DQ-162H	113	2.8	7.1	8.2	218	9.6	13.8	28.7	363	25.3	22.9	75.6
120	AC500DQ-182H	128	3.0	8.1	9.1	246	10.5	15.5	31.4	410	27.7	25.9	82.9
150	EV34191111/9	147	2.4	9.3	7.3	283	8.5	17.9	25.4	472	22.5	29.8	67.2
170	EV34191212/7	169	3.5	10.7	10.5	326	12.2	20.6	36.5	543	32.2	34.3	96.2
190	EV34191212/7	192	4.5	12.1	13.4	369	15.5	23.3	46.3	615	40.9	38.8	122.3

Figure 22: Standard Four-pass Condenser Pressure Drop

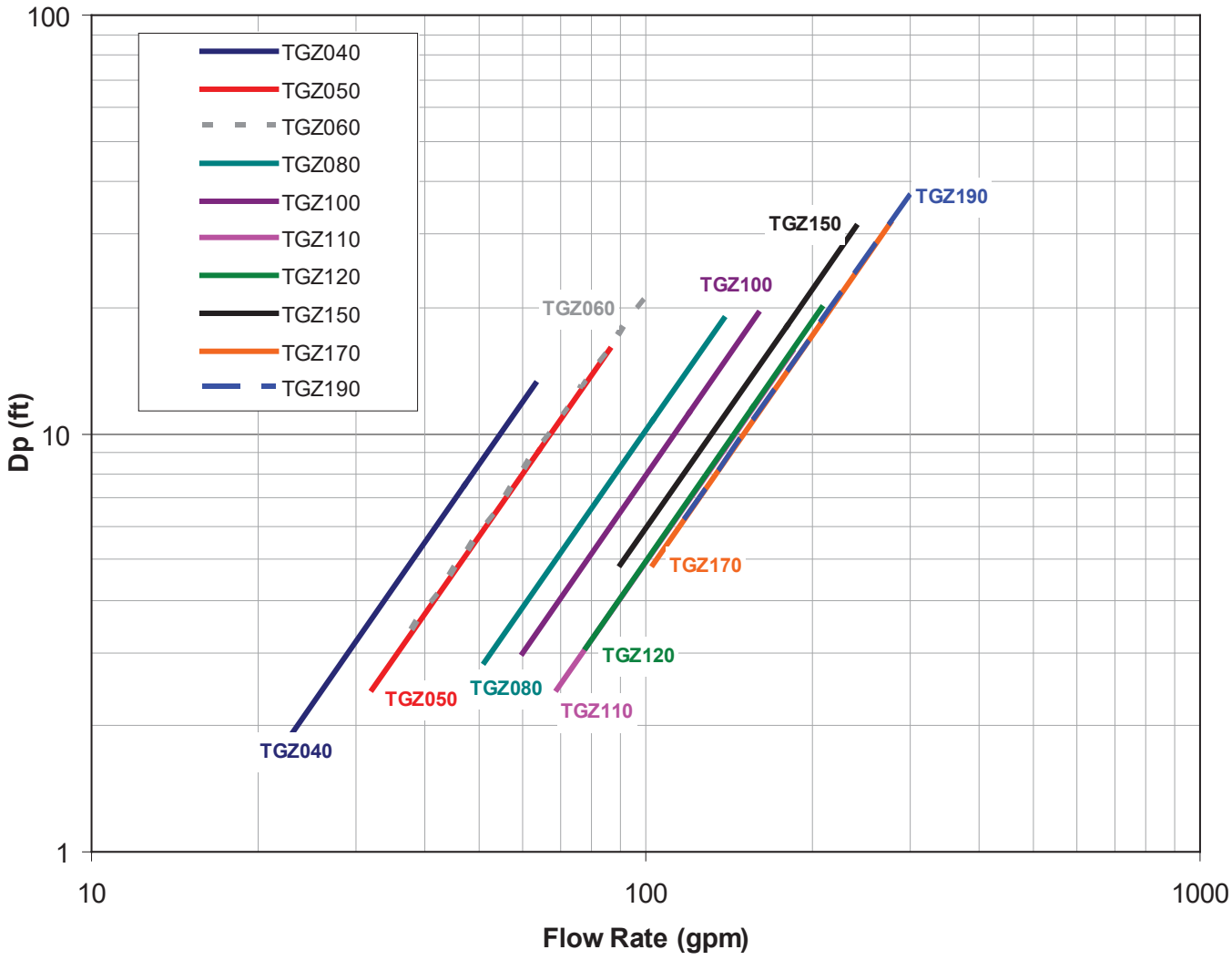


Table 9: Standard Four-pass Condenser Pressure Drop

UNIT MODEL	COND. MODEL	Minimum Flow Rate				Nominal Flow Rate				Maximum Flow Rate			
		Inch-Pound		S.I.		Inch-Pound		S.I.		Inch-Pound		S.I.	
		GPM	DP ft	lps	DP kpa	GPM	DP ft	lps	DP kpa	GPM	DP ft	lps	DP kpa
040	C1010-62	23	1.93	1.45	5.77	47	7.5	3.0	22.4	63	13.1	4.0	39.1
050	C1010-62	32	2.44	2.02	7.29	64	9.1	4.0	27.2	86	16.0	5.4	47.7
060	C1010-76	38	3.40	2.40	10.16	77	13.0	4.9	38.9	103	22.6	6.5	67.5
080	C1410-112	51	2.84	3.22	8.49	103	10.8	6.5	32.3	138	18.8	8.7	56.3
100	C1410-128	60	3.00	3.79	8.97	120	11.2	7.6	33.5	160	19.3	10.1	57.8
110	C1610-164	69	2.44	4.35	7.29	138	9.1	8.7	27.2	184	15.7	11.6	47.0
120	C1610-164	78	3.08	4.92	9.21	156	11.5	9.8	34.4	208	19.9	13.1	59.4
150	C1612-164	90	4.85	5.68	14.50	180	18.1	11.4	54.1	240	31.3	15.1	93.4
170	C1612-184	103	4.89	6.50	14.60	207	18.4	13.1	55.0	276	31.8	17.4	95.0
190	C1612-184	117	6.24	7.38	18.66	234	23.3	14.8	69.6	312	40.2	19.7	120.3

Figure 23: Optional Two-pass Condenser

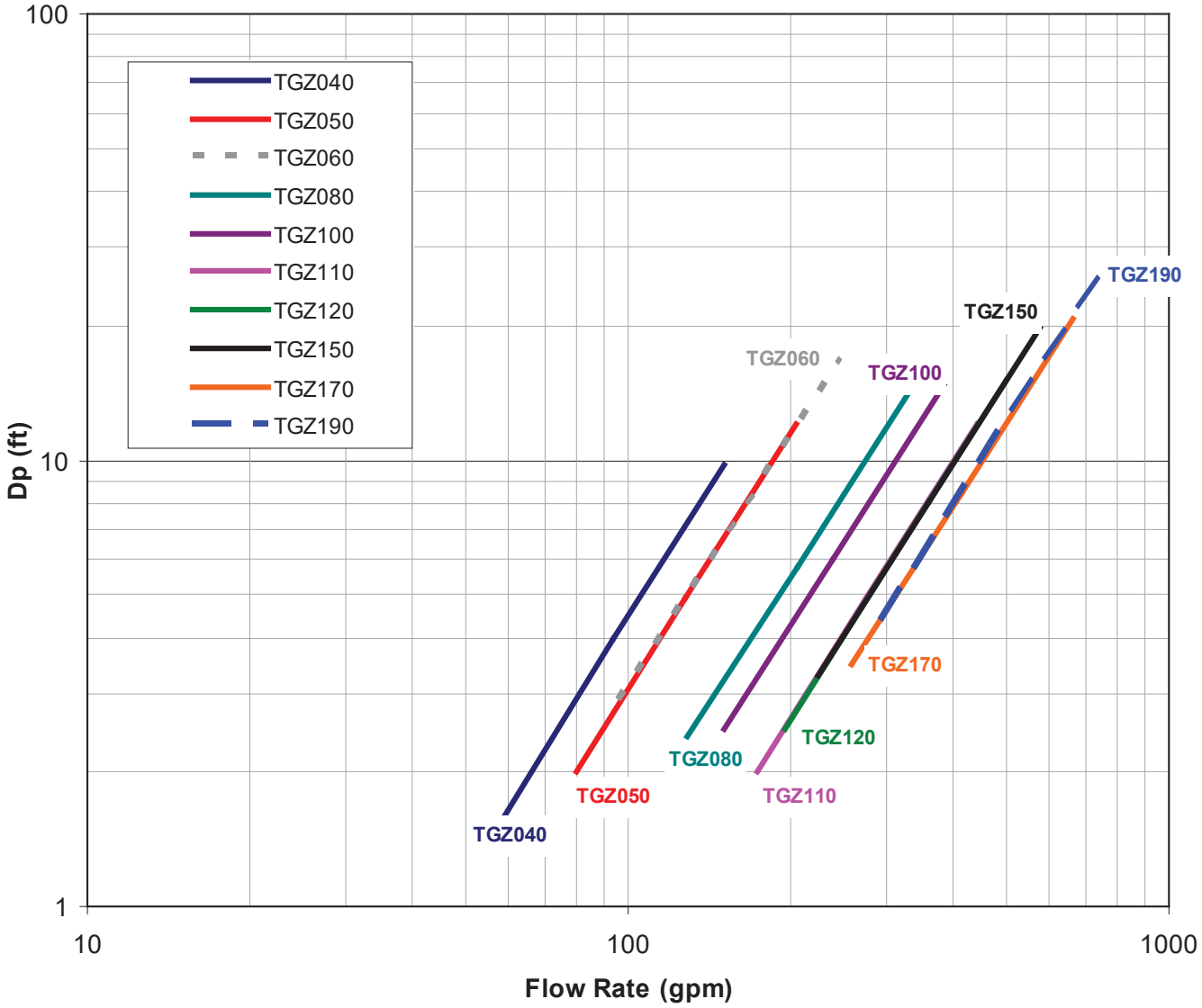


Table 10: Optional Two-pass Condenser

UNIT MODEL	COND. MODEL	Minimum Flow Rate				Nominal Flow Rate				Maximum Flow Rate			
		Inch-Pound		S.I.		Inch-Pound		S.I.		Inch-Pound		S.I.	
		GPM	DP ft	lps	DP kpa	GPM	DP ft	lps	DP kpa	GPM	DP ft	lps	DP kpa
040	C1010-62	59	1.6	3.7	4.9	94	4.0	5.9	12.0	150	9.8	9.5	29.3
050	C1010-62	80	2.0	5.0	6.0	128	4.9	8.1	14.6	205	12.0	12.9	35.8
060	C1010-76	96	2.9	6.1	8.5	154	7.0	9.7	20.9	246	17.0	15.5	51.0
080	C1410-112	129	2.4	8.1	7.1	206	5.8	13.0	17.3	330	14.2	20.8	42.3
100	C1410-128	150	2.5	9.5	7.3	240	6.0	15.1	17.9	384	14.7	24.2	43.8
110	C1610-164	173	2.0	10.9	6.0	276	4.9	17.4	14.6	442	12.0	27.9	35.8
120	C1610-164	195	2.5	12.3	7.6	312	6.2	19.7	18.5	499	15.1	31.5	45.3
150	C1612-164	225	3.3	14.2	9.9	360	8.1	22.7	24.2	576	19.8	36.3	59.1
170	C1612-184	259	3.5	16.3	10.4	414	8.5	26.1	25.4	662	20.8	41.8	62.1
190	C1612-184	293	4.4	18.5	13.2	468	10.8	29.5	32.3	749	26.4	47.2	78.8

