

# Aroace

## WATER-FIRED SINGLE-EFFECT ABSORPTION CHILLER

This product is a water-fired absorption unit which provides chilled water for cooling or hot water for heating (WFC-SH units only) in central plant type air conditioning systems. Units with nominal refrigeration capacities of 10, 20, 30, and 50 tons are complete with operating and safety controls. The unit is energized by heat medium (hot water) from a process, cogeneration, solar, or other waste heat applications that can supply the heat medium fluid within the operating temperature range of 158 – 203°F (70 – 95°C).

When this equipment is correctly applied, installed in accordance with Yazaki INSTALLATION INSTRUCTIONS, and properly maintained, it can provide many years of trouble-free operation.

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# GENERAL

These instructions are intended to acquaint the Owner/End User with the operation and general maintenance requirements of Yazaki WFC-S Water-Fired Single-Effect Absorption Chiller or Chiller-Heater units.

Please read ALL instructions carefully and observe precautions. Failure to operate and maintain this equipment in accordance with

the OPERATING INSTRUCTIONS may affect the equipment performance and product Warranty.

If the equipment does not operate as expected, check the Troubleshooting Guide in these instructions BEFORE calling your Yazaki Authorized Service Provider (ASP). This approach will not only save cost but also avoid any unnecessary downtime.

## ABSORPTION PRINCIPLE

Yazaki absorption chillers and chiller-heaters use a solution of lithium bromide and water, under a vacuum, as the working fluid. Water is the refrigerant and lithium bromide is the absorbent.

During cooling operation, refrigerant liquid boils under the influence of a deep vacuum in the evaporator and creates a refrigeration effect which removes heat from the chilled water circuit.

The single-effect absorption cycle has one generator heated by an external source of hot water, a condenser, an evaporator and an absorber.

The absorber and condenser are water cooled and heat is normally rejected to a cooling tower, though ground loop is also an option.

## COOLING OPERATION

### Generator

When the heat medium inlet temperature exceeds 154.4°F (68°C), with a maximum of 203°F (95°C), the solution pump forces dilute solution into the generator. The solution is dripped over the generator tubing bundle where it boils under vacuum, releasing refrigerant vapor. The hot refrigerant vapor flows into the condenser and concentrated solution drips into the generator sump where it drains down and flows through a heat exchanger before flowing to the absorber.

### Condenser

In the condenser, refrigerant vapor is condensed on the surface of the condenser tubing bundle and latent heat, removed by the cooling water, is rejected to a cooling

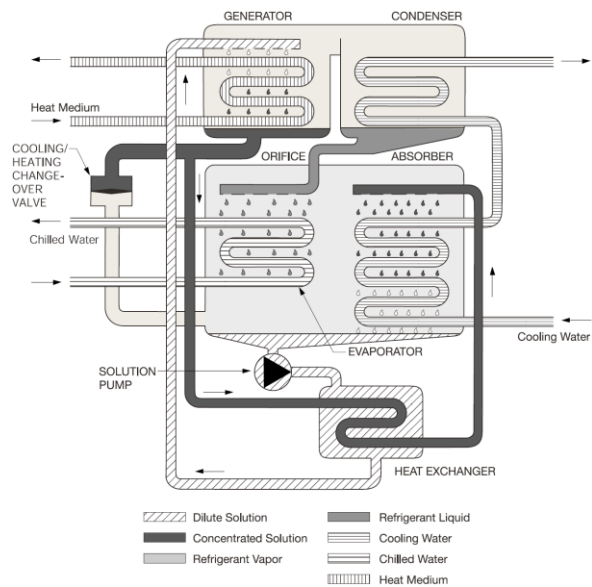
tower. Refrigerant liquid accumulates in the condenser and then passes through an orifice into the evaporator.

### Evaporator

In the evaporator, refrigerant liquid is exposed to a substantially deeper vacuum than in the condenser due to the influence of the absorber. As refrigerant liquid flows over the surface of the evaporator tubing bundle, it boils and removes from the chilled water circuit an amount of heat equivalent to the latent heat of the refrigerant. The recirculating chilled water is cooled to 44.6°F (7°C) while the refrigerant vapor is attracted to the concentrated solution dripping over the absorber tubing bundle.

## Absorber

A deep vacuum in the absorber is maintained by the affinity of the concentrated solution from the generator for the refrigerant vapor formed in the evaporator. Refrigerant vapor is absorbed by concentrated lithium bromide solution flowing across the surface of the absorber coil and being cooled by the cooling water. The heat of condensation and dilution are removed by the cooling water and rejected to a cooling tower. The resulting dilute solution is preheated in a heat exchanger before the solution pump returns it to the generator where the cycle is repeated.



**Figure 1 – SINGLE-EFFECT ABSORPTION CYCLE (COOLING)**

## HEATING OPERATION

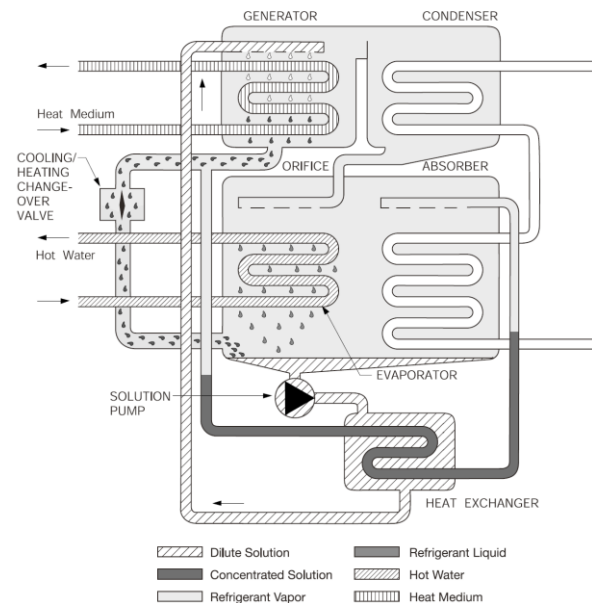
### Generator

When the heat medium inlet temperature exceeds 154.4°F (68°C), with a maximum of 203°F (95°C), the solution pump forces dilute solution into the generator. The solution is dripped over the generator tubing bundle where it boils under vacuum, releasing refrigerant vapor.

The changeover valve is open in the heating mode, allowing a mixture of hot refrigerant vapor and concentrated solution to flow directly into the evaporator. A small portion of the hot refrigerant vapor will also flow through the condenser before reaching the evaporator therefore it is imperative that there be NO cooling water flow while in the heat mode.

