YAZAKI

INSTALLATION INSTRUCTIONS

WFC-SC10, 20, 30, 50
WFC-SH10, 20, 30

Aroace

WATER-FIRED SINGLE-EFFECT ABSORPTION CHILLER

This product is a water-fired single-effect absorption unit which provides chilled water for cooling in central plant type air conditioning systems. WFC-SH model chiller-heaters also provide hot water for heating in two-pipe central plant type systems. Units with nominal refrigeration capacities of 10, 20, 30, and 50 tons are complete with operating and safety controls. The absorption chiller or chiller-heater is energized by a heat medium (hot water) from a process, cogeneration, solar, or waste heat source capable of providing a temperature range of 158 – 203°F (70 – 95°C).

CONTENTS

GENERAL

This equipment should only be installed by trained and qualified personnel who are familiar with absorption chillers. All precautions in these instructions, as well as on tags and labels attached to the unit, must be observed to ensure the safety of the personnel and maintain warranty validation.

Each Yazaki absorption chiller or chiller-heater has been evacuated, charged with lithium bromide and water solution, and run tested prior to leaving the factory.

Field wiring connections are located on the left side of the unit when facing the front of the unit, except on the WFC-SC50, which has them located at the rear of the unit. In all sizes, piping connections are all located at the rear of the unit.

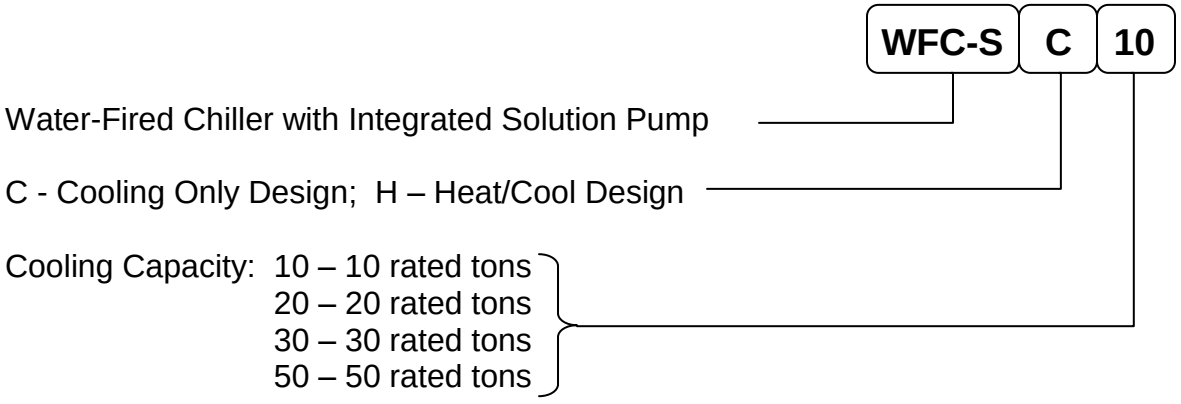
After the equipment has been installed, a Yazaki Authorized Service Provider (ASP) must check the installation and supervise or conduct the initial startup and operation of the unit.

CAUTION

THE YAZAKI WARRANTY WILL BE VOIDED IF THE FOLLOWING RESTRICTIONS ARE NOT OBSERVED:

1. DO NOT OPEN ANY SERVICE VALVES WITHOUT A PROPER EVACUATION ASSEMBLY ATTACHED TO THEM AS SUCH ACTION WILL RESULT IN LOSS OF VACUUM AND INTRODUCTION OF GASES TO THE INTERIOR OF THE MACHINE WHICH COULD CAUSE CORROSION.
2. ALWAYS HANDLE THE EQUIPMENT WITH CARE AND MAINTAIN IN A NEAR-VERTICAL POSITION DURING RIGGING. IF THE EQUIPMENT MUST BE TILTED, CAREFULLY FOLLOW INSTRUCTIONS PROVIDED WITHIN THIS DOCUMENT.
3. DO NOT ATTEMPT TO START THE SYSTEM WITHOUT SUPERVISION FROM A YAZAKI AUTHORIZED SERVICE PROVIDER (ASP).

MODEL DESIGNATION



ACCESSORIES

Provided with the Chiller/Chiller-Heater:

- ACT-3 Maintenance Checker (1)
- Eye bolts (4)
- Shims (6) {except on WFC-SC50}
- Installation Instructions (1)
- Operating Instructions (1)
- L-Anchor Plates {with WFC-SC50 Only}

Optional Accessories:

- Arotrend Remote Monitoring
- FS2 Cooling Water Flow Switch
- LON Adapter for BMS Interface
- WFC-S Service Manual
- WTI Inlet Chilled/Hot Water Sensor
- Heat Medium Bypass Valve Kits

STANDARD SPECIFICATIONS

Specifications			WFC-	SC10	SH10	SC20	SH20	SC30	SH30	SC50
Cooling Capacity			MBTUh (kW)	120.0 (35.2)		240.0 (70.3)		360.0 (105.5)		600.0 (175.8)
Heating Capacity			MBTUh (kW)	---	166.3 (48.7)	---	332.6 (97.5)	---	498.9 (146.2)	---
Chilled/Hot Water	Temperature	Cooling	°F (°C)	54.5 (12.5) Inlet / 44.6 (7.0) Outlet						
		Heating	°F (°C)	117.3 (47.4) Inlet / 131.0 (55.0) Outlet / {WFC-SH Models Only}						
	Evaporator Pressure Loss		PSI (kPa)	8.1 (55.8)		9.6 (66.2)		10.1 (69.6)		6.4 (44.2)
	Max Operating Pressure		PSI (kPa)	85.3 (588.1) / {High Pressure Option Available on WFC-SC50 only}						
	Rated Water Flow		GPM (l/s)	24.2 (1.5)		48.4 (3.1)		72.6 (4.6)		121.1 (7.6)
	Allowable Water Flow Range		% of Rated	80% - 120%						
	Water Retention Volume		Gal (liters)	4.5 (17.0)		12.4 (46.9)		19.3 (73.1)		33.6 (127.2)
Cooling Water	Heat Rejection		MBTUh (kW)	291.4 (85.4)		582.8 (170.8)		874.2 (256.2)		1457.0 (427.0)
	Temperature	Cooling	°F (°C)	87.8 (31.0) Inlet / 95.0 (35.0) Outlet						
	Absorber Pressure Loss		PSI (kPa)	12.3 (84.8)		6.6 (45.5)		6.7 (46.2)		6.6 (45.3)
	Condenser Pressure Loss		PSI (kPa)	Included in Absorber		6.6 (45.5)		6.7 (46.2)		3.2 (21.9)
	Max Operating Pressure		PSI (kPa)	85.3 (588.1) / {High Pressure Option Available on WFC-SC50 only}						
	Rated Water Flow[1]		GPM (l/s)	80.8 (5.1)		161.7 (10.2)		242.5 (15.3)		404.5 (25.5)
	Allowable Water Flow Range		% of Rated	100% - 120%						
	Water Retention Volume		Gal (liters)	17.4 (65.9)		33.0 (124.9)		51.3 (194.2)		87.2 (330.1)
Heat Medium	Heat Input		MBTUh (kW)	171.4 (50.2)		342.8 (100.5)		514.2 (150.7)		857.0 (251.2)
	Temperature		°F (°C)	190.4 (88.0) Inlet / 181.4 (83.0) Outlet						
	Allowable Temperature Range		°F (°C)	158.0 - 203.0 (70.0 - 95.0)						
	Generator Pressure Loss		PSI (kPa)	13.1 (90.3)		6.7 (46.2)		8.8 (60.7)		13.6 (93.7)
	Max Operating Pressure		PSI (kPa)	85.3 (588.1) / {No High Pressure Option}						
	Rated Water Flow		GPM (l/s)	38.0 (2.4)		76.1 (4.8)		114.1 (7.2)		190.4 (12.0)
	Allowable Water Flow Range		% of Rated	30% - 120%						
	Water Retention Volume		Gal (liters)	5.5 (20.8)		14.3 (54.1)		22.2 (84.0)		39.7 (150.3)
Electrical	Power Supply			208 volts AC / 60 Hz / 3-Phase						
	Consumption[2]		Watts	210		260		310		670
	MCA		Amps	0.6		0.9		2.6		4.7
	MOCP		Amps	15						
Construction	Dimensions[3]	Width	Inches (mm)	29.9 (760)		41.7 (1060)		54.3 (1380)		70.3 (1785)
		Depth	Inches (mm)	38.2 (970)		51.2 (1300)		60.8 (1545)		77.2 (1960)
		Height	Inches (mm)	74.8 (1900)		79.1 (2010)		80.5 (2045)		82.1 (2085)
	Weight	Dry	lbs (kg)	1100 (500)		2050 (930)		3200 (1450)		4740 (2150)
		Operating	lbs (kg)	1329 (603)		2548 (1155)		3975 (1800)		5955 (2700)
	Noise Level		dB(A)	49				46		51
Piping	Chilled/Hot Water		Inches	1-1/2 NPT		2 NPT				3 NPT
	Cooling Water		Inches	2 NPT				2-1/2 NPT		3 NPT
	Heat Medium		Inches	1-1/2 NPT		2 NPT		2-1/2 NPT		3 NPT

Note: All metric values are calculated from the Imperial values and are only approximate values.

1 - Minimum cooling water flow is 100%.

2 - Power consumption does not include external pumps or motors.

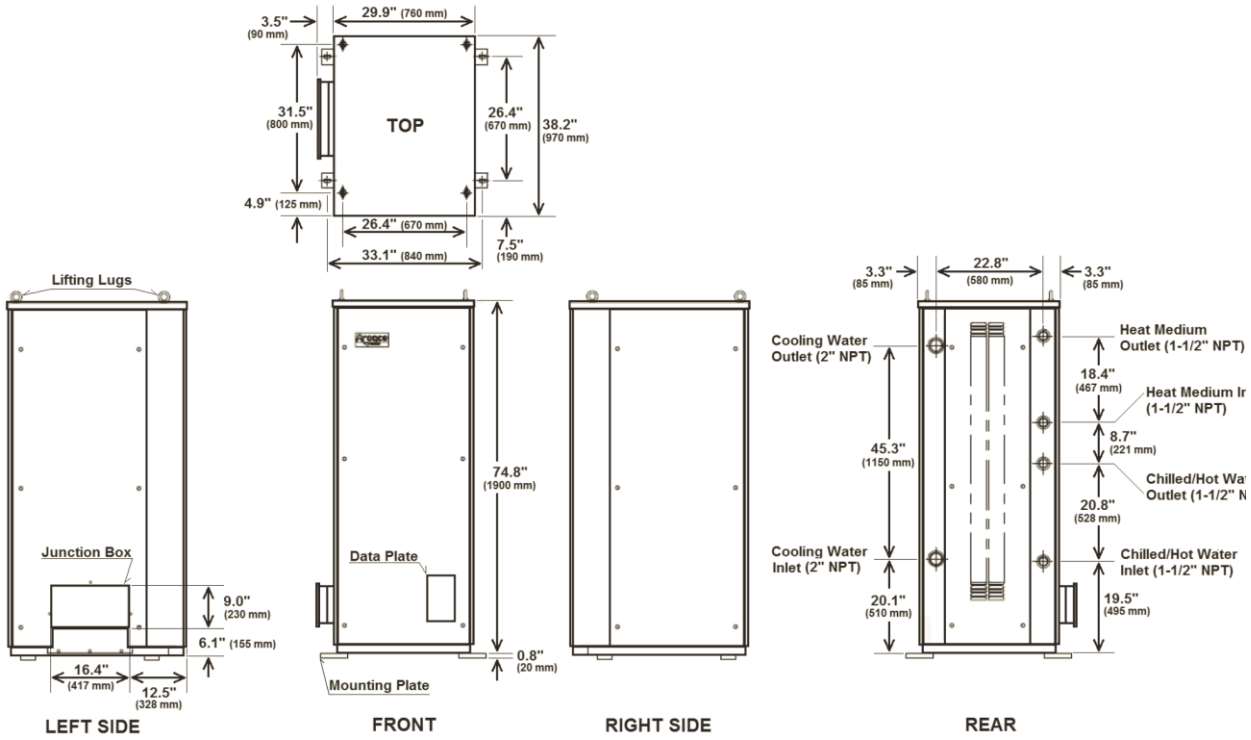
3 - Width/Depth does not include the junction box or mounting plates. Height does not include the removable lifting lugs but does include level bolts.