Table 11: TGZ 040B – 060B

TGZ Unit Model	TGZ040B		TGZ050B		TGZ060B	
No. Of Circuits	2		2		2	
COMPRESSORS (4)						
Nominal Horsepower	10	10	13	13	15	15
Number per Circuit	2	2	2	2	2	2
Unloading Steps, %	25 / 50 / 75 100		25 / 50 / 75 100		25 / 50 / 75 100	
Oil Charge, per compressor. Oz (l)	110 (3.3)		110 (3.3)		110 (3.3)	
CONDENSER						
Number	1		1		1	
No. Refrigerant Circuits	2		2		2	
Diameter, in. (mm)	10.75 (273)		10.75 (273)		10.75 (273)	
Tube Length, in (mm)	122 (3099)		122 (3099)		122 (3099)	
Design W.P.,psig (kPa):						
Refrigerant Side	500 (3447)		500 (3447)		500 (3447)	
Water Side	232 (1599)		232 (1599)		232 (1599)	
Relief Valve Setting, psig (kPa)	500 (3447)		500 (3447)		500 (3447)	
No. Of Water Passes - Standard	4		4		4	
No. Of Water Passes - Optional	2		2		2	
Water Volume, gallons (l)	13.6 (51.5)		13.6 (51.5)		16.3 (61.8)	
Pump-Down Refrig Capacity						
lb., (kg) (3)	121.7(55.2)	121.7(55.2)	121.7(55.2)	121.7(55.2)	107.3(48.7)	107.3(48.7)
Connections:						
Water In & Out, in., (mm) (4 Pass)	3 (76)		3 (76)		3 (76)	
Water In & Out, in., (mm) (2 Pass)	4 (102)		4 (102)		4 (102)	
Relief Valve, Flare in., (mm)	5/8 (15.9)		5/8 (15.9)		5/8 (15.9)	
Purge Valve, Flare in., (mm)	5/8 (15.9)		5/8 (15.9)		5/8 (15.9)	
Vent & Drain, in (mm) FPT	1/2 (12.7)		1/2 (12.7)		1/2 (12.7)	
Liquid Subcooling	Integral		Integral		Integral	
EVAPORATOR						
Number	1		1		1	
No. Refrigerant Circuits	2		2		2	
Water Volume, gallons (1)	3.7 (14.0)		5.0 (18.9)		5.0 (18.9)	
Refrigerant Side D.W.P., psig, (kPa)	450 (3102)		450 (3102)		450 (3102)	
Relief Valve Setting, psig (kPa)	450 (3102)		450 (3102)		450 (3102)	
Water Side D.W.P., psig, (kPa)	450 (3102)		450 (3102)		450 (3102)	
Water Connections:						
In & Out, in. (mm) victaulic	3 (76)		3 (76)		3 (76)	
Drain & Vent	Field Supplied		Field Supplied		Field Supplied	
UNIT DIMENSIONS						
Length, in. (mm)	138 (3506)		138 (3506)		138 (3506)	
Width, in. (mm)	33 (838)		33 (838)		33 (838)	
Height, in. (mm)	63.2 (1605)		63.2 (1605)		63.2 (1605)	
UNIT WEIGHTS						
Operating WT., lb., (kg)	2604 (1181)		2644 (1199)		2699 (1224)	
Shipping WT., lb. (kg)	2434 (1104)		2464 (1117)		2496 (1132)	
R-134a Ref. Charge, lb. (kg)	45 (20.4)	45 (20.4)	45 (20.4)	45 (20.4)	50 (22.7)	50 (22.7)

Table 12: TGZ080B – 100B

TGZ Unit Model	TGZ080B		TGZ100B	
No. Of Circuits	2		2	
COMPRESSORS (2)				
Nominal Horsepower	20	20	25	25
Number per Circuit	2	2	2	2
Unloading Steps, %	25 / 50 / 75 100		25 / 50 / 75 100	
Oil Charge, per compressor. Oz (l)	158 (4.7)		200 (5.9)	
CONDENSER				
Number	1		1	
No. Refrigerant Circuits	2		2	
Diameter, in. (mm)	14 (356)		14 (356)	
Tube Length, in (mm)	122 (3099)		122 (3099)	
Design W.P.,psig (kPa):				
Refrigerant Side	500 (3447)		500 (3447)	
Water Side	232 (1599)		232 (1599)	
Relief Valve Setting, psig (kPa)	500 (3447)		500 (3447)	
No. Of Water Passes - Standard	4		4	
No. Of Water Passes - Optional	2		2	
Water Volume, gallons (1)	27.5 (104)		27.5 (104)	
Pump-Down Refrig Capacity	186 (84.2)		186 (84.2)	
lb., (kg) (3)				
Connections:				
Water In & Out, in., (mm) (4 Pass)	4 (102)		4 (102)	
Water In & Out, in., (mm) (2 Pass)	4 (102)		4 (102)	
Relief Valve, Flare in., (mm)	5/8 (15.9)		5/8 (15.9)	
Purge Valve, Flare in., (mm)	5/8 (15.9)		5/8 (15.9)	
Vent & Drain, in (mm) FPT	1/2 (12.7)		1/2 (12.7)	
Liquid Subcooling	Integral		Integral	
EVAPORATOR				
Number	1		1	
No. Refrigerant Circuits	2		2	
Water Volume, gallons (1)	8.7 (32.9)		8.7 (32.9)	
Refrigerant Side D.W.P., psig, (kPa)	450 (3102)		450 (3102)	
Relief Valve Setting, psig (kPa)	450 (3102)		450 (3102)	
Water Side D.W.P., psig, (kPa)	450 (3102)		450 (3102)	
Water Connections:				
In & Out, in. (mm) victaulic	3 (76)		3 (76)	
Drain & Vent	Field Supplied		Field Supplied	
UNIT DIMENSIONS				
Length, in. (mm)	149 (3785)		151 (3836)	
Width, in. (mm)	32.5 (826)		32.5 (826)	
Height, in. (mm)	65.5 (1664)		65.5 (1664)	
UNIT WEIGHTS				
Operating WT., lb., (kg)	4422 (2005)		4749 (2154)	
Shipping WT., lb. (kg)	4116 (1867)		4418 (2004)	
R-134a Ref. Charge, lb. (kg)	85 (38.6)	85 (38.6)	90 (40.8)	90 (40.8)

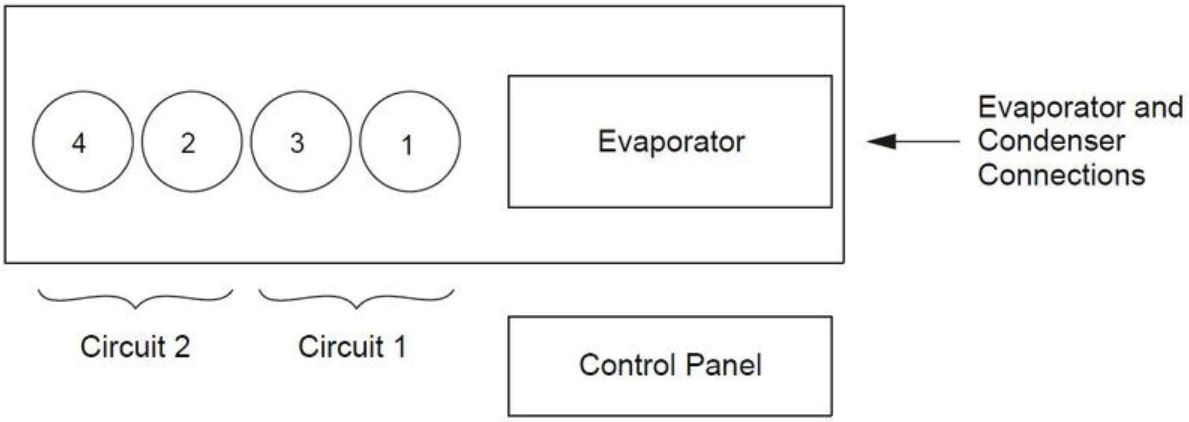
Table 13: TGZ 110B – 120B

TGZ Unit Model	TGZ110B		TGZ120B	
No. Of Circuits	2		2	
COMPRESSORS (4)				
Nominal Horsepower	25	30	30	30
Number per Circuit	2	2	2	2
Unloading Steps, %	27 / 50 / 77 /100		25 / 50 / 75 / 100	
Oil Charge, per compressor. Oz (l)	200 (5.9)	213 (6.3)	213 (6.3)	
CONDENSER				
Number	1		1	
No. Refrigerant Circuits	2		2	
Diameter, in. (mm)	16.0 (406.4)		16.0 (406.4)	
Tube Length, in (mm)	120 (3048)		120 (3048)	
Design W.P.,psig (kPa):				
Refrigerant Side	500 (3447)		500 (3447)	
Water Side	232 (1599)		232 (1599)	
Relief Valve Setting, psig (kPa)	500 (3447)		500 (3447)	
No. Of Water Passes - Standard	4		4	
No. Of Water Passes - Optional	2		2	
Water Volume, gallons (l)	35.4 (134)		35.4 (134)	
Pump-Down Refrig Capacity	252 (114)		252 (114)	
lb., (kg) (3)				
Connections:				
Water In & Out, in., (mm) (4 Pass)	4 (102)		4 (102)	
Water In & Out, in., (mm) (2 Pass)	5 (127)		5 (127)	
Relief Valve, Flare in., (mm)	5/8 (15.9)		5/8 (15.9)	
Purge Valve, Flare in., (mm)	5/8 (15.9)		5/8 (15.9)	
Vent & Drain, in (mm) FPT	1/2 (12.7)		1/2 (12.7)	
Liquid Subcooling	Integral		Integral	
EVAPORATOR				
Number	1		1	
No. Refrigerant Circuits	2		2	
Water Volume, gallons (1)	9.7 (36.7)		9.7 (36.7)	
Refrigerant Side D.W.P., psig, (kPa)	450 (3102)		450 (3102)	
Relief Valve Setting, psig (kPa)	450 (3102)		450 (3102)	
Water Side D.W.P., psig, (kPa)	450 (3102)		450 (3102)	
Water Connections:				
In & Out, in. (mm) victaulic	3 (76)		3 (76)	
Drain & Vent	Field Supplied		Field Supplied	
UNIT DIMENSIONS				
Length, in. (mm)	149 (3784)		149 (3784)	
Width, in. (mm)	34.5 (876)		34.5 (876)	
Height, in. (mm)	67 (1702)		67 (1702)	
UNIT WEIGHTS				
Operating WT., lb., (kg)	5373 (2437)		5319 (2412)	
Shipping WT., lb. (kg)	4967 (2253)		4913 (2228)	
R-134a Ref. Charge, lb. (kg)	110 (49.9)	110 (49.9)	110 (49.9)	110 (49.9)