### Evaporator

In the evaporator, hot refrigerant vapor condenses on the surface of the evaporator coil and heat, equivalent to the latent heat of the refrigerant, is transferred to the hot water circuit, heating it to a leaving temperature of 131°F (55°C). The condensed refrigerant drips off the evaporator and into the absorber sump where it mixes with the concentrated solution, diluting it once again.



**Figure 2 – SINGLE-EFFECT ABSORPTION CYCLE (HEATING)**

# CONTROLS

## GENERAL INFORMATION

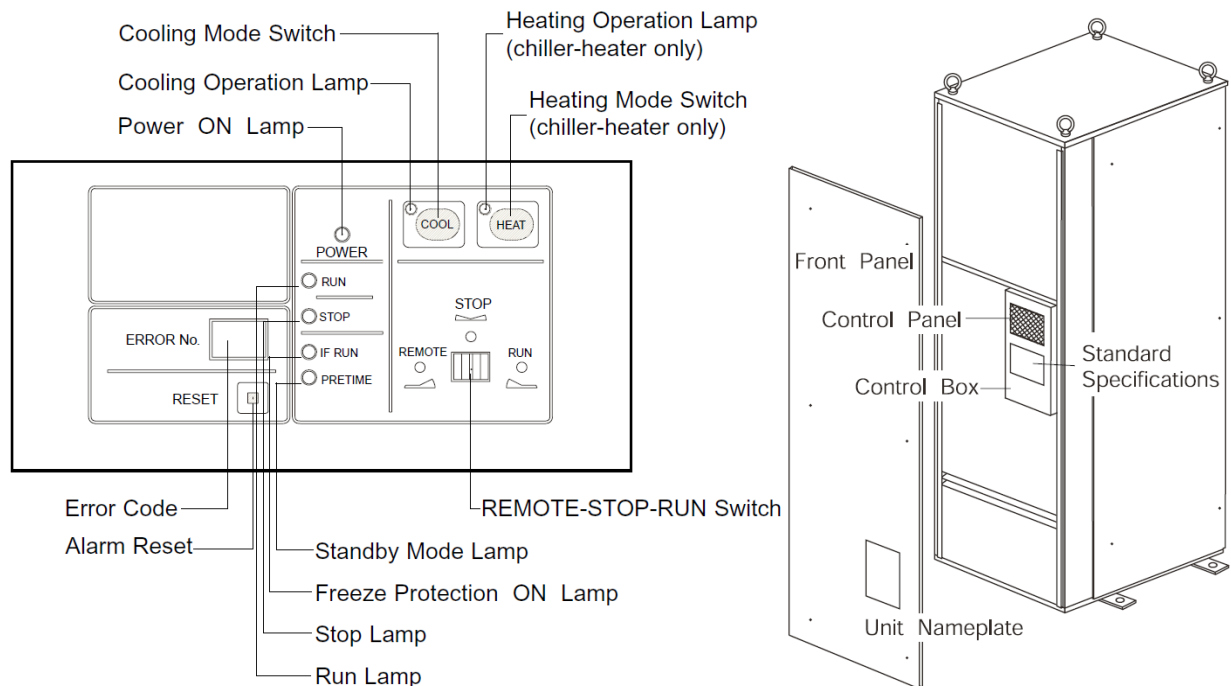
A control panel (Figure 3) is built into each absorption chiller or chiller-heater and is located on the control box, behind the front or front-right panel. After inspecting the control panel and/or making changes to the mode of operation, make sure that the front panel is replaced and secured properly with screws to prevent rain from entering the cabinet as well as unauthorized tampering with the controls.

The chiller or chiller-heater may also be supervised and controlled by external control systems to a limited degree when the necessary interconnections are installed. Additional controls and interlocks can be explained by your ASP.

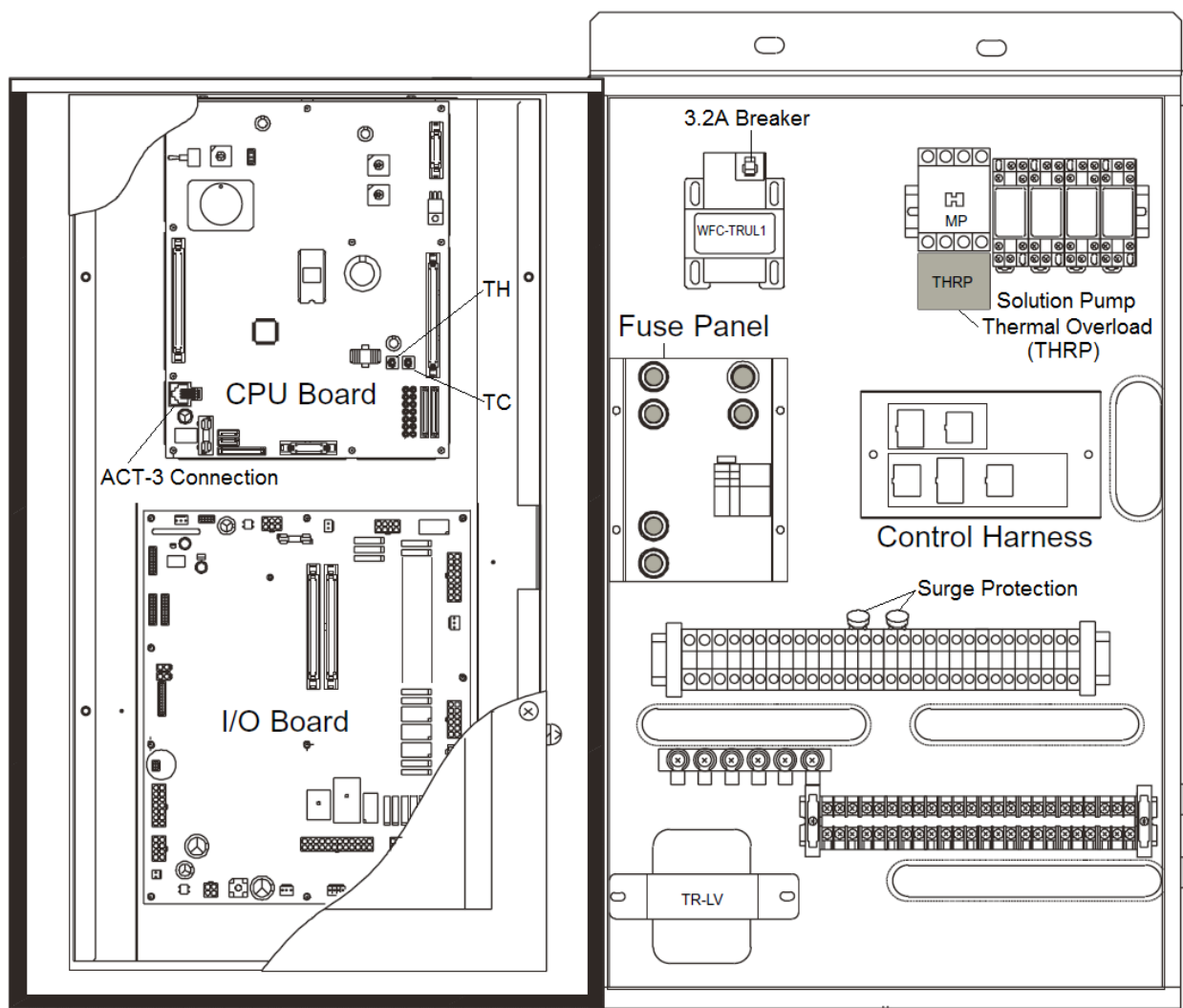
Once COOLING or HEATING operation is selected and the unit is started, the chiller or