Table 1 - Specifications

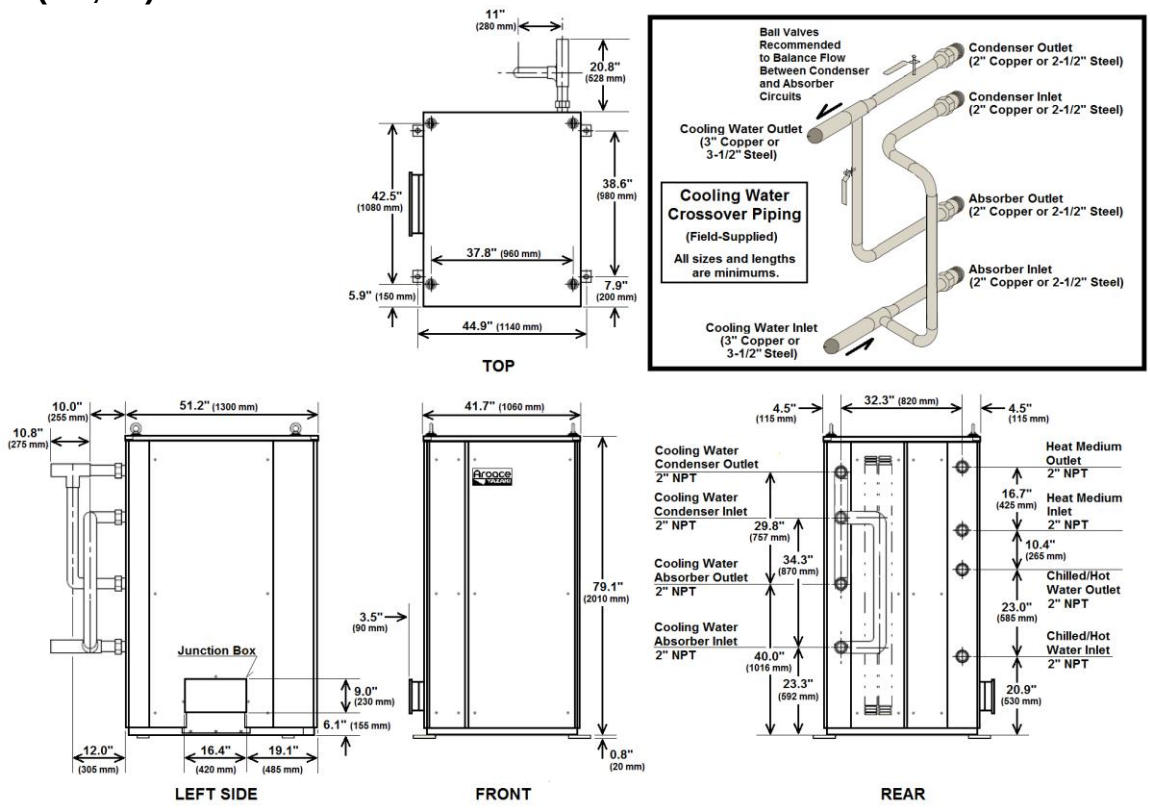
EQUIPMENT DIMENSIONS

(Drawings are not to scale)

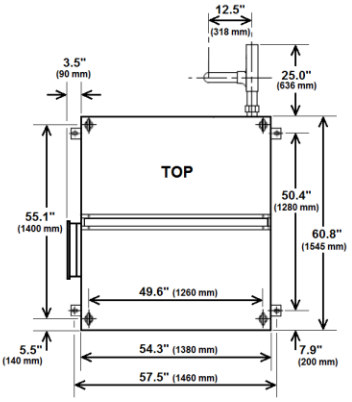
WFC-(SC,SH)10

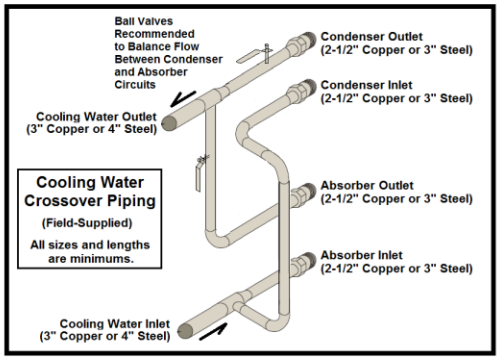


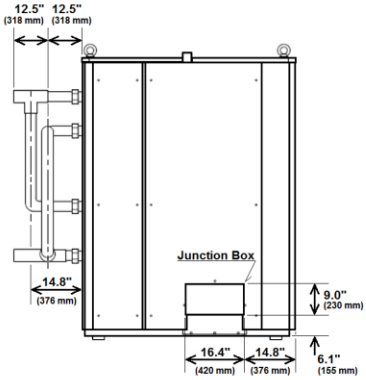
WFC-(SC,SH)20



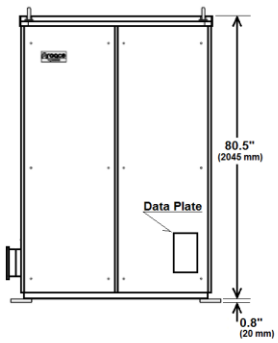
WFC-(SC,SH)30



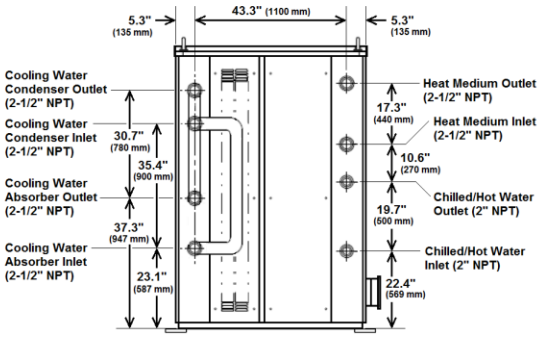




LEFT SIDE

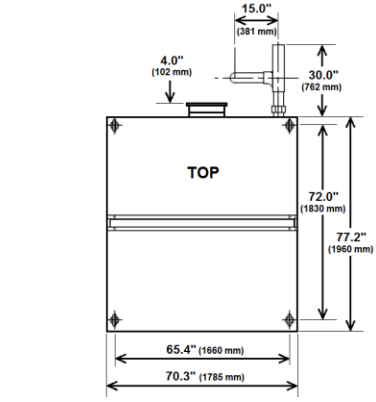


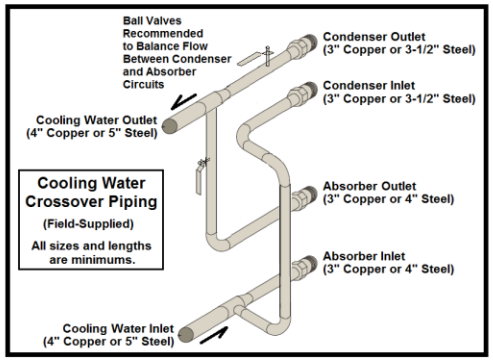
FRONT

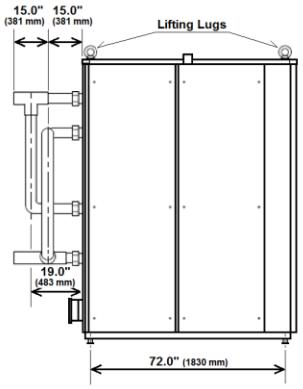


REAR

WFC-SC50







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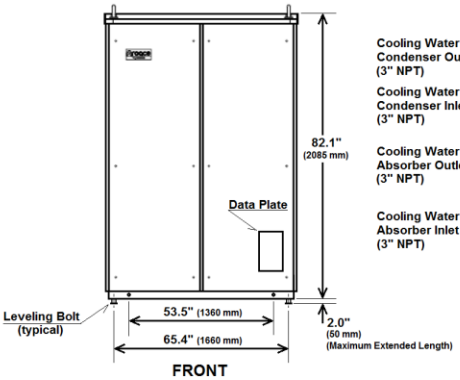
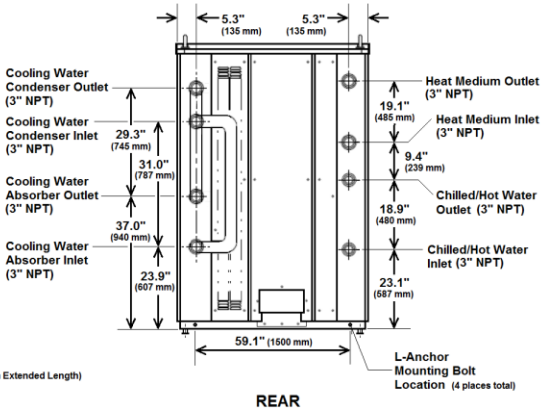