Table 14: TGZ 150B – 190B

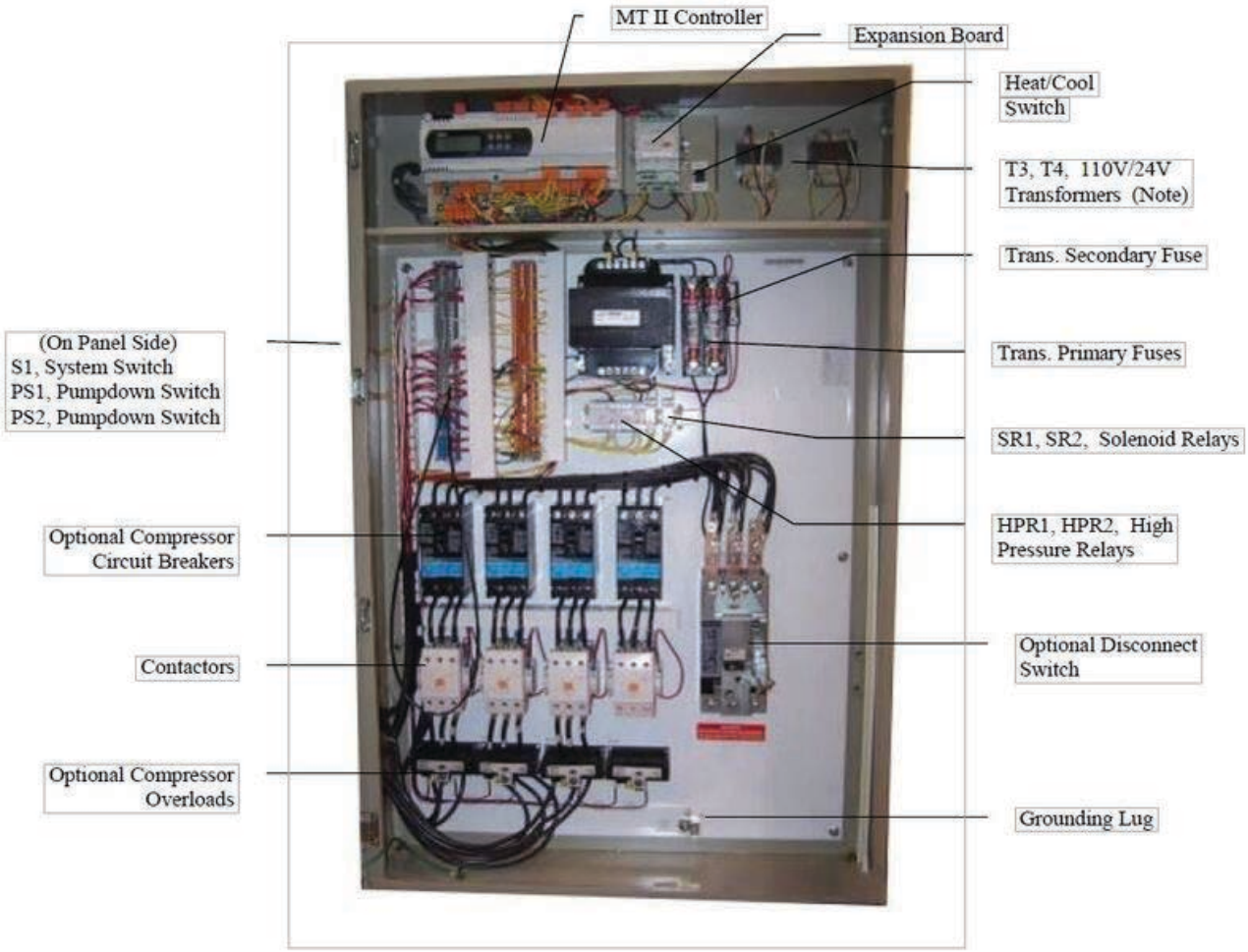
TGZ Unit Model	TGZ150B		TGZ170B		TGZ190B	
No. Of Circuits	2		2		2	
COMPRESSORS (6)						
Nominal Horsepower	25	25	25	30	30	30
Number per Circuit	3	3	3	3	3	3
Unloading Steps, %	17 / 33 / 50 / 67 /83 /100		17 / 35 / 50 / 69 /83 /100		17 / 33 / 50 / 67 /83 /100	
Oil Charge, per compressor. Oz (l)	200 (5.9)		200 (5.9)	213 (6.3)	213 (6.3)	
CONDENSER						
Number	1		1		1	
No. Refrigerant Circuits	2		2		2	
Diameter, in. (mm)	16 (406.4)		16 (406.4)		16 (406.4)	
Tube Length, in (mm)	144 (3658)		144 (3658)		144 (3658)	
Design W.P.,psig (kPa):						
Refrigerant Side	500 (3447)		500 (3447)		500 (3447)	
Water Side	232 (1599)		232 (1599)		232 (1599)	
Relief Valve Setting, psig (kPa)	500 (3447)		500 (3447)		500 (3447)	
No. Of Water Passes - Standard	4		4		4	
No. Of Water Passes - Optional	2		2		2	
Water Volume, gallons (l)	42.5 (160.9)		47.1 (178.4)		47.1 (178.4)	
Pump-Down Refrig Capacity	302 (137)		277 (126)		277 (126)	
lb., (kg) (3)						
Connections:						
Water In & Out, in., (mm) (4 Pass)	4 (102)		4 (102)		4 (102)	
Water In & Out, in., (mm) (2 Pass)	5 (127)		5 (127)		5 (127)	
Relief Valve, Flare in., (mm)	5/8 (15.9)		5/8 (15.9)		5/8 (15.9)	
Purge Valve, Flare in., (mm)	5/8 (15.9)		5/8 (15.9)		5/8 (15.9)	
Vent & Drain, in (mm) FPT	1/2 (12.7)		1/2 (12.7)		1/2 (12.7)	
Liquid Subcooling	Integral		Integral		Integral	
EVAPORATOR						
Number	1		1		1	
No. Refrigerant Circuits	2		2		2	
Water Volume, gallons (1)	57.6 (218)		56.9 (215.4)		56.9 (215.4)	
Refrigerant Side D.W.P., psig, (kPa)	450 (3102)		450 (3102)		450 (3102)	
Water Side D.W.P., psig, (kPa)	150 (1034)		150 (1034)		150 (1034)	
Relief Valve Setting, psig (kPa)	450 (3102)		450 (3102)		450 (3102)	
Water Connections:						
In & Out, in. (mm) victaulic	8 (203)		8 (203)		8 (203)	
Drain & Vent	1/2 (12.7)		1/2 (12.7)		1/2 (12.7)	
UNIT DIMENSIONS						
Length, in. (mm)	170 (4318)		170 (4318)		170 (4318)	
Width, in. (mm)	34 (864)		34 (864)		34 (864)	
Height, in. (mm)	78 (1981)		78 (1981)		78 (1981)	
UNIT WEIGHTS						
Operating WT., lb., (kg)	7877 (3572)		7991 (3624)		7972 (3616)	
Shipping WT., lb. (kg)	7019 (3183)		7101 (3220)		7082 (3212)	
R-134a Ref. Charge, lb. (kg)	140 (63.5)	140 (63.5)	150 (68)	150 (68)	150 (68)	150 (68)

Figure 24: Compressor Locations



NOTE: Models TGZ150 to TGZ190 add a #5 compressor to circuit #1 and a #6 compressor to circuit #2 and substitute an underslung shell-and-tube evaporator for the brazed-plate evaporator.

Figure 25: Electric Panel Components



NOTE: Models TGZ 150 – 190 have additional T5 for electronic expansion valves.

⚠ 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. 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.

Field Wiring

TGZ units are supplied as standard with compressor contactors and power terminal block, designed for multi-point power supply to the unit, no circuit breakers on the compressors. A factory-installed control circuit transformer is standard. Optionally, a field-installed control power source can be wired to the unit.

Wiring and conduit selections must comply with the National Electrical Code and/or local requirements. Unit power inlet wiring must enter the control box through the right side. A 7/8-inch pilot knockout is provided. Refer to the unit dimension drawings beginning with page 16 for the location of power and control connections.

⚠ CAUTION

To avoid equipment damage, use only copper conductors in main terminal block.

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 a circuit breaker.
2. All field wiring to unit power block or optional non-fused disconnect switch must be copper wire.
3. All field wire size values and electrical ratings are given on the unit nameplate and the unit selection report.
4. If a separate 115V power supply is used for the control circuit, then the wire sizing is 10 amps for all unit sizes.
5. 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.
6. 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 NEC Handbook.
7. Must be electrically grounded according to national and local electrical codes.

Voltage Limitations

1. Within +/- 10% 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 Standard. This is an important restriction that must be adhered to.

Panel Ratings

The supplemental overloads option is used to reduce the required electrical service size and wire sizing for units under 140°F leaving condenser water temperature. Multi-point power units will have a panel rating of 5 kA. Single point power panel ratings vary based on unit model and voltage.

Single Point Power Units without Supplemental Overloads

Table 15: Standard Panel Short Circuit Current Ratings

Model Size	Voltage			
	208-230	380	400-460	575
040-060	10 kA	10 kA	10 kA	5 kA
080-190	10 kA	10 kA	10 kA	10 kA

Table 16: Optional High Short Circuit Panel Ratings

Model Size	Voltage			
	208-230	380	400-460	575
040-050	100 kA	65 kA	65 kA	25 kA
060-110	100 kA	65 kA	65 kA	18 kA
120	100 kA	65 kA	65 kA	25 kA
150-170	100 kA	65 kA	65 kA	18 kA
190	N/A	65 kA	65 kA	25 kA

Single Point Power Units with Supplemental Overloads

Table 17: Standard Panel Short Circuit Current Ratings

Model Size	Voltage			
	208-230	380	400-460	575
040-060	10 kA	10 kA	10 kA	5 kA
080-190	10 kA	10 kA	10 kA	10 kA

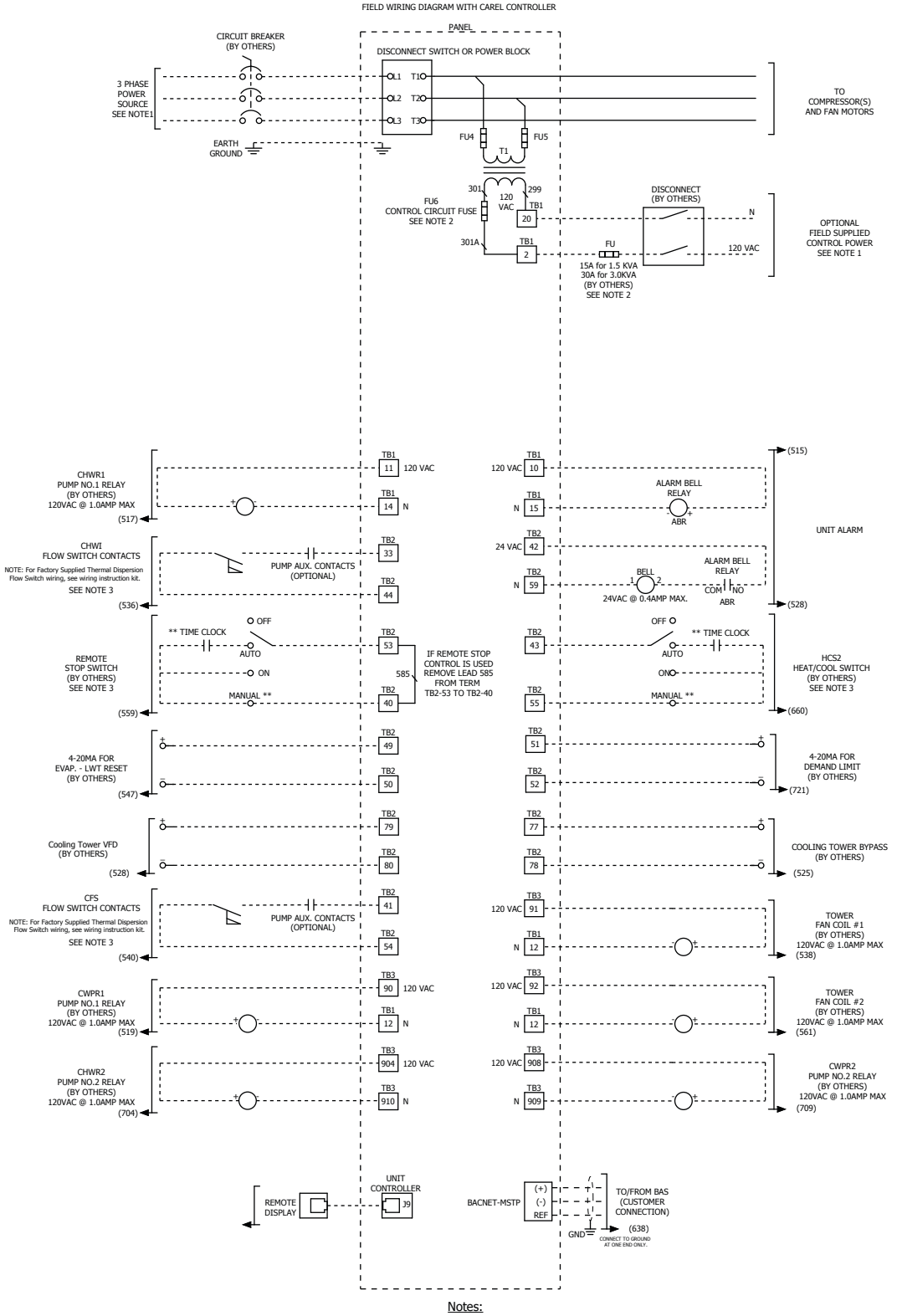
Table 18: Optional High Short Circuit Panel Ratings

Model Size	Voltage			
	208-230	380	400-460	575
040-050	100 kA	65 kA	65 kA	25 kA
060-170	100 kA	65 kA	65 kA	18 kA
190	N/A	65 kA	65 kA	18 kA

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 nameplate. 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.