chiller-heater will function automatically and remain in operation as long as there is a demand for chilled or hot water. The heat medium bypass valve is operated between ON and BYPASS in order to control the flow of heat medium through the generator in response to the leaving chilled/hot water temperature. When the temperature demand is satisfied, the solution is automatically diluted and the cooling water pump is stopped after 4 minutes.

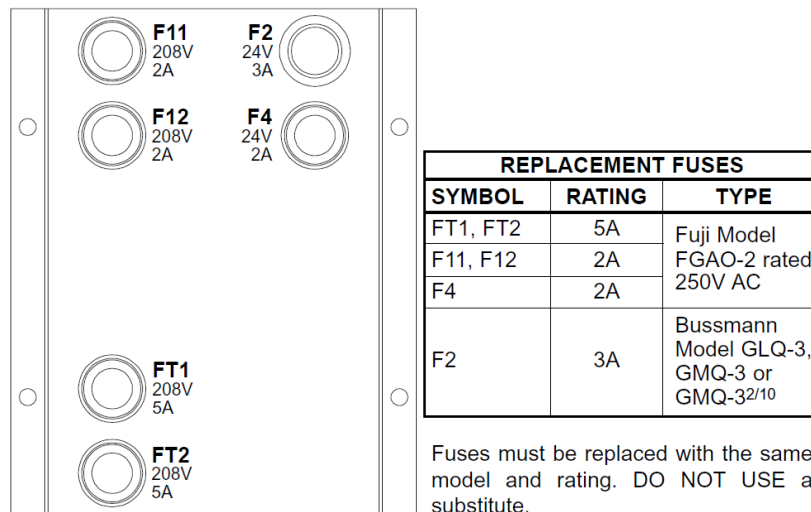
Be aware that the STOP lamp is lit anytime the unit is Disabled. The RUN lamp is lit anytime the unit is Enabled, whether or not the unit is actively running to control chilled water temperature.



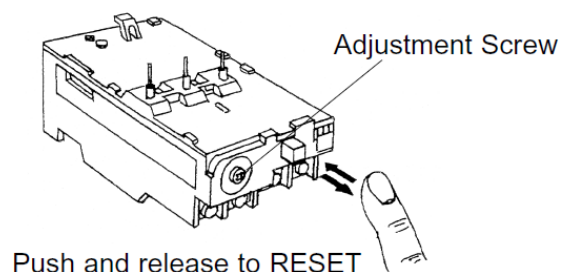
**Figure 3 – CONTROL PANEL**



**Figure 4 – CONTROL BOX LAYOUT**



**Figure 5 – FUSE PANEL**



Unit Size	THRP Setting (amps)
10	0.4
20	0.7
30	2
50	4.7

**Figure 6 – SOLUTION PUMP THERMAL OVERLOAD**

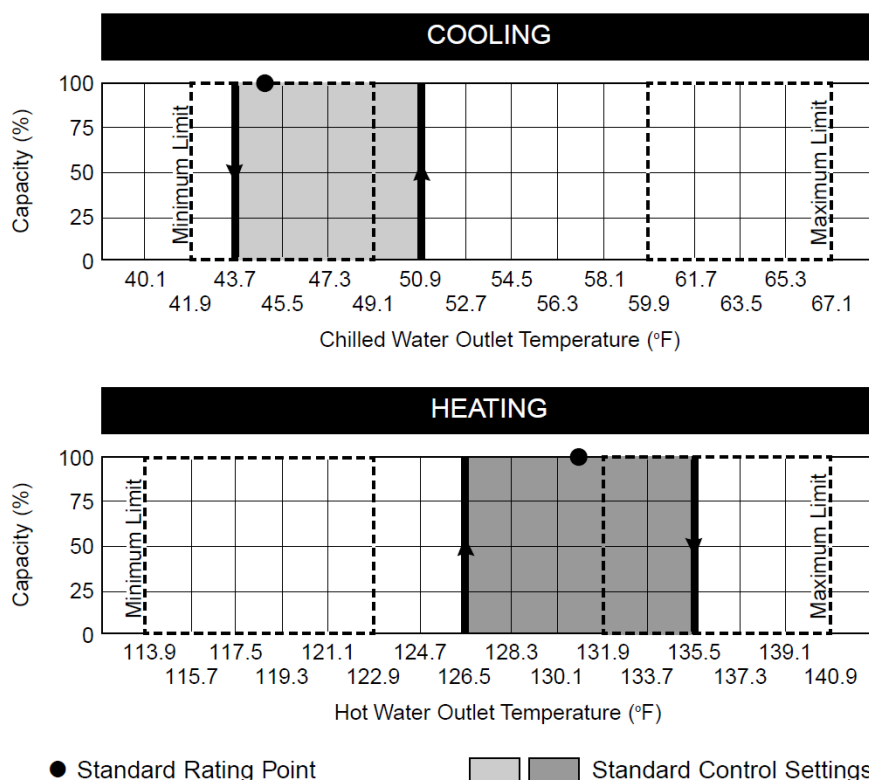
**CAUTION**  
FOR YOUR SAFETY DO NOT TOUCH ANY  
LIVE ELECTRICAL PARTS. ELECTRIC  
SHOCK CAN CAUSE INJURY OR DEATH.