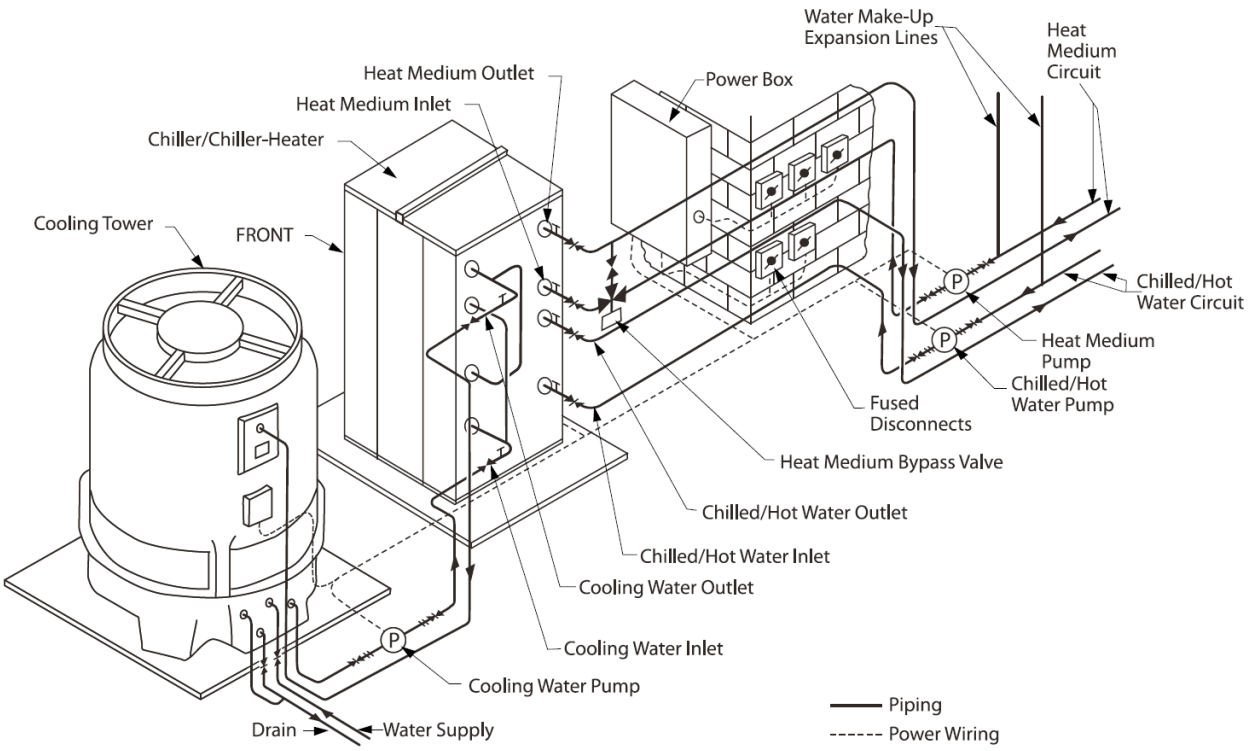
FRONT



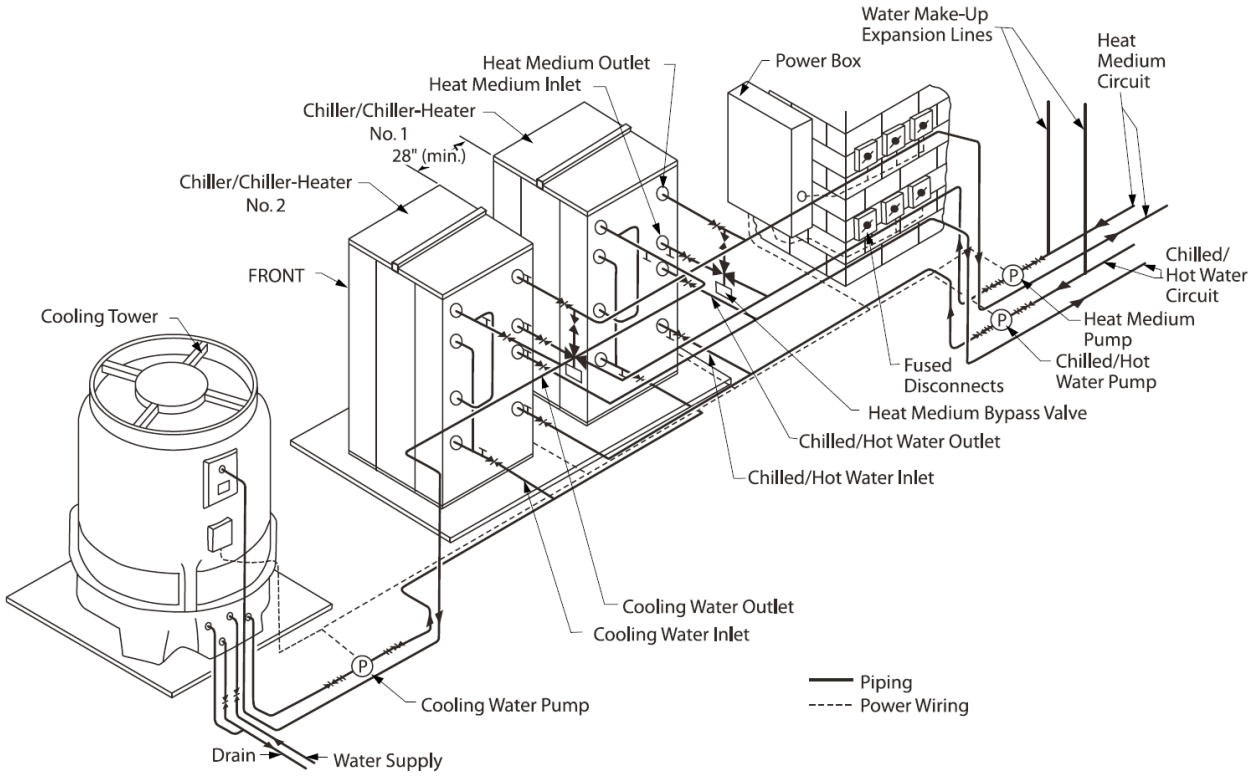
REAR

TYPICAL SYSTEM DESIGN

EXAMPLE OF A SINGLE MODULE



EXAMPLE OF MULTIPLE MODULES



WIRING DIAGRAMS

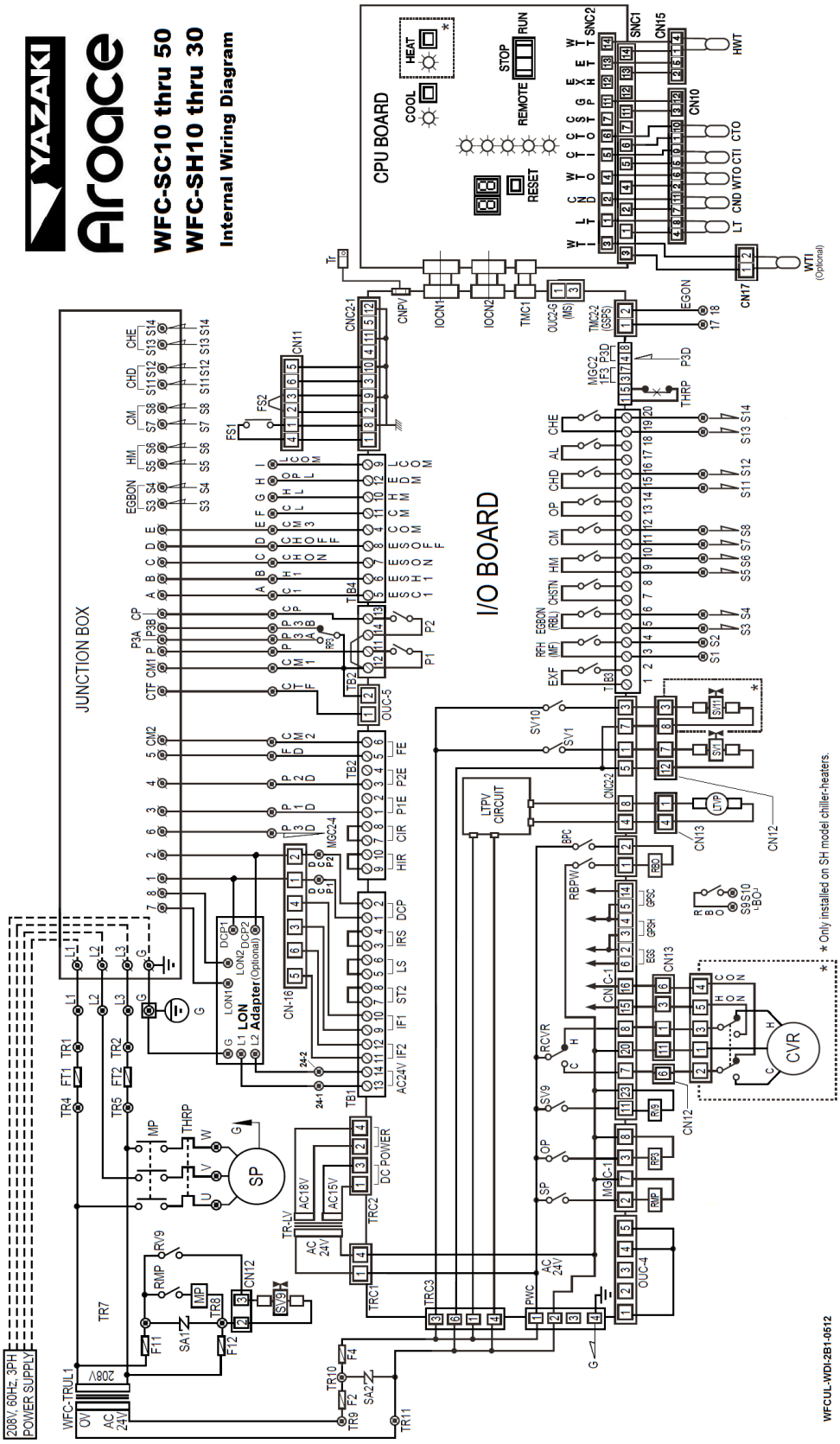


Figure 1 – Internal Wiring Diagram

TERMINALS

SYMBOL	LOCATION	REMARKS
	Control Box	
	Junction Box	Field wiring connections
	Control Box (I/O Board)	
	Molex Connector	

STANDARD JUNCTION BOX CONNECTIONS

TERMINAL	DESCRIPTION	REMARKS
3 (P1E)	Chilled/hot water pump safety interlock	Safety interlocks MUST be connected or the unit will lock out with pump/fan error codes.
4 (P2E)	Cooling water safety interlock	
5 (FE)	Cooling tower fan safety interlock	
6 (P3E)	Heat medium pump safety interlock	
CM1	Common to terminals CP, CTF, P, P3A, P3B	No voltage supplied by WFC-S unit on this terminal
CM2	Common to terminals 3, 4, 5, 6	WFC-S unit supplies 15vdc on this terminal
CP (P2)	Cooling water pump demand	Dry contacts, 24v, 60va max load
P (P1)	Chilled/hot water pump demand	
P3A	Heat medium bypass valve – demand position	
P3B	Heat medium bypass valve - bypass position	
S3, S4	Heat medium pump demand	

SOLUTION PUMP OVERLOAD SETTINGS

SYMBOL	WFC MODEL (*208 Volts AC)			
	SC/SH10	SC/SH20	SC/SH30	SC50
THRP	0.4	0.7	2.0	4.5

*Power supply tolerance is +10%, -5%

FUSE RATING

SYMBOL	AMPS (A)	REPLACEMENT
F2	3	Bussman GLQ-3 or GMQ-3.2, rated 300vac
F4, F11, F12	2	Fuji FGAO-2, rated 250vac
FT1, FT2	5	Fuji FGAO-5, rated 250vac