Figure 26: Field Wiring Diagram



Notes:

1.) ALL FIELD WIRING TO BE INSTALLED AS NEC CLASS 1 WIRING SYSTEM WITH CONDUCTOR RATED 600 VOLTS.
2.) IF FIELD SUPPLIED, CONTROL POWER USER MUST REMOVE FU6.
FIELD SHALL TERMINATE NEUTRAL (N) ON TERMINAL TB1:20 AND 120 VAC (H) ON TERMINAL TB1:2.
FIELD SHALL SUPPLY FU AS SHOWN.
3.) ** = USE 'DRY CONTACTS' ONLY. DO NOT SUPPLY FIELD POWER TO THIS CIRCUIT
4.) DO NOT SUPPLY FIELD POWER TO 24VAC OR 120VAC CONTROL CIRCUITS.

TGZ Controller Software Version

This software is shared with the WGZ water chiller product family and is selected for Templifier® operation through a set point selection. The software 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

Every MicroTech® II controller is programmed and tested prior to shipment to assist in a trouble-free start-up. 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

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 is retained in memory and can be easily displayed for operator review. In addition to displaying alarm diagnostics, the MicroTech® II chiller controller also provides the operator with a warning of pre-alarm conditions.

Keypad/Display

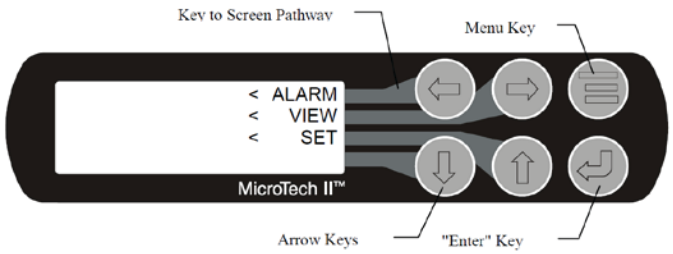
A 4-line by 20-character/line liquid crystal display and 6-key keypad is mounted on the unit controller. The four arrow keys (UP, DOWN, LEFT, RIGHT) have three modes of use.

1. Scroll between data screens as indicated by the arrows (default mode).
2. 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).
3. Change field values in edit mode according to the following:

   LEFT = Default
   RIGHT = Cancel
   UP = Increment
   DOWN = Decrement

See Using the Controller on page 47 for additional information for using the controller keypad.

Figure 27: Keypad and Display in MENU Mode



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. See Events and Alarms on page 43 for a full list of alarms.

Inputs and Outputs

The main controller used in the TGZ may have an expansion module for additional outputs on some unit configurations. The set point selection of the type of refrigerant (R-134a) is made at the factory and sets certain inputs and outputs.

In general, the following nomenclature applies for Type:

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

Table 19: Analog Inputs

	Description	Type	Signal Source	Range
1*	Evaporator Refrigerant Pressure #1	C1	0.1 to 0.9 VDC	0 to 132 psi
2*	Evaporator Refrigerant Pressure #2	C2	0.1 to 0.9 VDC	0 to 132 psi
3*	Condenser Refrigerant Pressure #1	C1	0.1 to 0.9 VDC	3.6 to 410 psi
4	Leaving Evaporator Water Temperature	UT	NTC Thermister (10k@25°C)	-58 to 212°F
5	Condenser Entering Water Temperature	UT	NTC Thermister (10k@25°C)	-58 to 212°F
6*	Condenser Refrigerant Pressure #2	C2	0.1 to 0.9 VDC	3.6 to 410 psi
7	Reset of Leaving Water Temperature	UT	4-20 mA Current	0-(10 to 80°F)
8	Condenser Leaving Water Temperature	UT	NTC Thermister (10k@25°C)	-58 to 212°F
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

Table 20: 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%

Table 21: Digital Inputs

	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)
6	Pump Down Switch #2	C2	0 VAC (Stop)	24 VAC (Start)
8	Condenser Water Flow Switch	UT	0 VAC (No Flow)	24 VAC (Flow)
9	Phase Voltage Fault #1 (See Note 1)	C1	0 VAC (Fault)	24 VAC (No Fault)
10	Phase Voltage Fault #2 (See Note 1)	C2	0 VAC (Fault)	24 VAC (No Fault)
11	Ground Fault Prot. #1 (See Note 2)	C1	0 VAC (Fault)	24 VAC (No Fault)
12	Ground Fault Prot. #2 (See Note 2)	C2	0 VAC (Fault)	24 VAC (No Fault)
13	Remote Start/Stop	UT	0 VAC (Stop)	24 VAC (Start)
15	Motor Protection #1	C1	0 VAC (Fault)	24 VAC (No Fault)
16	Motor Protection #2	C2	0 VAC (Fault)	24 VAC (No Fault)
18	Heat Mode Switch	UT	0 VAC (Normal)	24 VAC (Heat)

NOTE: 1. See Safety Alarms Table for “Phase Voltage Protection”. 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.

2. See Safety Alarms Table for “Ground Fault Protection”. 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 22: Digital Outputs

	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	Fan Contactor/ 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	Motor Control Relay #5 = Compr#5	C1	Starter	Compressor OFF	Compressor 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	C2	Starter	Compressor OFF	Compressor ON
12	Liquid Line #2	C2	Solenoid	Cooling OFF	Cooling ON
13	Condenser Fan #3	C1	Fan Contactor	Fan OFF	Fan ON
14	Hot Gas Bypass #1	C1	Solenoid	Cooling OFF	Cooling ON
15	Hot Gas Bypass #2	C2	Solenoid	Cooling OFF	Cooling ON
16	Condenser Fan #4 (R134a)	C2	Fan Contactor	Fan OFF	Fan ON
17	Condenser Fan #5&7 (R134a)	C1	Fan Contactor	Fan OFF	Fan ON
18	Condenser Fan #8	C2	Fan Contactor	Fan OFF	Fan ON
19	Condenser Fan #6&8	C2	Fan Contactor	Fan OFF	Fan ON

Expansion I/O Controller

Table 23: Digital Outputs

	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

Table 24: Analog Inputs

	Description	Type	Output Off	Output On
1	Entering Evaporator Water Temperature	UT	NTC Thermister (10k@25°C)	-58 to 212°F
2	Demand Limit	UT	4-20 mA Current	0-100 % Load
3	Liquid Line Temperature #1	C1	NTC Thermister (10k@25°C)	-58 to 212°F
4	Liquid Line Temperature #2	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 PW (password) column indicates the password level that must be active in order to change the set point...O = Operator, M = Manager.

Description	Default	Range	PW
Unit Enable	Off	Off, On	O
*Unit Mode	Cool	Cool, Cool w/Glycol, Heat, Heatw/Glycol, Test	O
Control source	Switches	Keypad, Network, Switches	O
*Available Modes	Cool	Cool, Cool w/Glycol, Heat, Cool/Heat, Cool/Heatw/Glycol, Heatw/Glycol, Test	M
Cool LWT	44.0°F	See Special Set Points and Ranges	O
Heat LWT	110.0°F	110.0 to 165.0°F	
Evap LWT sensor offset	0.0	± 5.0 degrees F	O
Cond LWT sensor offset	0.0	± 5.0 degrees F	O
Evap EWT sensor offset	0.0	± 5.0 degrees F	O
Cond EWT sensor offset	0.0	± 5.0 degrees F	O
Evap Delta T	10.0°F	6.0 to 16.0°F	O
Cond Delta T	20.0ºF	5.0 to 40.0ºF	O
Startup Delta T	10.0°F	1.0 to 15.0°F	O
Stop Delta T	0.5°F	0 to 3.0°F	O
Max Rate	1.0°F	0.5 to 5.0°F	M
Evap Recirculate Timer	30	15 to 300 seconds	M
Evap Pump	#1 Only	#1 Only, #2 Only, Auto, #1 Prim, #2 Prim	M
Cond Pump Recirculate Timer	30	15 to 90 seconds	M
Cond Pump	#1 Only	#1 Only, #2 Only, Auto, #1 Prim, #2 Prim	M
Demand Limit	Off	Off, On	M
Hot Gas Delay Time	30 seconds	30 to 180 seconds	M
BAS Protocol	Modbus	BACnet, LonWorks, Modbus	M
Identification number	001	000-200	M
Baud rate	9600	1200,2400,4800,9600,19200	M
*Refrigerant Select	None	R134a, R22, R407C, R410A (Templifier units will be set as R134a at the factory.)	M
Cooling Reset Type	None	None, 4-20mA, Return	O
Cooling Maximum Reset	10ºF	0 to 16ºF	O
Cooling Start Reset Delta T	10ºF	0 to 16ºF	O
Heating Reset Type	None	None, 4-20mA, Return	O
Heating Maximum Reset	10ºF	0 to 40ºF	O
Heating Start Reset Delta T	10ºF	0 to 40ºF	O
Compressor			
# of Compressors	4	4,6	M
Clear Cycle Timer	No	No, Yes	M
Stage Up Delay	240 seconds	120 to 480 seconds	M
Stage Down Delay	30 secounds	20 to 60 seconds	M
Start-Start	15 min	10 to 60 min - Start-Start is the time required before starting a compressor after the last time it has started.	M
Stop-Start	5 min	3 to 20 min - Stop-Start is the time required before starting a compressor after it has stopped.	M
Expansion Valve			
Expansion Valve Type	Thermal	Thermal, Electronic: Thermal for TGZ040-120, Electronic for TGZ150-190	M
Circuit 1 EXV Control	Auto	Auto, Manual	M
Circuit 1 EXV Position	N/A	0-100%	M
Circuit 2 EXV Control	Auto	Auto, Manual	M
Circuit 2 EXV Position	N/A	0-100%	M
Alarms			
Low Evap Pressure-Hold	29 psi	See Special Set Points and Ranges	M
Low Evap Pressure-Unload	28 psi	See Special Set Points and Ranges	M

Description	Default	Range	PW
High Cond Pressure – Unload	170 psi	155 to 415 psi	M
High Cond Pressure – Stop	185 psi	170 to 425 psi	M
Evap. Freeze	38.0°F	See Special Set Points and Ranges	M
Cond. Freeze	34.0°F	18 to 42°F	M
Evap Flow Proof	5 seconds	5 to 15 seconds	M
Cond Flow Proof	5 seconds	5 to 15 seconds	M
Recirc Timeout	3 minutes	1 to 10 minutes	M
*Phase Voltage Protection	No	No, Yes	M
*Ground Fault Protection	No	No, Yes	M
Low Source Temprature	40°F	See Special Set Points and Ranges (Available mode includes Heat)	M
Low Source Differential	5.0°F	5.0°F to 10.0°F (Available mode includes Heat)	M
Cooling Tower TGZ in Cooling Mode			
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 Set point	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 Position	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

* = Set at factory

Special Set points and Ranges

Cool LWT

Available Modes	Range
Without Glycol	40 to 85°F
With Glycol	20 to 85°F

Low Evaporator Pressure Hold and Unload

Available Modes	Range
Without Glycol	26 to 54 psi
With Glycol	12 to 54 psi

Evaporator Freeze Temperature

Available Modes	Range
Without Glycol	37 to 42°F
With Glycol	17.5 to 42°F

Low Source Temperature

Available Modes	Range
Without Glycol	37 to 85°F
With Glycol	17.5 to 85°F

Calculations

Control Band

The Control Band defines the temperatures around the Cool Leaving Water Temperature set point where compressors will be staged on or off.