## CONTROL ADJUSTMENTS

The leaving chilled water temperature is controlled to a standard rating point of 44.6°F (7°C). The operating dead band is 7.2°F (4°C). The dead band is not adjustable. The leaving chilled water temperature can be adjusted using the TC potentiometer on the CPU Board. The leaving chilled water set

point can be set in a range of 41.9°F (5.5°C) to 59.9°F (15.5°C).

Similarly, the leaving hot water standard rating point is 131°F (55°C). The dead band is 9°F (5°C) and is not adjustable. The leaving hot water set point can be set in a range of 122.9°F (50.5°C) to 140.9°F (60.5°C).



**Figure 7 – TEMPERATURE CONTROL ADJUSTMENTS**

# CONTROL SEQUENCE

A built-in microprocessor in the chiller or chiller-heater can control the external pumps and heat medium bypass valve (if installed) in response to the cooling or heating load. The operating sequence of each pump and the cooling tower fan after startup, during normal

operation, and after a normal stop is shown below in a series of flow charts. It is important that the chiller or chiller-heater has control over the pumps to allow for controlled shutdown under normal and abnormal circumstances.

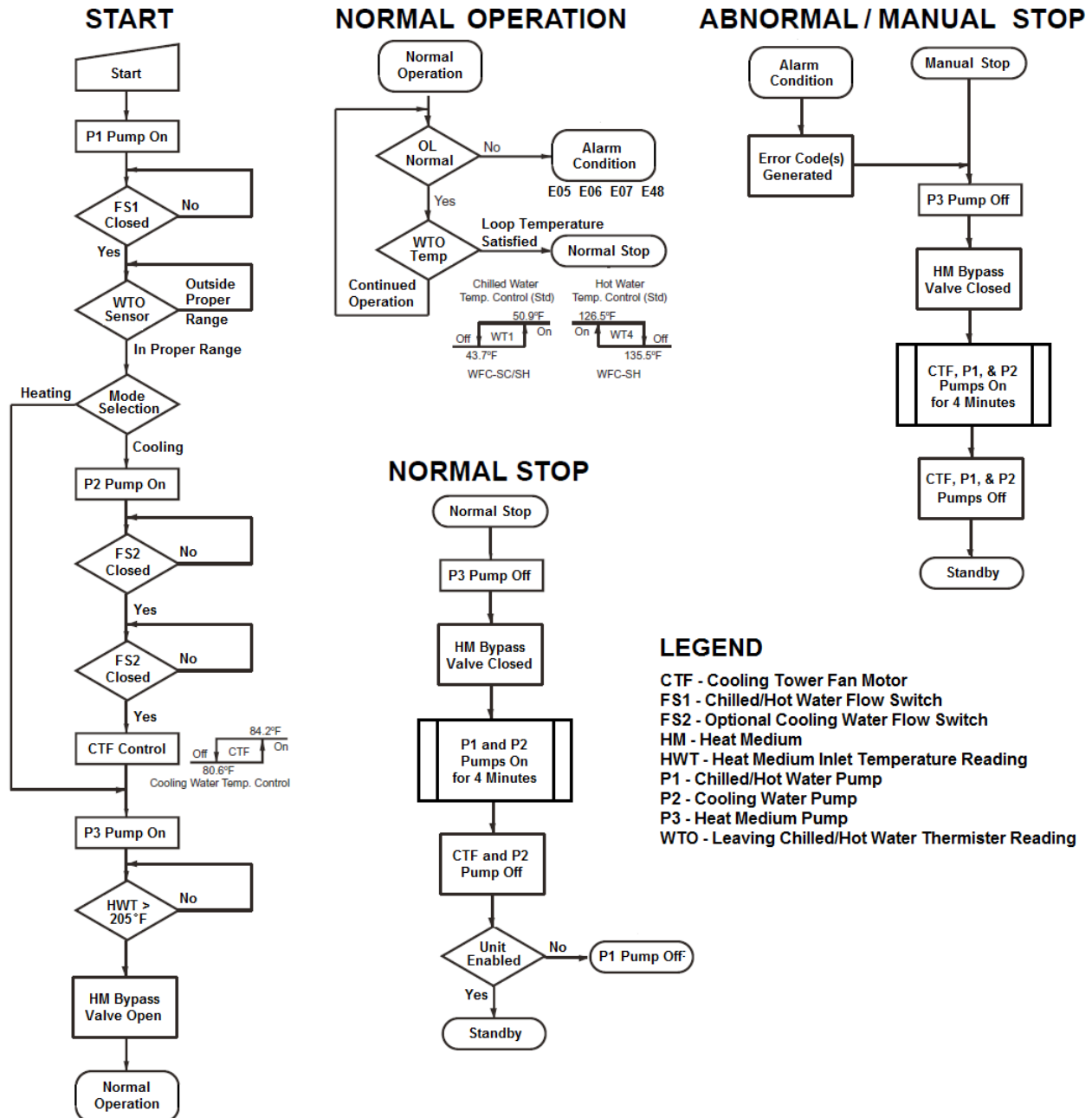


Figure 8 – CONTROL SEQUENCE

# OPERATION

## COOLING

To engage the unit in cooling mode, press the COOL button on the Control Panel. Then choose between RUN and REMOTE setting. A cooling-only chiller will engage cool mode immediately.

For chiller-heaters, if the unit was not in heat mode prior to this point, and the unit is Enabled, the unit will engage in cool mode immediately. If, however, the unit was previously in heat mode, the unit will engage a 30-minute mode change timer and the PRETIME light will illuminate. Once the 30-minute timer has expired, the PRETIME light will go out and the unit will engage cool mode immediately.

## HEATING

To engage a chiller-heater into heating mode, press the HEAT button on the Control Panel. Then choose between RUN and REMOTE setting. If the unit was not in cool mode prior to this point, and the unit is Enabled, the unit will engage in heat mode immediately. If, however, the unit was previously in cool mode, the unit will engage a 30-minute mode change timer and the PRETIME light will illuminate. Once the 30-minute timer has expired, the PRETIME light will go out and the unit will engage heat mode immediately.

## SAFETY CONTROLS

Safety and limit controls monitor critical operating conditions within the chiller or chiller-heater and will shut down the unit when abnormal conditions arise. An Error Code that designates the cause of the shutdown (see Table 2) is displayed on the control panel. When the abnormal condition has been cleared, press the alarm RESET button to restart the cooling or heating operation. If the unit does not restart, then contact your ASP.