INTERNAL WIRING

SYMBOL	DESCRIPTION	REMARKS
CTI	Cooling water inlet temperature sensor	
CVR	Changeover valve	Only on SH models
F2, F4, F11, F12, FT1, FT2	Fuses	Refer to Fuse Rating Table
FS1	Chilled/hot water flow switch	
HWT	Heat medium temperature sensor	
LT	Evaporator temperature sensor	
LTPV	Refrigerant proportional control valve	
MP	Solution pump motor contactor	
RMP, RP3, RV9, RBO	Control relays	5 amp, 250v max load
SA1, SA2	Surge absorbers	
SP	Solution pump	
SV1	Evaporator freeze protection valve	
SV9	Concentrated solution bypass valve	
SV11	Refrigerant drain valve	Only on SH models
THRP	Solution pump thermal overload	
TR-LV	Low voltage transformer	24vac primary / 18, 15vac dual secondary
WFC-TRUL1	Class 2 transformer	208vac primary / 24vac secondary
WTO	Leaving chilled/hot water temp sensor	

OPTIONAL JUNCTION BOX CONNECTIONS

TERMINAL	DESCRIPTION	REMARKS
1, 2 (DCP)	Arotrend Remote Monitoring connection	For use with **Optional** Arotrend System
7, 8	LON Adapter connection	For use with **Optional** Factory-Installed LON Adapter
A (C1)	Remote cool mode selection	Remote control (BMS) interface. ONLY USE DRY CONTACTS to control these signals!
B (H1)	Remote heat mode selection	
C (CHON)	Remote "Enable" signal	
D (CHOFF)	Remote "Disable" signal	
E (CM3)	Common for A, B, C, D	The WFC-S unit outputs 15vdc on this terminal
CTF	Cooling tower fan cycling control	Dry contacts. 24v, 60va max load.
S5, S6	Heat mode feedback relay	
S7, S8	Cool mode feedback relay	
S11, S12	"Enabled" mode feedback relay	
S13, S14	Alarm feedbackrelay	

OPTIONAL CONTROL BOX CONNECTIONS

TERMINAL	DESCRIPTION	REMARKS
2, 3 on CN11 (FS2)	Cooling water flow switch	Field-installed option
S9, S10 (BO)	Auxiliary boiler control relay	Dry contact, 24v, 60va max load. Closes at 185°F (85°C), Opens at 194°F (90°C).
TB1-7, TB1-8 (ST2)	Safety shut down	Shuts unit down in under 6 seconds. Configurable for NC or NO contacts.

TERMINAL	DESCRIPTION	REMARKS
TB1-9, TB1-10 (IF1)	Chilled/hot water circuit freeze protection logic	If the terminals are jumped, the WFC-S unit will use its internal freeze protection logic to turn on pumps when the fluid circuit is sensed to be approaching freezing.
TB1-11, TB1-12 (IF2)	Cooling water circuit freeze protection logic	
TB3-7, TB3-8 (CHSTN)	"Disabled" feedback relay	Dry contact, 24v, 60va max load.
TB3-17, TB3-18 (AL)	Alarm	

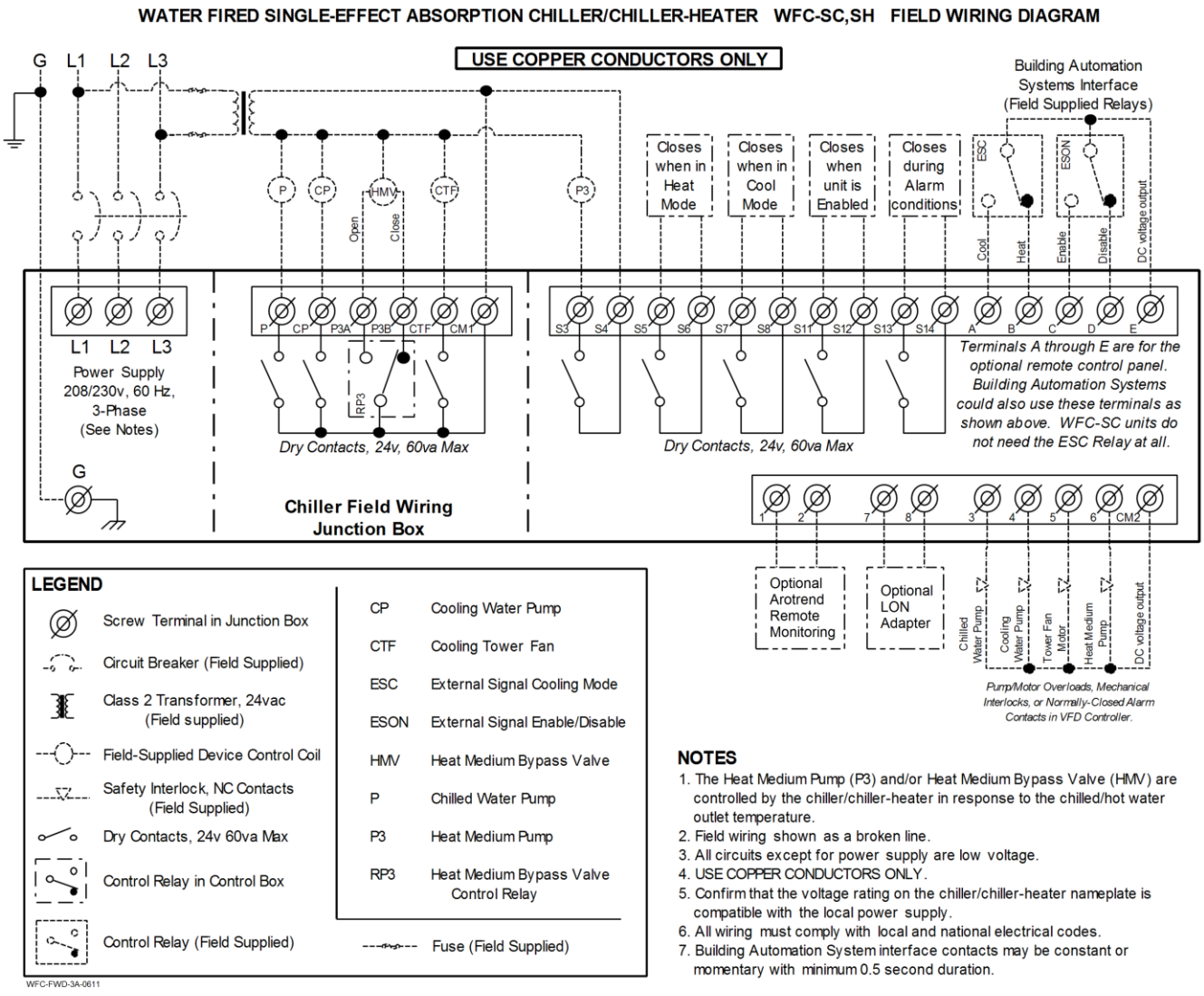


Figure 2 – Controls Wiring Diagram

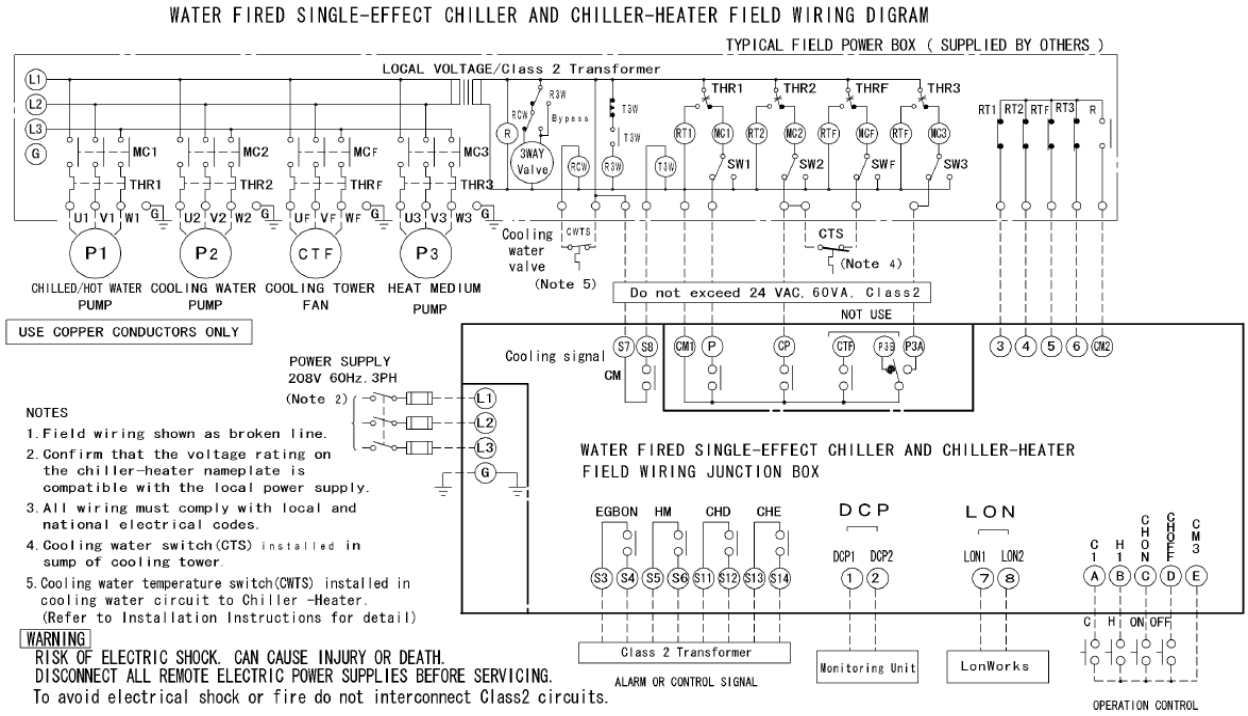
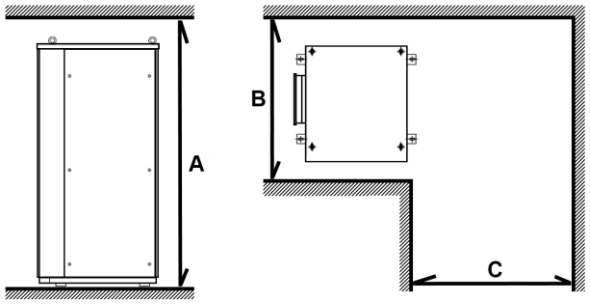


Figure 3 – Field Wiring Diagram as Supplied in the Junction Box

INSTALLATION

RIGGING AND MOVING

When the absorption chiller or chiller-heater is delivered, it should be inspected for transit damage. Should any damage be found, do not proceed with installation until the Yazaki distributor has been notified and any required remedial actions have been completed.



	WFC MODEL - Inches (mm)			
	SC/SH10	SC/SH20	SC/SH30	SC50
A	93 (2060)	98 (2490)		100 (2540)
B, C	63 (1600)	75 (1900)	88 (2235)	102 (2590)

Table 2 – Hallway Clearances

Remember to properly plan the route to the installation site. Also, keep in mind when choosing the site that the unit will someday have to be removed, so be mindful of permanent and semi-permanent barriers.

The Yazaki chiller-heater is designed for overhead rigging with lifting lugs provided from the factory.