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

Four compressor units

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

Six compressor units

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

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

Four compressor units

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

Six compressor units

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

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 = 39.0° F

Stage Up temperature is calculated as:

Stage Up temperature = 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 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

LWT Error

LWT error compares the actual LWT to the active LWT set point. The equation is:

LWT error = LWT – active LWT set point

Evaporator Approach

The evaporator approach shall be calculated for each circuit.:

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

Pumpdown 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. It 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 unit 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.

KEYPAD - would be normally selected as ON and is normal setting when no external signals are controlling the unit.

SWITCHES - an external switch is wired across terminals #40 and #53.

NETWORK - used with BAS signal which is wired to the three communication ports.

Changing the Unit Enable set point can be accomplished according to the following table. NOTE: An “x” indicates that the value is ignored.

Unit Input	Control Source	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 unit is set by the Unit Mode set point from one of the options listed below. This set point can be altered by the keypad, BAS, and Mode input. Templifier® operation is selected by setting the Refrigerant Selection set point to R134a. Ice Mode options are excluded when Templifier® operation is indicated.

- COOL - normal setting used with chilled water air-condition applications.
- COOL w/GLYCOL - used with low temperature, glycol applications. It allows a lower evaporator LWT set point to be used.
- HEAT - used when heating only applications.
- COOL/HEAT - used for doing both cooling and heating
- COOL/HEATw/GLYCOL - used for doing both heating and cooling with low evaporator temperature, glycol applications
- HEATw/GLYCOL - when glycol is present in the evaporator water loop used for heating applications.

Changes to the Unit Mode set point are controlled by two additional set points. Control Source settings can be KEYPAD, SWITCHES, or NETWORK as determined from the Mode Source set point. 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	Mode Input	Keypad Entry	BAS Request	Available Modes	Unit Mode
X	X	X	X	Cool	Cool
X	X	X	X	Cool w/ Glycol	Cool w/ Glycol
Switches	Off	X	X	Cool/Heat	Cool
Switches	On	X	X	Cool/Heatl	Heat
Keypad	X	Cool	X	Cool/Heat	Cool
Keypad	X	Heat	X	Cool/Heatl	Heat
Network	X	X	Cool	Cool/Heat	Cool
Network	X	X	Heat	Cool/Heatl	Heat
Switches	Off	X	X	Cool/Heat w/Glycol	Cool w/ Glycol
Switches	On	X	X	Cool/Heat w/Glycol	Heat w/ Glycol
Keypad	X	Cool	X	Cool/Heat w/Glycol	Cool w/ Glycol
Keypad	X	Heat	X	Cool/Heat w/Glycol	Heat w/ Glycol
Network	X	X	Cool	Cool/Heat w/Glycol	Cool w/ Glycol
Network	X	X	Heat	Cool/Heat w/Glycol	Heat w/ Glycol
X	X	X	X	Heat	Heat
X	X	X	X	Heat w/ Glycol	Heat w/ Glycol
X	X	X	X	Test	Test

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.

Unit Test Mode

The unit test mode allows manual testing of controller outputs. Entering this mode shall require 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.

Heat/Cool Changeover

With the proper piping and valve arrangement designed and installed, Templifier® units can be switched from heating mode (controlled by the condenser leaving temperature) to cooling mode (controlled by the evaporator leaving temperature).

Care must be exercised when changeover occurs to avoid mixing water streams that could possibly contaminate a water system. For example a unit can have chilled water in the evaporator and tower water in the condenser when in the cooling mode. Changeover to heating could put tower water through the evaporator and hot water (possibly potable water) through the condenser. This could introduce tower water into the chilled water system and into the hot water system and should be avoided.

At changeover, the unit is switched from heating to cooling on the Unit Mode set point. The changeover procedure can be manual or automatic and consists of the following steps:

1. Shut down the evaporator and condenser pumps and then the Templifier®.
2. Change over the system valves
   - Manual: Manually position valves for the correct flow through the Templifier® vessels and system.
   - Automatic: The external Heat/Cool Switch must position the motorized valves for the correct flow through the Templifier® vessels and system.
3. Change over the Templifier® operating mode.
   - Manual: Switch the unit-mounted manual Heat/Cool Switch to the correct position. It is located in the upper-center of the electric panel.
   - Automatic: The external Heat/Cool Switch (see Field Wiring Diagram on page 7) must switch as required. NOTE; The panel-mounted Heat-Cool Switch must be in the Cool position for the external switch to function.
4. Restart the pumps, and then restart the unit.

Circuit Available

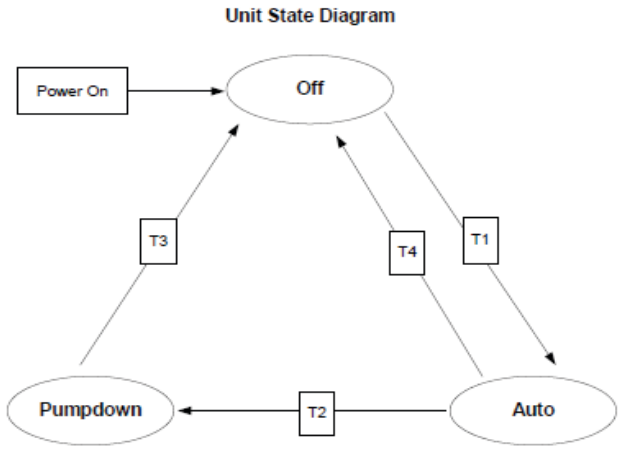
A circuit is available if the circuit switch is in the on position and no circuit alarms are active. Timers that delay startup or staging of a circuit do not render it unavailable.

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. In addition, the motor protect inputs are ignored during this time so as to avoid tripping a false alarm.

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 following diagram.



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

T3: Pumpdown to Off

Unit Alarm OR

Unit Switch Off OR

No Compressors Running

T4: Auto to Off

Unit Alarm OR

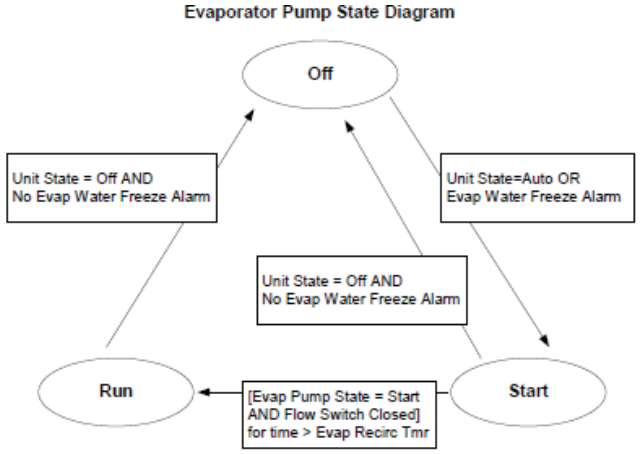
Unit Switch Off OR

No Compressors Running AND [No Circuit Available]

Evaporator Water Pump State Control (Evap State)

Most Templifier® applications will not use automatic starting of evaporator pumps by the unit. This feature is commonly used on conventional chilled water applications. Simply not wiring a field installed pump relay to the unit will obviate unit pump control.

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



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.

Leaving Water Reset

The leaving water reset input uses a 4-20mA signal to reset the leaving water set point to a higher value. The adjustment varies linearly from 0 to 10°F, with a reset of 0 for a 4mA signal and a reset of 10 for a 20mA signal.

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 Heat, then the active set point is equal to the Heat set point. If the unit mode is Cool, the active set point is the Cool set point plus the leaving water reset value.

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 start up 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 shutdown 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.

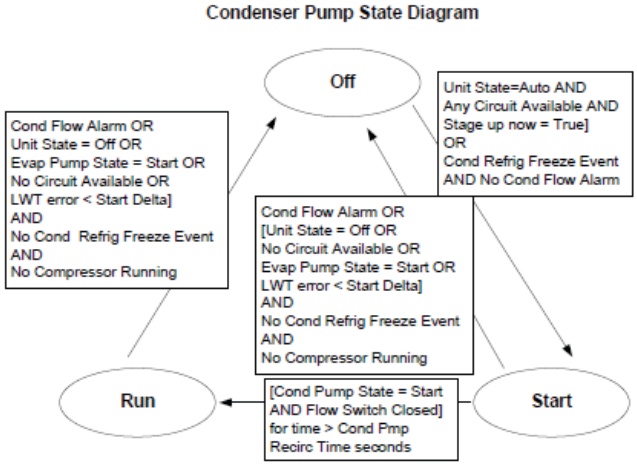
Condenser Pump and Tower Control – Water Cooled

Most Templifier® applications will not use automatic starting of condenser pump by the unit. This feature is commonly used on conventional chilled water applications.

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.



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.

Tower Fans (TGZ in Cooling Mode Only)

Cooling tower fan control is not normally used in Templifier® applications. If cooling tower fan control is desirable, the following will apply.

Cooling 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 starts. The first stage turns 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 occurs 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)

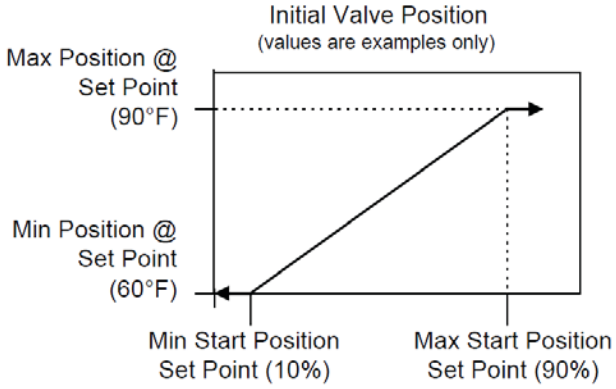
Each stage up or stage down event will restart both the stage up and stage down timers. Only one fan output will be switched at a time (except that all outputs switch OFF when the condenser pump state equals OFF).

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 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 but also as a function of leaving hot water temperature in the Heating Mode or leaving evaporator water temperature in the Cooling Mode. Of the four or six compressors on the unit, the 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.