## REMOTE CONTROL

The chiller or chiller-heater can be Enabled or Disabled remotely. It can also be instructed to change between Cool and Heat modes remotely. No other remote control capability exists. To enable the unit to be controlled remotely, switch the unit into REMOTE. The unit will now Enable or Disable based on the external connection signals tied into the Junction Box.

If the unit is in RUN, the unit will ignore Enable/Disable signals from the remote signal source, but the unit will still follow the Cool/Heat changeover commands while set to RUN.

## PRECAUTIONS

1. Ensure that all AUTO-OFF-HAND switches for external pumps and the cooling tower fan are set in the AUTO position during normal operation. The chiller or chiller-heater is designed to automatically control the chilled water pump, cooling water pump, heat medium pump and/or heat medium bypass valve.
2. At the beginning of the cooling season clean and refill the cooling tower with fresh water.
3. During the winter season the cooling tower and cooling water circuits should be drained to avoid freezing and scaling in the absorber and condenser circuits.
4. When two or more absorption chiller modules are installed in parallel, set all units for the same operating mode. Leaving water temperature set points may differ, but operating mode must always be the same.



# MAINTENANCE

## GENERAL INFORMATION

ALL MAINTENANCE SHOULD BE PERFORMED BY TRAINED AND EXPERIENCED PERSONNEL. Your Yazaki Authorized Service Provider (ASP) can help you establish a standard maintenance procedure.

For your safety, keep the area around the equipment clear and free of combustible materials, gasoline and other flammable substances. DO NOT obstruct service access to the equipment.

## ROUTINE MAINTENANCE

Routine maintenance should be provided throughout the life of the equipment to ensure satisfactory performance and operation.

During the warranty period, an ASP must be engaged to provide routine maintenance

on chillers at the beginning of each cooling season. When the chiller is used for process cooling or heavy load operation it may be necessary to schedule additional service visits to evacuate non-condensable gases from the vacuum section.

## MAINTENANCE INTERVALS

### Every 4 months:

1. Evacuate non-condensable gases from the vacuum section. Evacuation can be skipped during the winter season if the unit will not be used for either heating or cooling during that period.
2. Inspect the condition of the cooling tower and cooling water circuit.

### Every 12 months:

1. Check function of the flow switch.
2. Measure the absorption cycle temperatures to verify they remain in normal ranges.
3. Visual inspection of all controls and of the physical condition of the unit.
4. Verify the unit remains level.
5. Verify the proper solution pump rotation.
6. Conduct an inhibitor check (if needed)

## EVACUATION OVERVIEW

Arguably the most important aspect of maintenance for the chiller is maintaining a proper level of vacuum. Evacuation is performed at the front of the machine. The evacuation service valves are referred to as Service Valve A (upper) and Service Valve B (lower).

The evacuation service valves are back-seating access valves similar to those used throughout the refrigeration industry. The stem has a 10mm square head. The stem secures a copper seal to a steel seat inside the valve. Do not over-torque this valve or else the seal can become damaged and

compromise vacuum integrity. The proper torque is 14.75 ft-lbs (20 Nm). Yazaki offers a torque wrench (P/N N7510) specifically for use with this service valve.

A number of precautions should be observed at all times during evacuation.

<p><b>*** Great care must be taken to ensure that no oil enters the Yazaki chiller! Permanent damage could result from even a small amount of oil being introduced into the vacuum section! ***</b></p>
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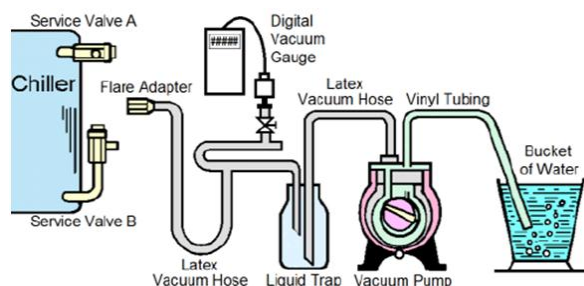
- **Never** leave a vacuum pump running unattended. Power loss could allow the chiller vacuum section to suck oil out of the pump in a matter of seconds.
- **Never** have the Service Valve open unless the vacuum pump is running and the integrity of the vacuum lines between the valve and the pump has been verified as tight.
- **Never** have the vacuum pump discharge tube in the water bucket unless the vacuum pump is running. The vacuum pump could suck water from the bucket and contaminate the oil charge.
- **Never** pull an extended vacuum (exceeding a few hours). If such seems to be necessary, there is likely to be something wrong with the vacuum pump or the oil has been contaminated with moisture inherently found inside the chiller vacuum section.
- **Always** start with a fresh oil charge in the vacuum pump.
- **Always** use a liquid trap or collection flask.
- **Always** use a vacuum gauge to verify the level of vacuum achieved. Run time has almost nothing to do with the level of vacuum achieved.

Use only dual-stage, deep vacuum pumps. Typical refrigeration vacuum pumps may not perform well on a vessel as large as

the chiller's vacuum section. Just because the vacuum pump has stopped producing bubbles in the water bucket does NOT mean the vacuum level is adequate. A digital vacuum gauge **MUST** be used in order to determine the true level of vacuum achieved.

The desired level of vacuum on a machine that is not running would be less than 1500 microns (<1.5mmHg), with less than 1000 microns (<1mmHg) preferred. On a machine actively running in Cool mode (currently attempting to satisfy chilled water loop load), the desired level of vacuum is 4000-5000 microns (4-5mmHg), no less. Any lower than that on a running machine can cause the vacuum pump to remove an extraordinary amount of refrigerant vapor (water).

A step-by-step, detailed evacuation method is provided in the Service Manual. The general evacuation assembly setup is displayed in Figure 9.



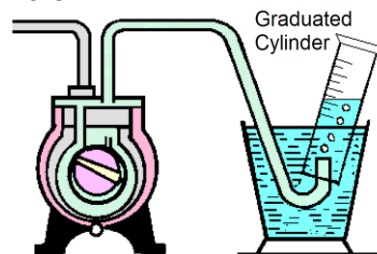
**Figure 9 – GENERAL EVACUATION ASSEMBLY SETUP**

## CHEMICAL MAINTENANCE

**It is not necessary to perform regular chemical maintenance on the Yazaki chiller itself.**

The chemical balance has been established in the factory during run testing. Normally, the only chemical that must be maintained is the inhibitor charge. By capturing non-condensable gases, as shown in Figure 10, comparisons can be made to determine if the normal hydrogen byproduct is being produced at anticipated rates. If more hydrogen is being produced than anticipated, a maintenance inhibitor charge

may need to be introduced into the machine by the ASP. An inhibitor charge is typically needed every eight years in Yazaki water-fired chillers.