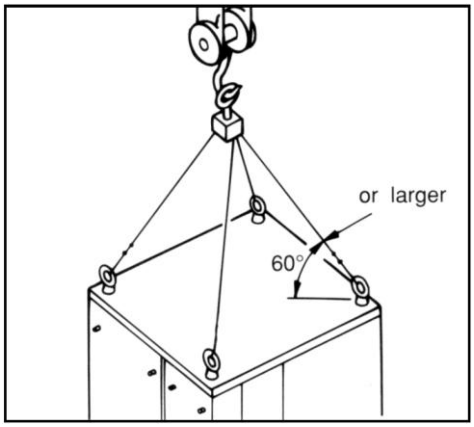


Figure 4 – Rigging

When rigging for overhead lift, attach shackle bolts to the lifting lugs. Bring the four individual rigging cables together at a point high enough that the angle between the rigging line and the top of the unit is no less than 60°, as shown in the Figure 4. This will require cable lengths a minimum of 36" (1m) for all sizes except the WFC-SC50 which will require 48" (1.3m) cable length.

There are times when the unit simply cannot be moved to the final installation site while remaining in the vertical position. It is be permissible to lay the unit on its side, so long as proper precautions and guidelines are followed.

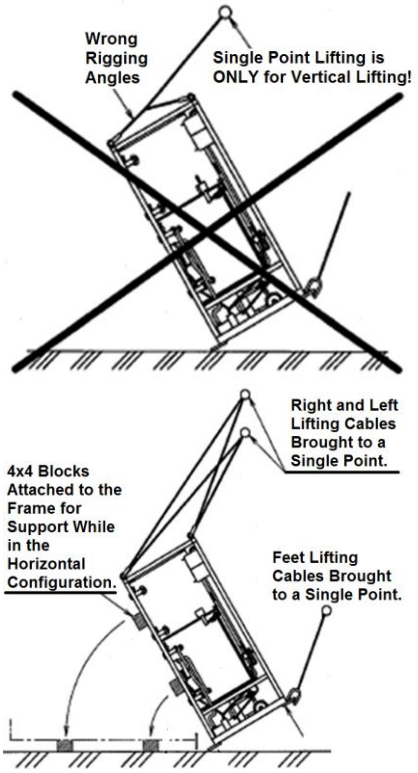


Figure 5 – Laying the Unit on its Side

1. **<u>Transport by vehicle ONLY with the unit in vertical configuration.</u>** *<u>THERE IS NO ALTERNATIVE.</u>* Transport by vehicle over roadway while the unit is not in the vertical configuration will void the warranty.
2. The unit may <u>ONLY</u> lay onto its back - the side with the water connections. It may <u>NOT</u> lay on any other side!
   a. While on its back, the water piping acts as legs to support the internal tubing bundles. On any other side, the tubing bundles will not be properly supported and may shift or become severely damaged, rendering the machine inoperable.
3. Do not simply tip the unit over onto its back. It should be lifted and turned to the horizontal configuration while fully supported and suspended, though it only need be barely off the ground while turning.
4. DO NOT lay the unit directly onto the ground in a manner that will allow the water connections support the weight of the unit. Attach 4x4 blocks or timbers to the frame for support in the horizontal configuration.
5. DO NOT USE A SINGLE POINT LIFTING when laying the unit onto its side. At least THREE lifting points will be necessary.

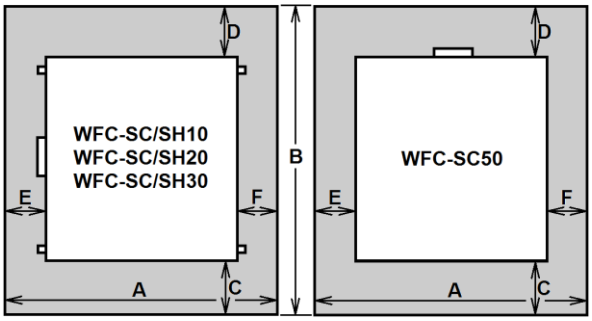
<u>To properly lay the unit onto its side:</u>

1. Remove all cabinet panels in order to prevent damage to them.
2. Attach 4x4 blocks or timbers to the rear frame to act as support feet while the unit is in the horizontal configuration.
3. Attach two rigging cables to the unit feet across the front of the unit. Bring these cables to a single point, maintaining a minimum of 60° between unit and cable.
4. Attach two rigging cables to the left side lifting lugs. Bring these cables to a single point.
5. Attach two rigging cables to the right side lifting lugs. Bring these cables to a single point.
6. Using these three points, lift the unit slightly off the ground, using the lifting cables on the feet to rotate the unit onto its back. Use the right and left side lifting cables to control the sideways rotation.
7. Once the unit is in the horizontal configuration, let it gently rest on the blocks that were attached during step 2.
8. Once the unit is to be turned back to the vertical configuration, it is preferable that the unit again be lifted and rotated in the same manner as described above. However, in cases where mechanical lifting is not available at the installation site, the unit CAN tilted over onto its feet.
   - **Do not let the unit fall hard onto its feet.**
   - **Do not allow the feet to become deformed.**

Be mindful of the considerable mass of the unit (refer to the Specifications page). Using human power alone to tip the unit is not advised as it could become a very dangerous and <u>potentially deadly</u> procedure.

LOCATION AND CLEARANCES

Particular care must be taken when placing the machine so as to provide adequate clearance for access to each side of the machine. Maintenance is mostly done through the front of the unit, but in a repair scenario, any panel on any side may need to be removed to access components behind them. The minimum space requirements shown below must be provided around and above each unit for installation and service access.



Unit WFC-	Installation Area		Maintenance Clearances			
	A	B	C (Front)	D (Back)	E (Left)	F (Right)
SC10	67.9" (1725 mm)	116.2" (2952 mm)	39" (1000 mm)	39" (1000 mm)	28" (700 mm)	10" (250 mm)
SC20	79.7" (2025 mm)	129.2" (3282 mm)				
SC30	92.3" (2345 mm)	141.0" (3582 mm)				
SC50	126.1" (3203 mm)	154.8" (3932 mm)				28" (700 mm)
SH10	85.9" (2182 mm)	116.2" (2952 mm)				
SH20	97.7" (2482 mm)	129.2" (3282 mm)				
SH30	110.3" (2802 mm)	141.0" (3582 mm)				

Table 3 – Required Installation Area and Maintenance Clearances

FOUNDATION

All aspects of foundation and support computations must be in accordance with national and local codes.

The chiller must be mounted on a level, non-combustible foundation capable of supporting the considerable weight of the machinery. This is particularly important for rooftop installations. Always make certain the structure can support not only the full mass of the chiller, but also the pumps, piping, cooling towers, etc. as may be required. The rooftop area should be well-drained and be at least 7 feet (2m) from the edge of the roof. Anti-fall measures should always be taken if the chiller is installed within 12 feet (4m) of the roof edge.

Additionally, for protection of the roofing material, it is recommended a suitable platform or walkway be provided around all sides of the unit.

If the chiller is to be installed outside, but at ground level, make certain the concrete base and the soil beneath are sufficient for the task. Settling over time could cause the unit to become un-level, which could have a serious, negative impact on the performance and lifespan of the unit. Concrete foundations are recommended to be sized so that it extends at least 12" (300 mm) beyond the unit in all directions in order to accommodate potential mounting and anchoring hardware.

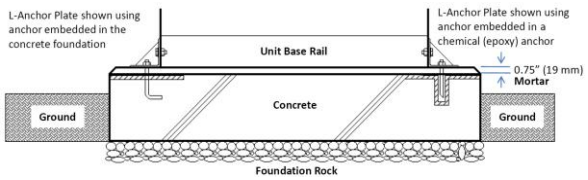
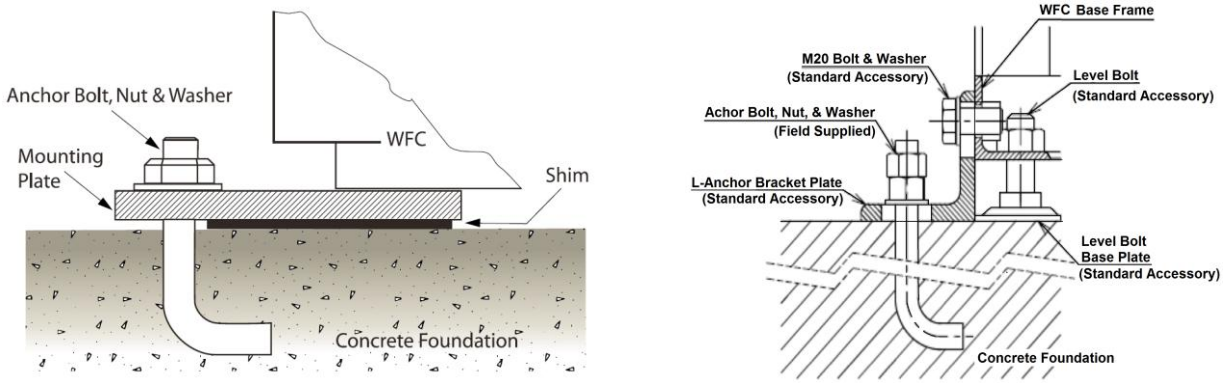


Figure 6 – Foundation Detail



WFC-(SC,SH)10, 20, 30 **WFC-SC50 Units Only**

Figure 7 – Securing the Unit to the Foundation

LEVELING

WFC-S Series units must be level in order for the fluids to be distributed properly over their respective tube bundles. There is a level bar mounted on the front of the main vessel of the machine, right above the control box.

The unit must be level to both the longitudinal and transverse alignments. It is essential that all leveling be completed before any piping connections are attempted.

Leveling of the unit is typically accomplished by use of factory-supplied metal shims, except for the WFC-SC50 which uses level bolts instead. In cases where the unit is required to be secured to the pad, anchor bolts, nuts, and washers must be field-supplied.

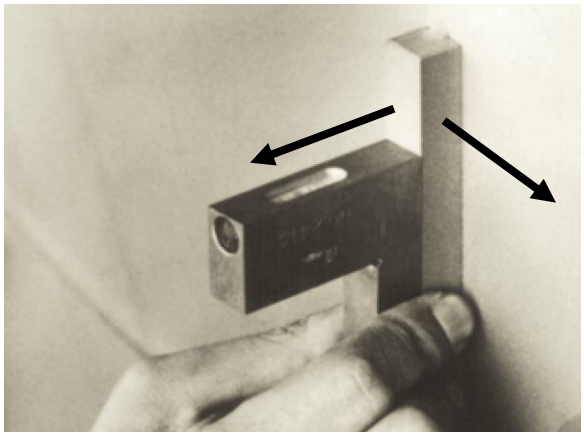


Figure 8 – Level Bar

PIPING

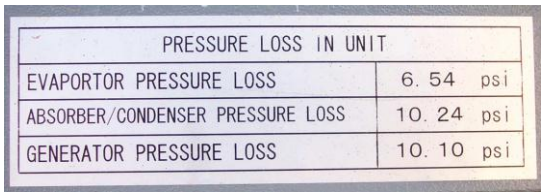
After the chiller has been leveled properly, the piping for the chilled water, cooling water, and heat medium circuits may be installed. Piping should be arranged so that there is no interference with service access or panel removal and should be adequately supported and braced independently of the unit so as to avoid undue strain on the unit piping connections. Maximum allowable pressure in any fluid circuit is 85.3 PSI (588 kPa).