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 5.0 psi. 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. If three compressors are running, then one compressor will stop immediately. 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 5.0 psi 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	Evap Press Required to Continue
Check #1	15 sec after start	> (0.48*Low Evap Press SP)
Check #2	30 sec after start	> (0.66*Low Evap Press SP)
Check #3	45 sec after start	> (0.83*Low Evap Press SP)
Check #4	60 sec after start	> 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 CIRCUITn (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, and 4) how many high pressure unload occurrences since the previous mid-night. See below for initial offset value and step-increase for each additional occurrence.

Hold Clear Reset Value =

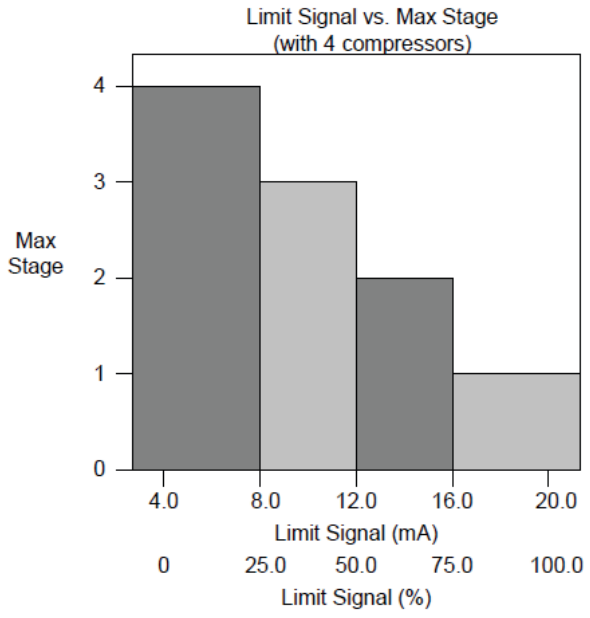
High Pressure Unload set point – ["Initial Offset" + ["Step-Increase" x ["number of occurrence"-1]]]

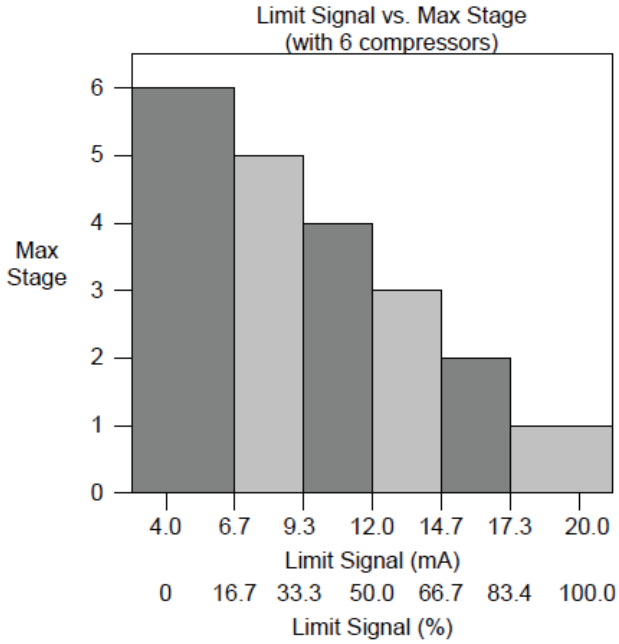
Unit Capacity Overrides

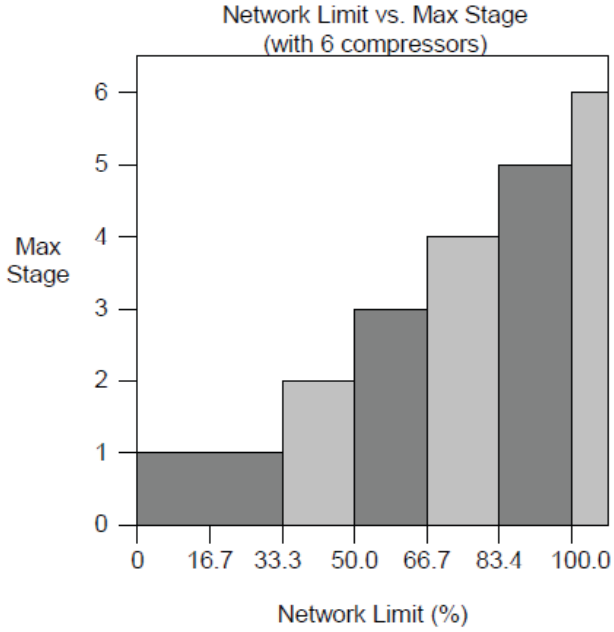
The following conditions shall override the automatic capacity control when the chiller is in cool mode only.

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 graphs. Any signal less than 4 mA does not limit the chiller capacity.

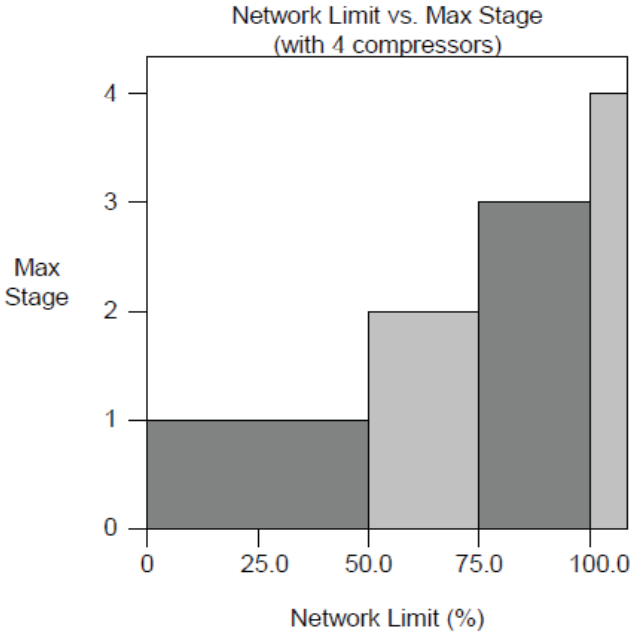






Network Limit

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 graphs. 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 can not 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
- A normal stage down occurs, and only one compressor on the circuit is running

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.

Rapid Circuit Shutdown

A situation may arise that requires a circuit to shut down immediately, without doing a pumpdown. This rapid shutdown will be triggered by any of the following:

- Unit State = Off
- Circuit Alarm

All compressors, hot gas, and liquid line outputs should be turned off immediately for a rapid shutdown.

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

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.

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 above.

EXV Control

The EXV control logic is active (but not necessarily used) regardless of the 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.

No. of Compressors	Valve Position	Compressors Running		
		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.

Maximum EXV Operating Pressure

This logic only applies to TGZ units equipped with electronic expansion valves (Models TGZ150-190). The purpose of this logic is to prevent the operating circuit's evaporator pressure from exceeding the 'MaxOpPress' set point (found on "SET COMP SPs (6) screen) and overloading the compressors. The electronic expansion valves (EEV) will close to prevent the operating circuit's evaporator pressure from exceeding the 'MaxOpPress' set point.

Events and Alarms

Protection (Shutdown) Alarms

Equipment protection alarms trigger a rapid compressor shutdown. The following section identifies each equipment protection alarm, gives the trigger that causes the alarm to occur, states the action taken because of the alarm and reset method. Most equipment protection alarms require a manual reset. These alarms will energize a remote alarm if the unit is so wired in the field.

Alarms and Events

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 will be turned ON when any stop alarm occurs. They will be turned off when all alarms have been cleared.

Evaporator Flow Loss

Alarm description (as shown on screen): 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 (as shown on screen): 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 (as shown on screen): 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 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

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 (as shown on screen): 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 (as shown on screen): 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 (as shown on screen): 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 (as shown on screen): 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.

Evaporator Water Freeze Protect

Alarm description (as shown on screen): 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 (as shown on screen): 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 if the sensor is back in range.

Leaving Condenser Water Temperature Sensor Fault

Alarm description (as shown on screen): CondLWT Sens Fault

Trigger: Sensor shorted or open AND TGZ unit (refrig = R134a) AND operating in ‘heat’ mode.

Action Taken: Normal stop all circuits

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

Suction Temperature Sensor Fault

Alarm description (as shown on screen): SuctT Sensor Fail N

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

Action Taken: Rapid stop circuit

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

Evaporator Pressure Sensor Fault

Alarm description (as shown on screen): 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 if the sensor is back in range.

Condenser Pressure Sensor Fault

Alarm description (as shown on screen): CondP Sensor Fail N

Trigger: Sensor shorted or open

Action Taken: Rapid stop circuit

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

Condenser Entering Sensor Fault

Alarm description (as shown on screen): OAT Sensor Fault

Trigger: Sensor shorted or open

Action Taken: Normal stop all circuits

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

Evaporator Water Freeze Protect

Alarm description (as shown on screen): 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 Evaporator Pressure Drop

Alarm description (as shown on screen): No Evap Press Drop N

Trigger: After start of first compressor on the circuit, either a 1 psi drop in evaporator pressure OR a 5 psi rise in condenser pressure has not occurred after 15 seconds

Action Taken: Rapid stop circuit

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

EXB Comm Failure on CP1

Alarm description (as shown on screen): 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.

⚠ CAUTION

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

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 (as shown on screen): 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
- there 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 is 8 psi. The event is also reset if the circuit state is no longer Run.

Low Evaporator Pressure - Unload

Event description (as shown on screen): 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
- there 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 + 8psi for R134a). The event is also reset if the circuit state is no longer Run.

High Condenser Pressure - Unload

Event description (as shown on screen): 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.

Compressors	Pressure (psi)	Step-Increase (psi)
4	30	10
6	20	10

Failed Pumpdown

Event description (as shown on screen): Pumpdown Fail Cir N

Trigger: Circuit state = pumpdown for time > 60 seconds

Action Taken: Shutdown circuit

Reset: N/A

Condenser Freeze Event

Event description (as shown on screen): 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

Event description (as shown on screen): 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 (as shown on screen): SuctT Sensor Fail N

Trigger: Sensor shorted or open.

Action Taken: None.

Reset: N/A

Entering Evaporator Water Temperature Sensor Failure

Event description (as shown on screen): Evap EWT Sensor Fail

Trigger: Sensor shorted or open.

Action Taken: None.

Reset: N/A

Liquid Line Temperature Sensor Fail

Event description (as shown on screen): Low Source Temp

Trigger: Sensor shorted or open.

Action Taken: None.

Reset: N/A

Low Source Water Temperature (Heat mode only)

Event description (as shown on screen): LiqL Sensor Fail N

Trigger: Unit is in heat mode and the leaving evaporator water temperature drops below the Low Source Temperature set point.

Action Taken: Stage off one compressor immediately and the remaining being staged off based upon the “InterStage Dn” set point time interval.

Reset: N/A

EXB Comm Failure on CP1 (TGZ unit only)

Event description (as shown on screen): No EXB comm CP1

Trigger: CP1 does not have communication with either EXB1 for 60 seconds after power up. This event is only active when the expansion board is not intended to operate evaporator or condenser pump #2.

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.

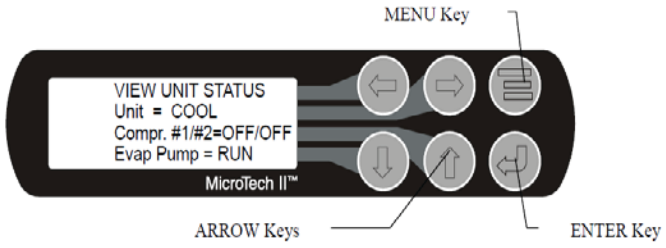
Using the Controller

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 the set point values that can be changed.