**Figure 10 – CAPTURING GASES**

## WINTER SHUTDOWN

The fluids within the chiller or chiller-heater itself need no preparation for freezing conditions. Only the fluids in the chilled water, cooling water, and heat medium fluid circuits need to be addressed during potentially freezing conditions.

If a unit is to be shut down for the winter, but no fluid circuits are to be drained, then simply Disable the chiller and allow the unit to complete its Post Dilution Cycle. Once completed, it is safe to leave the unit as it sits for the off season. Make certain that appropriate measures are taken to ensure the fluids in all fluid circuits are protected from freezing (glycol, heat tape, etc.).

If a chiller is to be shut down and fluid circuits are to be drained, Disable the chiller and allow the unit to complete its Post Dilution Cycle. Once completed, turn off the breaker on the unit control panel. Then drain

each fluid circuit. Once drained, make sure to blow in both directions through each circuit with compressed air (or similar) to make sure no significant amount of liquid remains inside them.

When the equipment is located outdoors in climates subject to freezing, cooling water should be drained from the chiller, fluid circuit piping, and cooling tower at the end of the cooling season. Use glycol of adequate concentration in the chilled water and heat medium circuits to prevent freeze damage. The glycol will reduce the cooling and heating capacity but this may be offset somewhat by increasing the circuit fluid flow rate. If in doubt about potential freeze damage in your area, discuss it with your ASP. Remember, damage to the chiller due to freezing is not covered by the product warranty.

## TROUBLESHOOTING

### SYMPTOM: Chiller does not operate.

Possible Cause	REMEDY
No High Voltage	Check the LED for the Power indication on the Control Panel. If it is not illuminated, check the main power disconnect, fuses, and breakers.
Solution Pump Not Running	Check the THRP overload switch. Check the HWT temperature. Until the heat medium temperature rises above 154.4°F (68°C), the solution pump will remain off. If the heat medium temperature falls below 145.4°F (63°C) at any time during operation, the solution pump will stop.
Chiller is not running but WTO temperature is above set point.	Nothing may be wrong. If the system chilled water loop has satisfied by reaching the desired set point, the unit will shut down until the WTO sensor reads a temperature 7.2°F (4°C) above the set point temperature, no matter how long that may take. To force operation, turn off power to the chiller, leave power off for 10 seconds, and then restore power. The chiller should start up if the WTO sensor reading is above the set point.

### SYMPTOM: Poor cooling capacity.

Possible Cause	REMEDY
Poor Vacuum	Evacuate the machine per normal maintenance procedure.
High Inlet Cooling Water Temperature	Check the cooling tower fan. Check the cooling tower fluid level.
Low Cooling Water Flow Rate	Check the cooling tower sump and cooling water circuit strainers.
Condenser/Absorber Fouling, Scale Buildup	Check the cooling water circuit strainers. It may be necessary to drain the cooling water circuit and open the inspection doors on the chiller condenser and absorber for a visual confirmation.
Everything appears normal but the leaving chilled water temperature is too high.	Nothing may be wrong. If the load of the chilled water circuit exceeds the capacity of the chiller, the system will find equilibrium at a higher leaving chilled water temperature. If the temperature drop through the chilled water loop is approximately 8-12°F (4-6°C), then the chiller may actually be giving its full capacity and its capacity simply may not be enough. Check for reasons that the load may have artificially increased (open doors, new equipment, leaking valves, etc.)

## WATER QUALITY

It is the End User's responsibility to have the cooling water analyzed and chemically treated as often as necessary so that it conforms to the

limits specified in Table 1. The water quality in the chilled water, cooling water, and heat medium circuits shall not exceed the following limits:

ITEM		CHILLED WATER	HEAT MEDIUM	COOLING WATER	MAKE-UP WATER
Standard	pH (at 77°F)	6.8 - 8.0	7.0 – 8.0	6.5 - 8.2	6.8 - 8.0
	Conductivity ( $\mu\text{S}/\text{cm}$ at 77°F)	400	300	800	300
	Chloride ion ( $\text{Cl}^-$ ppm)	50	30	200	50
	Sulfate ion ( $\text{SO}_4^{2-}$ ppm)	50	30	200	50
	M-alkalinity ( $\text{CaCO}_3$ ppm)	50	50	100	50
	Total hardness ( $\text{CaCO}_3$ ppm)	70	70	200*	70
	Calcium hardness ( $\text{CaCO}_3$ ppm)	50	50	150	50
	Ionic silica ( $\text{SiO}_2$ ppm)	30	30	50	30
Reference	Total iron (Fe ppm)	1.0	1.0	1.0	0.3
	Copper (Cu ppm)	1.0	1.0	0.3	0.1
	Sulfide ion ( $\text{S}^{2-}$ ppm)	ND	ND	ND	ND
	Ammonium ion ( $\text{NH}_4^+$ ppm)	1.0	0.1	1.0	0.1
	Residual chlorine (Cl ppm)	0.3	0.1	0.3	0.3
	Free carbon dioxide ( $\text{CO}_2$ ppm)	4.0	0.4	4.0	4.0
	Ryzner stability index	-	-	6.0 - 7.0	-

NOTES:

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

**Table 1 – WATER QUALITY REQUIREMENTS**

## ERROR CODES

Error Code Number	Error Description	Notes	Reset Type
FS	Flow switch alarm	Chilled/hot water flow switch FS1 open, but for less than 10 minutes. After 10 minutes, this changes automatically to error code 27.	Auto
01	DCP power error	Optional Arotrend remote monitoring package has lost power.	Auto
02	DCP communication line short	Power available to the optional Arotrend remote monitoring package but communications line is shorted.	Auto
03	DCP communication line noise	Optional Arotrend Remote monitoring package cannot communicate with the chiller-heater.	Auto
04	Accessory error	Optional fire safety (ST2 contacts) shutdown.	Manual
05	Chilled/hot water pump interlock error	Voltage signal from terminal CM2 in the junction box is not returning to terminal 3 in the junction box.	Manual
06	Cooling water pump interlock error	Voltage signal from terminal CM2 in the junction box is not returning to terminal 4 in the junction box.	Manual
07	Cooling tower fan interlock error	Voltage signal from terminal CM2 in the junction box is not returning to terminal 5 in the junction box.	Manual
08	Solution pump error	Solution Pump overload THR1 has tripped.	Manual
13	WTO sensor error	WT sensor reads below 14°F (-10°C) or above 194°F (90°C).	Auto