Piping rules and conventions used with Yazaki chillers and chiller-heaters are exactly the same as those used with any other type of chiller; therefore, this installation manual will not delve deeply into piping design.

Thermo-wells, pressure gauges, etc. may be installed at the inlet and/or outlet of each fluid circuit connection to facilitate startup and future routine maintenance. Strainers in each circuit, particularly the cooling water circuit, are recommended as well. These should be placed before the inlet connection of the pump. Also, ensure that unit panels are not restricted by the pipe insulation.

When setting the flow through each fluid loop, consult the Pressure Loss in Unit tag, located on the frame just below and to the left of the control panel. This tag often shows values that are different than submittals or spec sheets, including the ones

in this document. The values on the tag must be used in lieu of any other values. During the run test at the factory, the pressure drop listed on this tag was observed to be the exact pressure drop of the unit when all other conditions were at the design conditions. Each chiller in a group may have individual and unique values as no two tubing bundles are exactly alike.



PRESSURE LOSS IN UNIT	
EVAPORTOR PRESSURE LOSS	6.54 psi
ABSORBER/CONDENSER PRESSURE LOSS	10.24 psi
GENERATOR PRESSURE LOSS	10.10 psi

Figure 9 – Example of the Pressure Loss in Unit Tag

When setting proper flow rates through a fluid loop, it will be necessary to measure the pressure at both the inlet and the outlet of the same circuit, and then subtract the higher value from the lower value. The result is the pressure drop through that circuit. The target pressure drop is the value listed on the Pressure Loss in Unit tag (see Figure 9). In order to ensure proper flow through the fluid circuits, make certain the pressure drop through the loop is equal to or slightly greater than the value listed on the Pressure Loss in Unit tag.

Each inlet and outlet tube has a pressure test needle valve installed into it. This needle valve has a special metric flare connection so it requires a specialized tool, available from Yazaki, in order to access the fluid circuit for pressure readings.

As an alternative, there is an accessory kit available to replace the metric flare needle valves with ¼" SAE flare valves. It may also be possible to procure ¼" SAE flare needle valves locally for the purpose.

FLOW SWITCH

The factory-installed flow switch is shipped disconnected from the water piping in order to help prevent damage during shipment. After the factory run test is completed, the flare nuts that connect the water pipes to the differential pressure flow switch are disconnected and plugged with a small plastic cap.

One of steps of the installation process is to locate the flow switch, remove the plastic plugs, and attach the flare nuts to the flow switch once again. If this step is forgotten, then water will leak from these pipes as the fluid circuit is being filled.

The flow switch must be set in order to perform properly. In order to set the switch, reduce the pressure drop through the chilled/hot water circuit to ½ of the value listed on the Pressure Loss in Unit tag, adjust the flow switch until it opens at this pressure setting, then restore the chilled/hot water circuit to the normal pressure drop. This method will test simultaneously set up the flow switch as well as test its function.

CHILLED/HOT WATER PIPING

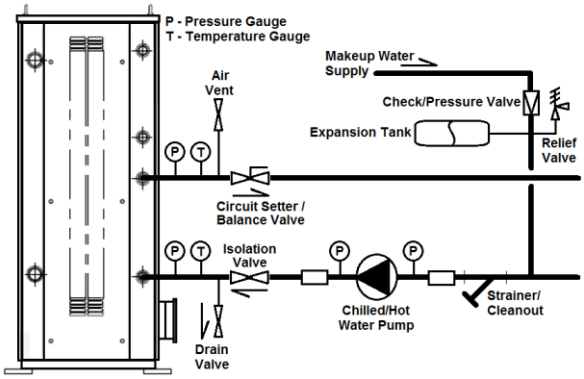


Figure 10 – Chilled Water Piping

CAUTION

1. DO NOT EXCEED 80 – 120% OF STANDARD CHILLED WATER FLOW.
2. DO NOT EXCEED 85.3 PSI (588 kPa) IN THE CHILLED WATER CIRCUIT AT THE ABSORPTION CHILLER.
3. DO NOT INSTALL ANY VALVES IN THE EXPANSION LINE.

A balance valve should be installed at the chilled water outlet and a stop valve should be installed at the chilled water inlet.

After thoroughly testing for leaks, insulate the piping circuit, ensuring an adequate vapor barrier is obtained. Be sure to allow access to any valves, wells, and ports that may be present.

COOLING WATER PIPING

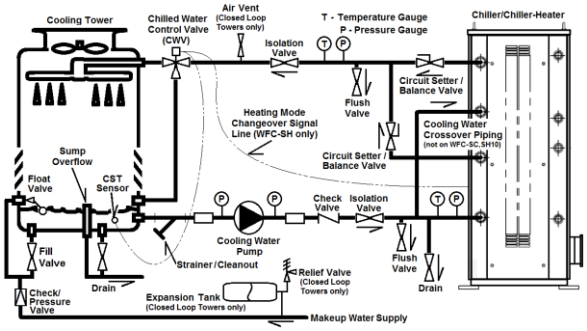


Figure 11 – Cooling Water Piping

CAUTION

1. DO NOT EXCEED 100 – 120% OF STANDARD COOLING WATER FLOW.
2. DO NOT EXCEED 85.3 PSI (588 kPa) IN THE COOLING WATER CIRCUITS AT THE ABSORPTION CHILLER.
3. DO NOT INSTALL ANY VALVES IN EXPANSION LINES, WHEN USED.

If possible, the cooling tower should be installed at the same level or above the level of the chiller-heater. If this is not possible, give careful consideration to the prevention of drain-back and loss of cooling water due to overflow of the tower. Such matters must be given prior consideration by the design engineer.

As with the chilled water connections, a balance valve should be installed on the cooling water outlet and a stop valve installed on the cooling water inlet. Both valves should be in close proximity to the chiller. After thoroughly testing for leaks, insulate the piping circuit, ensuring an adequate vapor barrier is obtained. Be sure to allow access to any valves, wells, and ports that may be present.

Additionally, there should be flush and drain valves installed between the machine and the balance/stop valves so as to allow for flushing of the absorber-condenser coils should it ever become necessary.

One important element in the cooling water piping is the Cooling Water Crossover (not used on 10 ton units). This is always field-supplied. It is recommended that balance valves be installed on the outlets of both the Condenser and Absorber in order to be able to properly balance the flow through each tubing bundle in accordance to the Pressure Drop in Unit tag. The crossover tubing sizes are listed below.

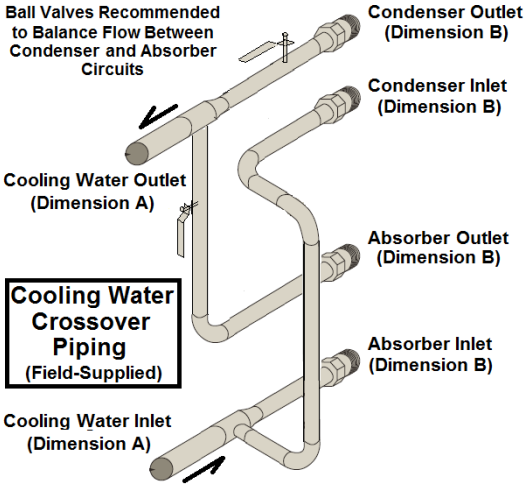


Figure 12 – Crossover Piping

MODEL WFC-	COPPER TUBING		STEEL TUBING	
	A	B	A	B
SC/SH20	3"	2"	3-1/2"	2-1/2"
SC/SH30	3"	2-1/2"	4"	3"
SC50	4"	3"	5"	3-1/2"

If piping size reduction is required, it should be done at the unit.
All sizes listed are minimum sizes.

Table 4 – Crossover Piping Tube Sizes

CROSSOVER PIPING NOTES:

1. Installing flow balancing valves in each circuit outlet is recommended.
2. Install cooling water flow valves at least 5 pipe diameters upstream and/or downstream of their respective "T" fittings.
3. The crossover pipe configuration must allow for clear access to the rear of the chiller for maintenance.

HEAT MEDIUM PIPING

The Heat Medium Piping contains the hot water to drive the absorption system. Provided this water remains between 158-203°F (70-95°C), refrigerant vapor can be generated in a usable quantity. If a mixing valve is to be used to control this temperature, IT MUST NOT BE COMBINED WITH THE HEAT MEDIUM BYPASS VALVE. It MUST be a separate and distinct control.

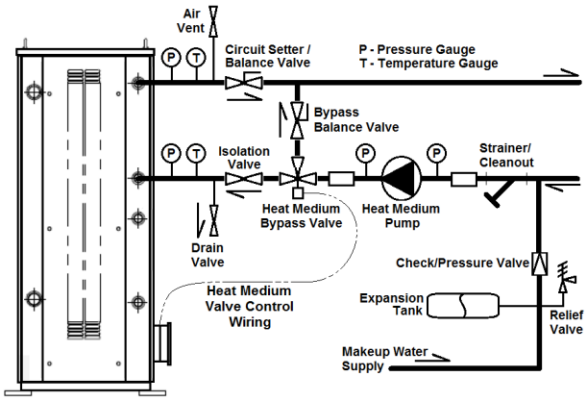


Figure 13 – Heat Medium Piping

CAUTION

1. DO NOT EXCEED 30 – 120% OF STANDARD HEAT MEDIUM FLOW.
2. DO NOT EXCEED 85.3 PSI (588 kPa) IN THE HEAT MEDIUM CIRCUIT AT THE ABSORPTION CHILLER.
3. DO NOT INSTALL ANY VALVES IN THE EXPANSION LINE.

The key device required for the proper operation of the unit is a Heat Medium Bypass Valve. When the unit requires heat medium, it will send a signal to this valve to open. When the unit does not require heat medium, for whatever reason, this valve will be commanded to move into bypass position.

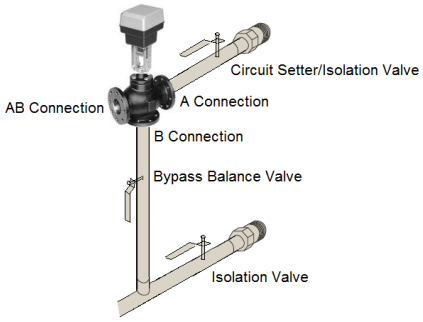


Figure 14 – Heat Medium Bypass Valve (HMV) Installation

Valves and actuators are available in accessory kits and those kit items are used in the illustration in Figure 14. The fact that a particular brand or type of valve and actuator is used in the accessory kit should not be taken as an endorsement or preference for the brand of components used in the accessory kit. Specific wiring instructions are included in the accessory kit.

A balancing valve should be installed at the heat medium outlet to facilitate flow rate adjustments. An isolation valve should be installed at the heat medium inlet and must remain fully open at all times when the unit is intended to operate.