The controller 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 arrow keys on the controller are used to navigate through the menus by using the LEFT/RIGHT keys to move between columns and the UP/DOWN keys to move between rows. The keys are also used to change numerical set point values contained in certain menus.

Figure 28: Display in the Shortcut (SCROLL) Mode and Keypad Layout



There are two ways to navigate through the menu matrix to reach a desired menu screen. Some of these top-level screens have sub-screens located under them.

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 of screen titles arranged across the top of the horizontal row. 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.

For example, selecting ALARM will go the next row of menus under ALARM (ALARM LOG or ACTIVE ALARM).

```
ALARM          < ACTIVE
               <    LOG
               <
               <
```

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

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

After pressing the second level “UNIT” menu button, the selected data screen will show:

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

Pressing the “SET” menu button, a menu screen will show:

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

Two four-digit passwords provide OPERATOR and MANAGER levels of access to changeable parameters. The passwords are preprogrammed into the controller. Either password must be entered using the ENTER PASSWORD screen before a protected setting can be changed.

The password 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. After the correct password has been entered, the controller will automatically return to the original set screen.

Once a password has been entered, it remains valid for 15 minutes after the last key-press.

ENTER Key

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

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

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

UP key - Increment, increases the value of the setting

DOWN key - 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.

Alarm Screens

```
ALARM ACTIVE (X)
Alarm Description
hh:mm:ss dd/mmm/yyyy
```

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.

An alarm will cause a red light in back of the LEFT-ARROW KEY on the controller. 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.

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.

```
ALARM LOG (X)
Alarm Description
hh:mm:ss dd/mmm/yyyy
Data
```

Optional Controls

Phase/Voltage Monitor

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 output relay is deactivated, disconnecting power to the thermostatic control circuit. The compressor will automatically pump down.

The output 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 output relay should close and the “run light” should come on. If the output relay does not close, perform the following tests.

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. If these voltages are extremely low or widely unbalanced, check the power system to determine the cause of the problem.
3. If the voltages are good, turn off the power and interchange any two of the supply power leads at the disconnect. This can be necessary as the phase/voltage monitor is sensitive to phase reversal. Turn on the power. The output relay should now close after the appropriate delay.

⚠ CAUTION

The hot gas line can become hot enough to cause injury in a very short time; care should be taken during valve checkout.

Hot Gas Bypass

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. A solenoid valve in the hot gas bypass line is wired in parallel with the compressor unloader U1. Thus, the hot gas solenoid cannot open unless the compressor is operating in an unloaded mode. If only one hot gas valve is specified for the unit, the hot gas bypass is wired in the first refrigerant circuit and the lead-lag switches are therefore eliminated. The hot gas bypass option is also available for the second refrigerant circuit whereby the lead-lag switches remain.

The pressure regulating valve is factory set to begin opening at 58 psig (400 kPa). This setting can be changed by changing the pressure of the air charge in the adjustable bulb. 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.

Figure 29: Hot Gas Bypass Piping

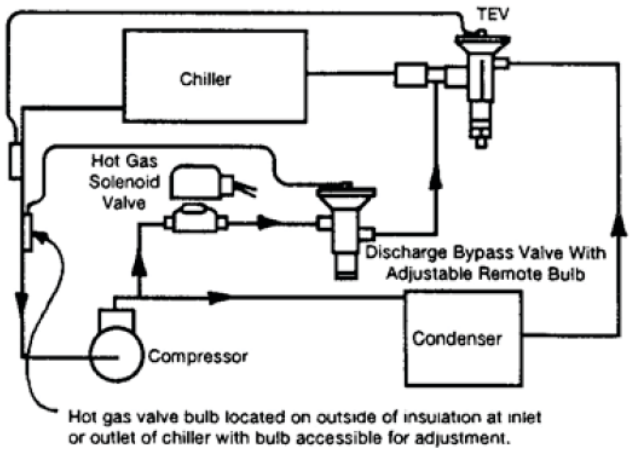
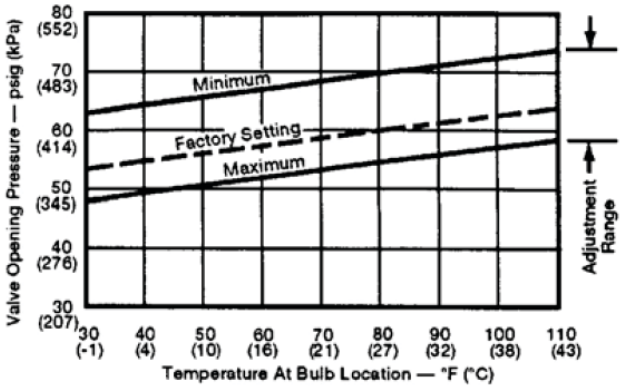


Figure 30: Hot Gas Bypass Adjustment Range



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

⚠ DANGER

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

Pre-Startup

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

NOTICE

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

⚠ CAUTION

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

1. With main disconnect open, check all electrical connections in control panel and starter to be sure they are tight and provide good electrical contact. Use only copper wire to connection points.
2. Check and inspect all water piping. Make sure flow direction is correct and piping is made to correct connection on evaporator and condenser.
3. Open all water flow valves to the condenser and evaporator.
4. Flush the cooling tower (if there is one used) and system piping to be sure the system is clean. Start source water pump and manually start hot water pump. 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, non-corrosive water.
5. Check to see that the water temperature sensor is installed in the correct water line.
6. Making sure control stop switch S1 is open (off) and pumpdown switch(es) PS1 and PS2 are on “manual pumpdown,” throw the main power and control disconnect switches to “on.” This will energize the crankcase heaters. Wait a minimum of 12 hours before starting up unit.
7. Check compressor oil level. Prior to start-up, the oil level should cover at least one-third of the sightglass.
8. Check pressure drop across evaporator and condenser, and see that water flow is correct per the design flow rates and data starting on page 21
9. 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.
10. Check that the panel-mounted Heat/Cool switch is in the correct position
11. Make sure all wiring and fuses are of the proper size. Also make sure all interlock wiring is completed per Daikin Applied diagrams. Use only copper wire.
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 adequate cooling heat is available for initial start-up.

Start-Up

1. Before powering the machine and starting the compressors, open all valves that were closed at the factory for shipping. The valves to be opened are:
   - Open the compressor suction and discharge shutoff valves until backseated. Always replace valve seal caps.
   - Open the manual liquid line shutoff valve
2. Leak test the unit.
3. Check to see that the unit circuit breakers are in the “off” position.
4. 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.
5. Place the main power and control circuit disconnects to the “on” position.
6. Verify crankcase heaters have operated for at least 12 hours prior to start-up. Crankcase should be warm.
7. Adjust the set point on the MicroTech II controller to the desired hot water temperature.
8. Start the auxiliary equipment for the installation by turning on the time clock, ambient thermostat and/or remote on/off switch and chilled water pump.
9. Check resets of all equipment protection controls.
10. Switch the unit circuit breakers to “On”.
11. Place pumpdown switches PS1 and PS2 to “auto” for restart and normal operation.
12. Start the system by pushing the system switch S1 to “On”.

13. After running the unit for a short time, check the oil level in each compressor crankcase and check for flashing in the refrigerant sightglass.
14. After system performance has stabilized, complete the “Scroll Compressorized Equipment Warranty Form” to obtain full warranty benefits. .
15. Verify all control settings appropriate to the application.

Start-up after Extended Shutdown

1. Inspect all equipment to see that it is in satisfactory operating condition.
2. Open the compressor suction and discharge valves until backseated. Always replace valve seal caps.
3. Open the manual liquid line shutoff valves.
4. Check circuit breakers. They must be in the “off” position.
5. Check to see that the pumpdown switch(es) PS1 and PS2 are in the “manual shutdown” position and the control system switch S1 is in the “off” position.
6. Throw the main power and control circuit disconnects to the “on” position.
7. Allow the crankcase heaters to operate for at least 12 hours prior to start-up.
8. Start the source water flow and purge the water piping as well as the evaporator in the unit.
9. Start the auxiliary equipment for the installation by turning on the time clock, ambient thermostat and/or remote on/off switch.
10. Adjust the set point on the MicroTech II controller to the desired hot water temperature.
11. Check resets of all equipment protection controls.
12. Switch the unit circuit breakers to “on.”
13. Start the system by pushing the system switch S1 to “on.”
14. Place pumpdown switch(es) PS1 and PS2 to the “auto pumpdown” position for restart and normal operation.
15. After running the unit for a short time, check the oil level in each compressor crankcase and for flashing in the refrigerant sightglass (see Maintenance section).

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 31, comes as a 2 part unit consisting of a flow switch and an adapter labeled E40242 by the supplier.

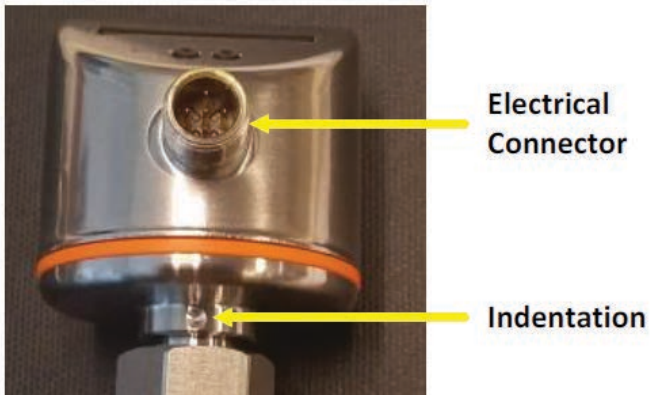
Figure 31: Thermal Dispersion Flow Switch and Adapter

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

Figure 32: Flow Switch Details

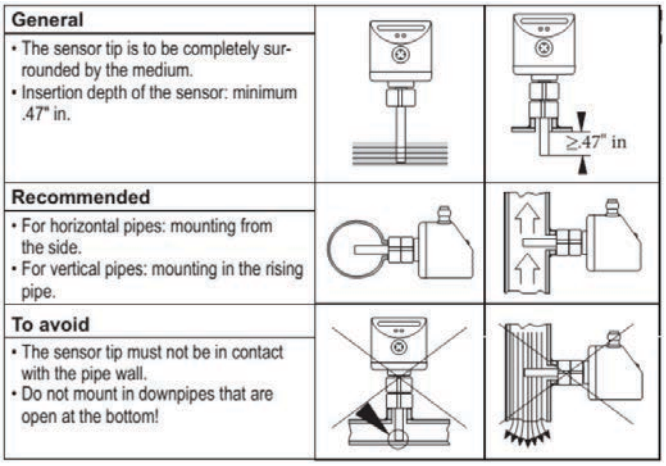


It is required that the flow switch be mounted such that the electrical connection and indentation ‘mark’ are oriented as recommended in Figure 33. It is important that the flow switch be mounted so that the probe is sufficiently inserted into the fluid stream. It may not be mounted directly on top or 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 **inlet** 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 inlet pipe to reflect flow leaving the barrel. If installation on the outlet 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 33: 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 25 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 34.

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 35 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.