20	Cooling water scale alarm	CND - CTO > 7.2°F (4°C)	No Reset Required
21	Cooling water scale error	CND - CTO > 12.6°F (7°C)	Manual
25	High cooling water temperature	Cooling water above acceptable temperatures: CTI above 95°F (35°C) and/or CTO above 108°F (42°C) for 3 consecutive minutes.	Auto
27	Chilled/hot water flow switch error (FS1)	FS1 open when it should be closed. Condition has existed for more than 10 minutes.	Auto
28	Cooling water flow switch error (FS2)	Optional cooling water flow switch (FS2) open when it should be closed.	Auto
29	CTO sensor error	CTO sensor reads below 14°F (-10°C) or above 194°F (90°C). Ignored for first 10 minutes of P2 operation.	Manual
33	CTI sensor error	CTI sensor reads below 14°F (-10°C) or above 194°F (90°C). Ignored for first 10 minutes of P2 operation.	Manual
36	CND sensor error	CND sensor reads below 14°F (-10°C) or above 194°F (90°C).	Auto
37	Cooling water over temp error 1	CTI sensor reads over 95°F (35°C) for 5 continuous seconds. Ignored for the first 3 minutes of P2 operation.	Manual
38	Heat Medium over temp error	HWT sensor reads over 204.8°F (96°C) for 5 continuous seconds. Reset not allowed until HWT sensor reading falls below 190.4°F (88°C).	Manual
40	Loss of cooling capacity	LT temperature reading has not fallen below 59°F (15°C) within 30 minutes. Ignored until HWT sensor reads above 154.4°F (68°C).	Manual
41	Cooling mode interrupt error	CIR contacts open for 20 consecutive seconds when they should be closed. CIR jumped from the factory.	Manual
42	Heating mode interrupt error	HIR contacts open for 20 consecutive seconds when they should be closed. HIR jumped from the factory.	Manual
43	Low cooling water temperature	CTI sensor reads below 46.4°F (8°C) at start of operation, or has dropped below this limit for 2 consecutive minutes during operation. Automatically resets after CTI sensor reading rises above 48.2°F (9°C).	Auto
44	Changeover valve error	Changeover valve end switch has not closed within 22 seconds. WFC-SC models should not use this.	Manual
47	HWT sensor error	HWT sensor reads above 239°F (115°C). Automatically resets when HWT sensor falls below 230°F (110°C).	Auto
48	Heat Medium pump interlock error	Voltage signal from terminal CM2 in the junction box is not returning to terminal 6 in the junction box.	Manual
49	Cooling water overtemp error 2	LT sensor reads above 59°F (20°C) for 20 consecutive minutes while HWT sensor reads 140°F (60°C) or greater.	Manual
72	LT sensor error	LT sensor reads below 14°F (-10°C) or above 194°F (90°C).	Manual
88	Circuit Board Error	Either the CPU Board or the I/O Board or both are not responding. All functions frozen.	Not Possible
93	Model setting error	DS1 and DS3 settings are incompatible.	Manual
94	TS1 Position Error	Unit left with Toggle Switch TS1 in BC or VC test position without interaction longer than 30 minutes.	Auto
95	Data Error	CPU board requires reboot or replacement.	Manual

**Table 2 - ERROR CODES**

# WARRANTY

## YAZAKI LIMITED EXPRESS WARRANTY

**1. Scope of Coverage.** The Limited Express Warranty of Yazaki Energy Systems, Inc ("Company") applies to the initial retail purchaser and assigns ("Customer") of Yazaki water fired chillers and chiller-heaters ("Product") installed in the U.S.A., Canada and Mexico.

**2. General Express Warranties.**

(a) The Company warrants to the Customer, that the Product shall be free from defects in materials and workmanship within a period of one (1) year ("Original Warranty Period") from the time when the Product is initially placed in operation ("Start-Up Date"), or two (2) years from the date of manufacture, whichever expires first, and subject to the disclaimers and limitations of this Limited Express Warranty.

(b) For liability under this Limited Express Warranty, the Customer must arrange at its own cost for annual and seasonal routine maintenance of the Product, prior to cooling operation and prior to heating operating of the Product, by a Service Provider authorized by the Company, in accordance with the Yazaki Operating and Maintenance Instructions.

**3. Disclaimer and Limitation of Express Warranties.**

There are no express warranties other than those contained in this Limited Express Warranty.

**4. Warranty Registration Card.** Every new Product is accompanied by a Warranty Registration Card which must be completed, signed by an authorized representative of the Customer, and returned to the Company. This Limited Express Warranty shall not apply unless the Warranty Registration Card is fully completed and returned to the Company within thirty (30) days of the Start-Up date of the Product.

**5. Warranty Service.** All routine maintenance, parts replacement and vacuum section repairs of the Product during the Original Warranty Period must be performed by a Service Provider authorized by the Company.

**6. Remedy During Original Warranty Period.** The Company shall, at its sole discretion, repair or replace the covered Product or parts thereof which the Company shall determine upon examination to be defective or not in conformity with the Original Warranty contained herein ("Defective Part"), subject to the terms hereof. The Company shall supply by standard ground transportation all parts required to repair or replace any Defective Part and shall pay to the Service Provider the necessary labor charges as fixed in the Company's warranty service payment schedule in effect from time to time ("Fixed Labor Charges"). The Customer shall be solely responsible for all labor costs or charges in excess of the Fixed Labor Charges.

**7. Limitation of Warranty and Limitation of Remedy.**

Customer's remedies shall be limited (even in the event of the Company's default of its warranty obligations or the failure of the essential purposes of this Warranty) exclusively to those provided in Section 6. UNDER NO CIRCUMSTANCES SHALL THE COMPANY BE LIABLE FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES. If the limitation of liability fails the essential purpose, the Company's liability shall be

expanded to the minimum extent to avoid failure of the essential purpose. Customer waives any cause of action or theory of liability including, but not limited to, those arising under contract, tort, strict liability, product liability, statutes, or otherwise except as specifically provided by the Uniform Commercial Code as modified and limited herein. The warranty periods of all replacement parts and Products shall be deemed to commence on the Start-Up Date of the original component or Product, not the installation date of the replacement part or Product, and the Company's warranty obligation hereunder shall not be extended because of such replacement.