A balancing valve, usually a ball valve, should be used in the bypass line. This valve should be used to set the pressure drop through the bypass line to be equal to the pressure drop through the heat medium circuit of the unit.

AFTER LEAK TESTING, insulate the piping to help prevent heat loss. Ensure that all stop valves, balancing valves, and thermowells are accessible.

FREEZE PROTECTION

When the chiller/chiller-heater and/or associated piping are installed in a location that may be subjected to freezing conditions, appropriate freeze protection steps must be taken. Many methods are available but the most common method is the use of glycol. Glycol may be permitted for use in Yazaki chiller-heaters with certain precautions:

1. Do not use automotive glycol (Antifreeze) since it may contain chemical additives that could be inappropriate and potentially damaging to the Yazaki chiller-heater. Use only glycol appropriate for use with copper tubing and brass fittings.

Exception: The heat medium circuit is constructed of stainless steel so glycol used in this circuit must not corrode that material. There is no copper or brass in this circuit.

2. Do not exceed a mixture of 50% by weight.

3. Be aware that loss of performance will result when glycol is used. The impact can become very significant.

4. Propylene Glycol is preferred over Ethylene Glycol. There is little difference in anti-freeze characteristics, PG is non-toxic, and PG is also less viscous than EG, reducing the required pump power.

5. Use of glycol can cause the unit to operate at higher internal temperatures. This may cause faster depletion of inhibitor than what may be perceived as normal.

ELECTRICAL

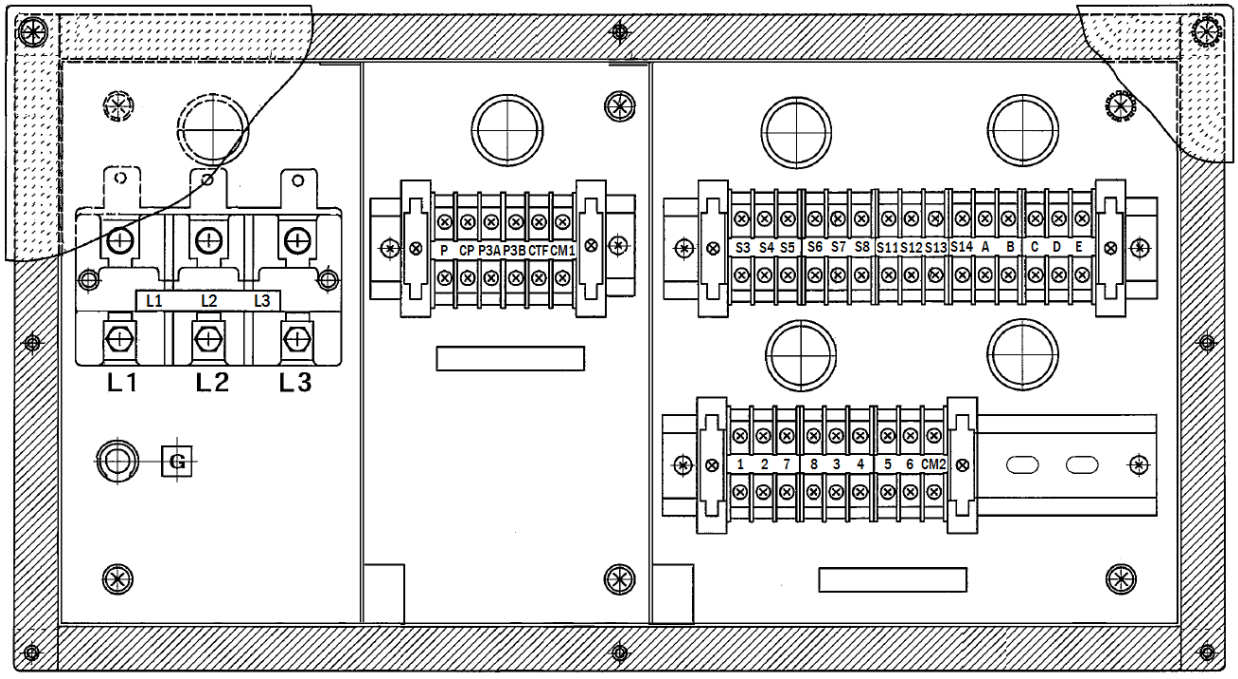


Figure 15 – Junction Box

Each absorption chiller/chiller-heater is factory-wired for the specific voltage listed on the Unit Nameplate. The standard field wiring connections are provided in the junction box located on the left side of the unit on all models except for the WFC-SC50 model which has the junction box located at the back.

Optional field wiring connections for accessories and alarms are provided in the junction box as well as in the control box.

All absorption chillers/chiller-heaters must be electrically grounded and field wiring installed in accordance with the National Electrical Code (NFPA 70, latest edition).

HIGH VOLTAGE CONNECTIONS

The high voltage wiring should connect to L1, L2, L3, and G in the left section of the junction box, shown in Figure 15.

Check the voltage of each leg to ground. Whichever leg has the greatest deviation from the other two legs (the high leg or "wild" leg) should be terminated on L2.

Use of phase-monitors to protect the motor of the solution pump is recommended in areas where power supply voltage is known to be unstable.

Phase rotation should be checked at these terminations as well. A phase rotation meter is recommended to be used since the amp draw of the solution pump is so low that it is difficult to use that to determine proper loading of the pump motor. While almost any brand of phase rotation meter will do, the Hioki 3126 is suggested.

Figure 16 – Hioki 3126 Rotation Meter

The proper rotation by rotation meter is Clockwise. If the rotation detected is incorrect, reverse the rotation by turning off power to the unit, swapping the wires terminating at L1 and L3, turning power back onto the unit, and verifying proper rotation.

CONTROLLING PUMPS AND VALVES

The unit logic should control the pumps and/or heat medium bypass valve rather than any remote system such as BMS. Field-supplied voltage is provided to terminal CM1 in the junction box. This voltage is then controlled through dry-contact relays by the unit logic. See Figure 3 – Controls Wiring Diagram for further details.

1. **Chilled Water Pump Control:** The unit logic will output the voltage provided to terminal CM1 to terminal P when the chilled/hot water pump is demanded.
2. **Cooling Water Pump Control:** The unit logic will output the voltage provided to terminal CM1 to terminal CP when the cooling water pump is demanded.
3. **Heat Medium Pump Control:** To control the heat medium pump, use the dry contact terminals S3 and S4 in the right section of the junction box. A jumper may be placed between CM1 and S3 if necessary to provide voltage for the dry contacts. Unit logic will close the factory-supplied dry contacts between terminals S3 and S4 when the heat medium pump is demanded.
4. **Heat Medium Bypass Valve Control:** To control the heat medium bypass valve, the unit logic will output the voltage provided to CM1 to terminal P3A when the unit logic wants heat medium flow through the chiller/chiller-heater. Similarly, the unit logic will output the voltage provided to CM1 to terminal P3B when the unit logic wants the heat medium flow to bypass the chiller/chiller-heater.

While it is preferable to have both a Heat Medium Bypass Valve and control of the Heat Medium Pump (P3), there are times where this simply cannot be accomplished. In such cases, by using modified wiring, just having one of these two devices is enough to control heat medium flow through the unit.

If the unit has a Heat Medium Bypass Valve (HMV), but does not have control of the P3 pump, then wire the valve as shown in Figure 17. This configuration will allow any alarms or control signals that would normally be directed to the P3 pump to act on the HMV instead. If only one device is possible, the HMV is the preferred device as it will provide positive shut off during the off cycle, preventing any possible thermal siphoning.

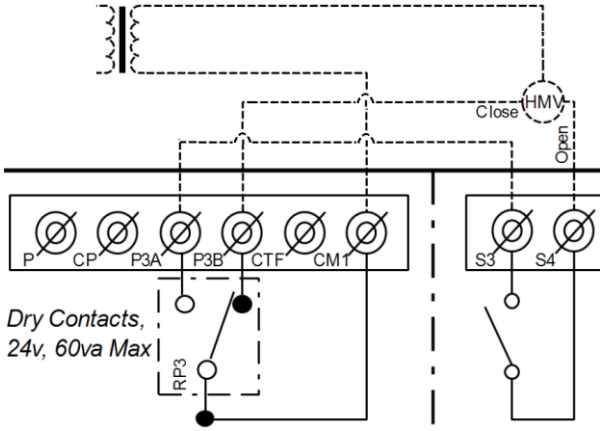


Figure 17 – No Control of Heat Medium Pump

If the unit has control of the P3 but not of the HMV, or there is no HMV at all, then wire the P3 pump as shown in Figure 18. This will allow any alarms or control signals that would normally act on the HMV to act on the P3 instead. Be cautious. Without the HMV, there is no positive shut off in the off cycle, and thermal siphoning could occur easily. Anti-thermal siphoning steps will be crucial.

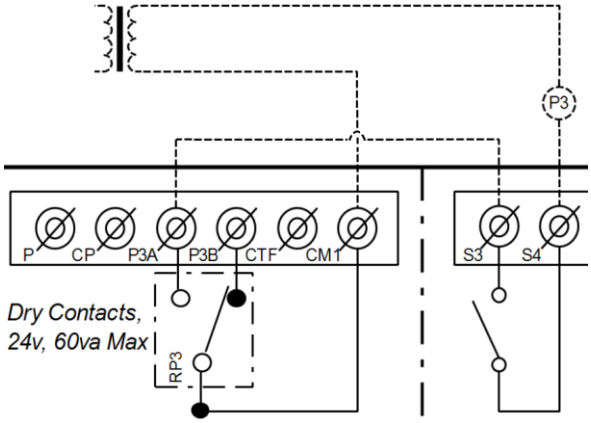


Figure 18 – No Heat Medium Bypass Valve

COOLING TOWER FAN CONTROL

The unit logic can control the cooling tower fan if necessary. It is a simple On-Off control scheme, but it is better than nothing at all, provided the cooling tower fan in use can handle being cycled in that fashion.

This control scheme should not be considered superior to other methods of cooling water temperature control such as VFD fans, etc. and should not be used in conjunction with any other method of cooling water temperature control.

When the CTI sensor indicates the cooling water inlet temperature to be above 84.2°F (29°C), the unit logic will close the factory-supplied dry contacts that will allow the voltage provided to terminal CM1 to be output to terminal CTF.

When the CTI sensor indicates the cooling water inlet temperature has fallen below 80.6°F (27°C), the unit logic will open the CTF dry contacts.

PUMP SAFETY INTERLOCKS

Each chiller/chiller-heater has a set of terminals located at the bottom-right of the control panel labeled 3, 4, 5, 6, and CM2. These are used as pump safety interlocks and MUST be connected in order for the unit to run. If even one of these connections is missing or electrically open, the unit will lock out immediately in alarm condition. Such a lock out is a Manual Reset event.