Table 25: 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

Figure 34: Automatic Teach of Set point

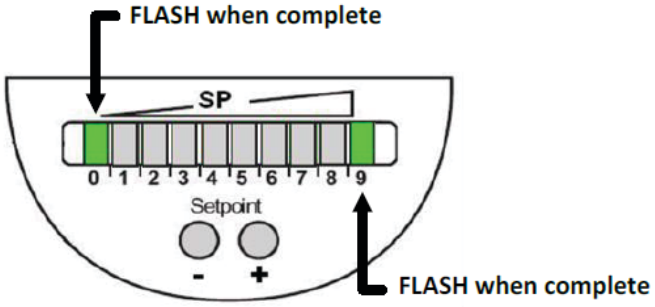
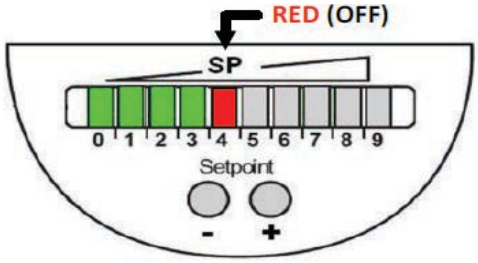


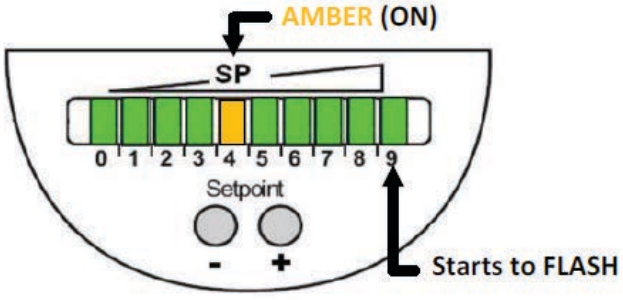
Figure 35: Teach Adjustment Complete



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 36: Upper Range of Minimum Flow



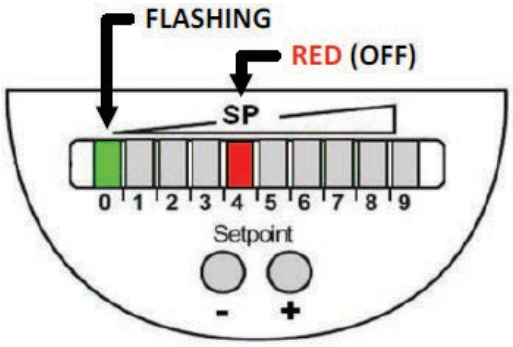
Step 5: Once the SP is set, it is recommended that the sensor be locked to avoid inadvertent readjustment. This can be performed by pressing both the '+' and '-' buttons simultaneously for 10 seconds. The indication goes out momentarily indicating the unit is locked. To unlock, the same procedure is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

NOTE:

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

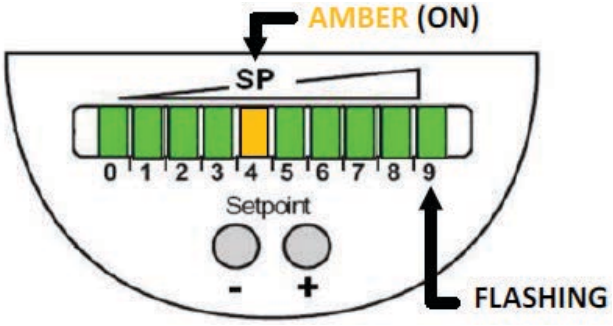
Flow <u>below</u> display range: The SP LED will be lit red and the leftmost LED will be flashing green. For example, if the SP was set to 200 cm/s, the flashing labeled '0' would indicate that the flow was below 180 cm/s. This would be shown if no flow through chiller or lowered than desired flow.

Figure 37: 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 38: : Display for Flow Above Range



⚠ 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.

General Maintenance

Water supplies in some areas can tend to foul the TGZ heat exchangers to the point where cleaning is necessary. The fouled vessel will be indicated by an abnormally high condensing pressure or low evaporating pressures and can result in nuisance trip-outs. To clean the vessels, a chemical descaling solution should be used according to the manufacturer's directions. An inlet water strainer is required and further information is given in "Inlet Strainer Guidelines" on page 12.

The condenser 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 maintenance includes checking the sensor tip for buildup and cleaning the tip using a soft cloth. Stubborn build up (e.g., lime) can be removed using a common vinegar cleaning agent.

Electrical Terminals

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

⚠ DANGER

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

⚠ CAUTION

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

⚠ WARNING

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

⚠ DANGER

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

If motor or compressor damage is suspected, do not restart until qualified service personnel have checked the unit.

An open fuse indicates a short, ground, or overload. Before replacing a fuse or restarting a compressor, the root cause must be identified and corrected.

Compressor POE Oil

The oil level should be watched carefully upon initial start-up. The compressor oil level must be checked periodically to be sure the level is at the center of the oil sightglass. Low oil level can cause inadequate lubrication and additional oil must be added. Compressor oil must be one of the following:

- Copeland brand Ultra 22 CC
- Copeland brand Ultra 32 CC
- Copeland brand Ultra 32-3MAF
- Mobil EAL Artic 22 CC
- Uniqema RL32-3MAF

This is synthetic polyolester oil with anti-wear additives and is highly hygroscopic which means it will quickly absorb moisture if exposed to air and form acids that can be harmful to the chiller. Avoid prolonged exposure of refrigerant to the atmosphere to prevent this problem. Oil can be added to the compressor through the oil fill hole on the compressor.

⚠ CAUTION

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

⚠ WARNING

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

Oil Equalization

All compressor models come equipped with oil equalization lines connecting the crankcases of the compressors. 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. This method of equalization prohibits the oil level from dropping below the bottom level of the sightglass in one compressor. Some difference in crankcase oil levels will still exist during unit operation due to compressor internal pressures.

Small compressors have an oil level sightglass in the compressor housing and a small equalization line. Larger compressors have a larger equalization line with an oil level sightglass in it.

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 at about 80°F (26.7°C) before the system is started up, to minimize lubrication problems or liquid slugging of compressor on start-up.

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.

Sightglass and Moisture Indicator

The liquid line sightglass/moisture indicator on all circuits should be checked monthly.

A clear glass of liquid indicates that there may be an adequate refrigerant charge in the system to provide proper feed through the expansion valve. Bubbling refrigerant in the sightglass may indicate that the system is short of refrigerant charge. Refrigerant gas flashing in the sightglass 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 sightglass indicates what moisture condition corresponds to a given element color. If the sightglass does not indicate a dry condition after about 12 hours of operation, the oil should be tested for acid and the filter-driers changed if necessary.

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 should be changed if acid test or oil analysis indicated acid conditions.

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 reading 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. A normal pressure drop through the solenoid valve is approximately 3 psig (20.7 kPa) at full load conditions.

Changing Filter-Driers

To change the filter-drier, pump the unit down by moving pumpdown switches PS1 and PS2 to the manual pumpdown" position.

Circuit Number	Jumper Across Terminals
1	42 to 44
2	72 to 74

Move the control switch S1 to the "off" position. Turn off all power to the unit and install jumpers across the terminals shown in the table. This will jump out the low pressure control. Close the manual liquid line shutoff valve(s). Turn power to the unit back on and restart the unit by moving the control switch S1 to the "on" position. The unit will start pumping down past the low pressure setting. When the evaporator pressure reaches 0 to 5 psig, (0 to 34.5 kPa) move control switch S1 to the "off" position. Remove the jumper.

Front seat the suction line King valve(s). Remove and replace the filter-drier(s). Evacuate the lines through the liquid line manual shutoff valve(s) to remove non-condensables that may have entered during filter replacement. A leak check is recommend 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(es) PS1 and PS2 to the "manual pumpdown" 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 pumpdown switch(es) PS1 and PS2 to the "auto pumpdown" position.

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

Maintenance Schedules

	Monthly	Quarterly	Semi-Annually	Annually	As Required By Performance
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 temperature)		X			
C. Lubrication System					
• Oil Level	O			X	
• Oil Appearance (clear color, quantity)	O				
• Oil change if indicated by oil analysis					X
Controls					
A. Operating Controls					
• Check Settings and Operation			X		
B. Protective Controls					
• Test Operation of:					
- Alarm Relay		X			
- Pump Interlocks		X			
- High and Low Pressure Cutouts		X			
Condenser					
A. Test Water Quality		X			
B. Clean Condenser Tubes (or as required)				X	
C. Eddy Current Test - Tube Wall Thickness					X
D. Seasonal Protection					X
Evaporator					
A. Test Water Quality		X			
B. Clean Evaporator Tubes (or as required)					X
C. Eddy Current Test - Tube Wall Thickness (or as required)					X
D. Seasonal Protection					X
Expansion Valves					
A. Performance Evaluation (Superheat Control)		X			
Compressor - Chiller Unit					
A. Performance Evaluation	O				
B. Leak Test:					
• Compressor Fittings and Terminal		X			
• Piping Fittings		X			
• Vessel Relief Valves		X			
C. Vibration Isolation Test		X			
D. General Appearance					
• Paint				X	
• Insulation				X	
Starter(s)					
A. Examine Contactors (hardware and operation)		X			
B. Verify Overload Setting and Trip		X			
C. Test Electrical Connections		X			
Optional Controls					
A. Hot Gas Bypass (verify operation)		X			

Key: O = Performed by in-house personnel X = Performed by service personnel

Troubleshooting Charts

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 online.
	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 safety switch.
	No heating required	Wait until unit calls for heating.
	Liquid line solenoid will not open	Repair and 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 compressor.
High Discharge Pressure	Condenser water insufficient or temperature too high.	Investigate ways to increase hot water supply or lower the temperature of the hot water. Check operation of the supplementary heater.
	Fouled condenser tubes	Clean the tubes.
	Non-condensables in system	Purge the non-condensables.
	System overcharged with refrigerant.	Remove excess refrigerant.
	Discharge shutoff valve partially closed.	Open valve.
	Condenser undersized.	Check condenser rating against the operation.
Low Discharge Pressure	Suction shutoff valve partially closed	Open valve
	Insufficient refrigerant in system	Check for leaks. Repair and add charge.
	Low suction pressure	See corrective steps for low suction pressure below.
	Compressor operating unloaded	See corrective steps for failure of compressor to load.
	Condenser too large	Check condenser rating against the operation.
High Suction Pressure	Excessive load.	Reduce load or add additional equipment.
	Expansion valve overfeeding	Check remote bulb. Regulate superheat.
	Compressor unloaders open.	See corrective steps for failure of compressor to load.
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.
	Insufficient water flow	Adjust flow.
Compressor will not unload or load	Defective capacity control	Replace
	Faulty thermostat stage or broken capillary tube	Replace
	Stages not set for application	Reset thermostat setting to fit application.

Problem	Possible Causes	Possible Corrective Steps
Compressor Loading/ Unloading Intervals Too Short	Erratic water thermostat	Replace thermostat.
	Insufficient water flow	Adjust flow.
Little or No Oil Pressure	Clogged suction oil strainer	Clean strainer
	Excessive liquid in crankcase	Check crankcase heater. Reset expansion valve for higher superheat. Check liquid line solenoid valve operation.
	Oil pressure gauge defective	Repair or replace gauge. Keep valve closed except when taking reading.
	Low oil pressure safety switch defective	Replace switch
	Worn oil pump	Replace pump
	Oil pump reversing gear stuck in wrong position	Reverse direction of compressor rotation by switching compressor leads.
	Low oil level	Add oil
	Loose fitting on oil lines	Check and tighten system.
	Pump housing gasket leaks	Replace gasket.
	Flooding of refrigerant into crankcase.	Adjust thermal expansion valve.
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 no 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.
	Blown valve plate gasket	Replace gasket.
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 APPLIED AMERICAS INC.
LIMITED PRODUCT WARRANTY
(North America)

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

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

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

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

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

EXCEPTIONS

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

ASSISTANCE

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

SOLE REMEDY

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

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

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

Daikin Applied Training and Development

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

Warranty

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

Aftermarket Services

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

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

Products manufactured in an ISO Certified Facility.