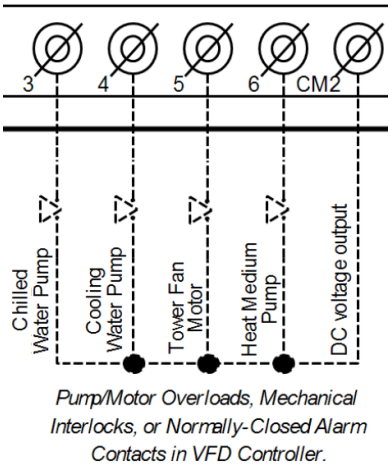


Figure 19 – Pump/Motor Safety Interlocks

The safety interlock circuit is intended to be routed through a set of auxiliary contacts attached to the appropriate pump/motor starter overload. They should NOT be connected to auxiliary contacts of the starter contactor itself or else the unit will lock out every time the pump shuts down.

Most starter packages in the USA no longer have auxiliary contacts available even as options and very few pumps have internal dry contact thermostats imbedded in the windings either. However, with the advent of VFD pump/motor controllers, the availability of an alarm circuit allows the interlocks to be wired to the Normally Closed set of alarm contacts.

If no method of pump safety interlock is available at all and/or the safety interlocks are to be jumped, it is highly recommended that the optional FS2 flow switch be installed in the cooling water circuit. The FS1 flow switch for the chilled/hot water circuit is a standard equipment item with all Yazaki chillers/chiller-heaters. The installation instructions for the FS2 flow switch are included in the accessory package.

BUILDING MANAGEMENT SYSTEMS

The chiller/chiller-heater can be controlled by Building Management Systems (BMS) or other remote devices by using field-supplied SPDT relays, as shown below. Only a simple Enable/Disable command and a Heat/Cool command are available. Please be aware, <u>temperature set points cannot be set remotely</u>.

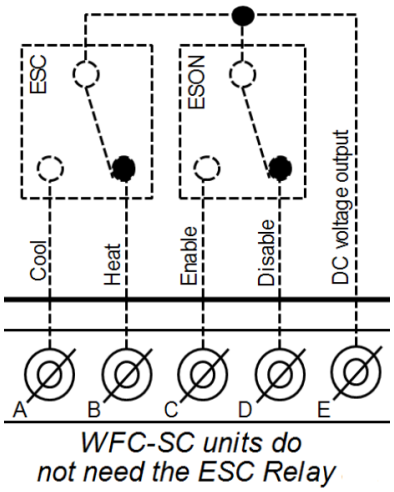


Figure 20 – BMS Connections

1. The chiller/chiller-heater itself provides voltage on terminal E.
2. If the voltage from terminal E is routed back to terminal A, the unit will engage Cool mode.
3. If the voltage from terminal E is routed back to terminal B, the unit will engage Heat mode.
4. If the voltage from terminal E is routed back to terminal C, the unit will be Enabled
5. If the voltage from terminal E is routed back to terminal D, the unit will be Disabled.

The rocker switch on the front of the Control Panel must be set to “REMOTE” in order for the unit to be controlled by the BMS in this manner.

It is recommended that field-supplied SPDT relays be used to prevent conflicting signals. The wiring diagram designates the relay controlling Cool/Heat as ESC and the relay controlling Enable/Disable as ESON. If a WFC-SC model chiller is being wired to a BMS, then there is no heat mode available, therefore, the ESC relay is not needed.

Be aware that if the unit receives the voltage from terminal E back on both terminals A and B at the same time or on terminals C and D at the same time, the unit will be receiving conflicting commands. The unit the unit will attempt to satisfy the commands by switching back and forth between the two conflicting commands until the conflict is resolved.

REMOTE MONITORING

There are two optional methods of remote monitoring. The first is by use of the LON Adapter and the second is by use of the Arotrend Remote Monitoring package. It is possible to use both options at the same time on the same unit.

The optional LON Adapter accessory will allow the direct interface of the supported output data from the Yazaki controls to any LON-compatible control system. It mainly provides output data. The only input allowed is the Enable/Disable signal.

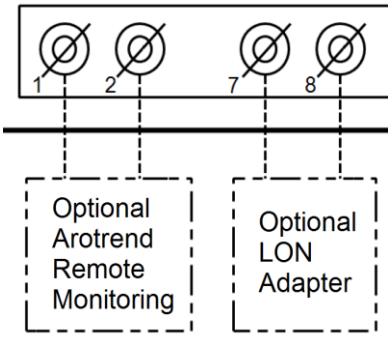


Figure 21 – Arotrend and LON Adapter Connections in the Junction Box

The LON Adapter installation and wiring instructions are included with the accessory package. The LON Adapter is a field-installed option, though it could be factory-installed on the WFC-SC50 if ordered as such.

The available output data from the LON Adapter is as follows: Alarm condition (with 2-digit error code number), Enable/Disable mode feedback (is the unit Enabled or Disabled), Mode feedback (is the unit in Heat or Cool mode), Operation feedback (is the unit operating or in standby mode), the entering and leaving cooling water temperature (CTI and CTO thermister reading), and leaving chilled/hot water temperature (WTO thermister reading). At the time of this writing, no other data is available through the LON Adapter.

If the LON Adapter is not suitable for use with the BMS in place, a number of feedback dry contacts are available in the Junction Box that can be used to provide information to the BMS. Consult the Controls Wiring Diagram in the wiring section for further details.

A second method of remote monitoring is the use of the Arotrend Remote Monitoring package. The Arotrend can connect the unit to a Yazaki-monitored server or to a computer that has the proper software installed. Contact Yazaki Energy Systems, Inc., for more information on the software and monitoring services offered as these options can change or be discontinued without notification at any time.

The Arotrend Remote Monitoring package wires to terminals 1 and 2 in the Junction Box (see Figure 21). The Arotrend package can report much more data than the LON Adapter can provide, including temperatures. It is permitted to use both the LON Adapter and the Arotrend at the same time.

Finally, Arotrend remote monitoring can do nothing except monitor. There is no ability for any input commands through the Arotrend.

<u>It is not possible in any way to remotely adjust the leaving water temperature set points.</u>

WATER QUALITY

Water used in the chilled water, cooling water, and heat medium circuits may cause scaling and/or corrosion if not correctly maintained within specific limits. In some areas, the water supply may contain minerals that cause scaling or may be extremely soft and corrosive. Where these conditions exist, a water treatment company should be consulted. If the absorption chiller is damaged as a result of scaling, corrosion, or erosion caused by poor water quality control, the equipment warranty may be void. Water quality should not exceed the following limits:

	ITEM	CHILLED WATER	COOLING WATER	HEAT MEDIUM	MAKE-UP WATER
Standard	pH (at 77°F)	6.8 - 8.0	6.5 - 8.2	7.0 – 8.0	6.8 - 8.0
	Conductivity (μS/cm at 77°F)	400	800	300	300
	Chloride ion (Cl^- ppm)	50	200	30	50
	Sulfate ion (SO_4^{2-} ppm)	50	200	30	50
	M-alkalinity ($CaCO_3$ ppm)	50	100	50	50
	Total hardness ($CaCO_3$ ppm)	70	200*	70	70*
	Calcium hardness ($CaCO_3$ ppm)	50	150	50	50
	Ionic silica (SiO_2 ppm)	30	50	30	30
Reference	Total iron (Fe ppm)	1.0	1.0	1.0	0.3
	Copper (Cu ppm)	1.0	0.3	1.0	0.1
	Sulfide ion (S^{2-} ppm)	ND	ND	ND	ND
	Ammonium ion (NH_4^+ ppm)	1.0	1.0	0.1	0.1
	Residual chlorine (Cl ppm)	0.3	0.3	0.1	0.3
	Free carbon dioxide (CO_2 ppm)	4.0	4.0	0.4	4.0
	Ryzner stability index	-	6.0 - 7.0	-	-

NOTES:

1. ND (Not Detectable)
2. *Maximum total hardness of make-up water shall not exceed 70 ppm when bleed off is the only method used to control water quality.

Table 5 – Water Quality

INSTALLATION CHECK & REQUEST FOR STARTUP

After the absorption chiller has been installed, piped, and wired as described in these instructions, but before any attempt is made to start the unit, the Yazaki Authorized Service Provider (ASP) should be advised so that the startup can be scheduled.

Complete the REQUEST FOR STARTUP form and send it to the ASP or to Yazaki Energy Systems, Inc., at least three (3) weeks prior to the required startup date.

The contractor is expected to provide personnel to assist the ASP with final adjustments to the system controls and fluid flow rates as may be necessary.

YAZAKI WFC-SC/SH SERIES CHILLER
INSTALLATION CHECK AND REQUEST FOR START-UP

Yazaki Authorized Service Provider: _____

Address: _____

Project Name: _____

Project Address: _____

Model No: _____ Serial No: _____

Anticipated Startup Date: _____

A. CHILLER-HEATER

1. Unit placed properly on foundation ☐
2. Unit leveled properly ☐
3. Service clearance provided on all sides and top (40 in. front) ☐
4. Chilled water flow switch piping connected ☐

B. WATER PIPING

1. Chilled water piping installed between chiller, pumps, and air handling unit(s) ☐
2. Cooling water piping installed between chiller, pumps, and cooling tower ☐
3. Heat medium piping installed between chiller, pumps, and heat source ☐
4. Water piping leak tested and flushed ☐
5. Fluid circuits filled with water and glycol (if required) and trapped air vented ☐
6. Flow setters installed in water piping ☐
7. Test plugs (Pete's plugs) and/or thermowells installed in the inlet and outlet piping of each chiller ☐
8. Valves installed at each chiller for flow balancing and isolation ☐
9. Air vent valves installed on piping ☐
10. Strainers present and clean ☐
11. Expansion tank (properly charged) and water make-up piping installed to chilled water system ☐
12. Expansion tank (properly charged) installed on heat medium piping ☐
13. Water make-up and fill lines installed to the cooling tower ☐
14. Pressure relief valves, set to maximum of 85.3 psig (588 kPa), installed on piping adjacent to each chiller (if required) ☐

C. POWER WIRING

1. Power supply, as indicated on the UNIT NAMEPLATE, is connected ☐
2. Wiring completed between the chiller-heater, motor contactors and/or starters for the following : Chilled/hot water pump, cooling water pump, heat medium pump, and cooling tower fan ☐
3. Rotation of each external pump and fan motor checked ☐
4. Power supply wiring connected between a fused disconnect and each chiller. (DO NOT operate the chiller) ☐
5. Power supply available near the chiller for a vacuum pump ☐

D. CONTROL WIRING

1. Motor contactors, starters, and/or manual controllers installed for all external motors ☐
2. Control wiring (24vac max) installed between chiller and pump/motor contactors ☐
3. Interlock wiring installed between chiller and thermal overloads on the following motors: Chilled water pump, cooling water pump, heat medium pump, and cooling tower fan ☐

E. CONDITIONS

1. Personnel available to assist with start-up who are familiar with the system and have appropriate tools (adequate vacuum pump, vacuum gauge, proper hoses, etc.) ☐

YAZAKI AUTHORIZED SERVICE PROVIDER

For information concerning service, operation
or technical assistance, please contact your
Yazaki Authorized Service Provider or the following:

YAZAKI ENERGY SYSTEMS, INC.
701 E PLANO PKWY, SUITE 305
PLANO, TEXAS 75074-6700
Phone: 469-229-5443
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