**8. Disclaimer of Implied Warranties.** The Company DISCLAIMS ALL IMPLIED WARRANTIES (OTHER THAN GOOD TITLE) INCLUDING BUT NOT LIMITED TO THOSE OF FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, AND NON-INFRINGEMENT. There are no warranties which extend beyond those express warranties contained in this Limited Express Warranty. Customer affirms that it has not relied upon the Company's skill nor judgement to select or furnish Product for any particular purpose. The Company does not warrant that the Product complies with the requirements of any safety or environmental code or regulation of any federal, state, municipality or other jurisdiction beyond the specific express warranties in this Limited Express Warranty.

**9. Specific Exclusions.** In addition to all other exclusions contained in this Limited Express Warranty, the Company's warranty shall also not apply under the following circumstances:

(a) Damage to the Product caused by an unauthorized Service Provider;

(b) Defect in any part which is not supplied by the Company;

(c) Installation or operation of the Product in any way not described in the applicable Yazaki Installation and Operating Instructions;

(d) Applications for process cooling (except single-effect absorption chillers);

(e) Failure to provide routine maintenance of the Product by a Company Authorized Service Provider in accordance with the applicable Yazaki Operating and Maintenance Instructions;

(f) Failure to maintain the quality, flow and supply temperature of cooling water in accordance with Yazaki standards and limitations;

(g) Damage caused to the Product from freezing, overpressure and corrosion in any water circuit;

(h) Misuse, abuse, negligence, accident, natural disaster, alteration, misapplication or experimental use of the Product;

(i) Normal fading and minor deterioration of the cabinet surface caused by exposure to the elements;

(j) Removal of the Product from its original installation site unless the relocation is approved in writing by the Company and performed by a Company authorized Service Provider;

(k) Materials, such as inhibitor and batteries (if required), that are consumed during normal operation of the Product;

(l) Damage to other products outside the Product, not supplied by the Company, caused by use of materials that are not compatible with the operating temperatures of the Product, regardless of the absence of specific instructions in Yazaki Installation and Operating Instructions.



## WFC Start-Up & Maintenance Data Sheet, Rev 1E

Project Name: \_\_\_\_\_  
Project Address: \_\_\_\_\_

Contractor: \_\_\_\_\_

ASP Technician: \_\_\_\_\_

Chiller-Heater Model #: \_\_\_\_\_

Date of Service: \_\_\_\_\_

Chiller-Heater Serial #: \_\_\_\_\_

(Fill out as completely as possible. Please write legibly.)

### Type of Service:

- ☐ Start-Up
- ☐ Seasonal Changeover
- ☐ Preventive Maintenance
- ☐ Service Call

### Machine Vacuum Condition:

Amount of Non-Condensables Removed: \_\_\_\_\_

Hydrogen Present in the Removed Gas? \_\_\_\_\_

Inhibitor Added? \_\_\_\_\_

Level of Vacuum (mmHg/torr): \_\_\_\_\_

Calling for Operation? (circle one) Yes / No

### ACT-3 Input Readings:

FS1 \_\_\_\_\_  
CVRC \_\_\_\_\_  
CVRH \_\_\_\_\_  
ESC1 \_\_\_\_\_  
ESH1 \_\_\_\_\_  
ESON \_\_\_\_\_  
ESOF \_\_\_\_\_  
P1D \_\_\_\_\_

### ACT-3 Output Readings:

SV2 \_\_\_\_\_ P2 \_\_\_\_\_  
SV1 \_\_\_\_\_ CHSTN \_\_\_\_\_  
LOW \_\_\_\_\_ SRC \_\_\_\_\_  
CVR \_\_\_\_\_ SRH \_\_\_\_\_  
HIGH \_\_\_\_\_ CHM \_\_\_\_\_  
RCM \_\_\_\_\_ SPON \_\_\_\_\_  
RPCH \_\_\_\_\_ SPER \_\_\_\_\_  
P1 \_\_\_\_\_ CHD \_\_\_\_\_

### ACT-3 Temperature Readings:

LT \_\_\_\_\_  
CND \_\_\_\_\_  
WTO \_\_\_\_\_  
CTO \_\_\_\_\_  
CTO \_\_\_\_\_  
HWT \_\_\_\_\_  
TC \_\_\_\_\_  
TH \_\_\_\_\_

### Water Circuits:

#### Pressure Drops

	Tag Value	Actual
Chilled/Hot Water:	80-120%	_____
Absorber Water:	100-120%	_____
Condenser Water:	100-120%	_____
Heat Medium Water:	30-120%	_____

#### Flow Rates

	Tag Value	Actual
Chilled/Hot Water:	_____	_____
Absorber Water:	_____	_____
Condenser Water:	_____	_____
Heat Medium Water:	_____	_____

#### Water Pressure

	at Inlet (85# max)
Chilled/Hot Water:	_____
Absorber Water:	_____
Condenser Water:	_____
Heat Medium Water:	_____

### Solution Pump:

#### Volts (to G)

#### Amps

	Volts (to G)	Amps
L1	_____	_____
L2 (high leg)	_____	_____
L3	_____	_____

### General Electrical

\_\_\_\_\_ Breaker/Fuse Size  
\_\_\_\_\_ Wire Size  
\_\_\_\_\_ SP Rotation Checked

### Electrical Connections Made in Junction Box:

- ☐ P – CM1 (Chilled/Hot Water Pump Motor Dry Contacts)
- ☐ CP – CM1 (Cooling Water Pump Motor Dry Contacts)
- ☐ CTF – CM1 (Cooling Tower Fan Dry Contacts)
- ☐ P3A – CM1 (Heat Medium Signal, NO Dry Contacts)
- ☐ P3B – CM1 (Heat Medium Signal, NC Dry Contacts)
- ☐ S3 – S4 (Heat Medium Pump Dry Contacts)
  
- ☐ 3 – CM2 (Chilled/Hot Water Pump Overloads, Powered Contacts)
- ☐ 4 – CM2 (Cooling Water Pump Overloads, Powered Contacts)
- ☐ 5 – CM2 (Cooling Tower Fan Overloads, Powered Contacts)
- ☐ 6 – CM2 (Heat Medium Pump Overloads, Powered Contacts)

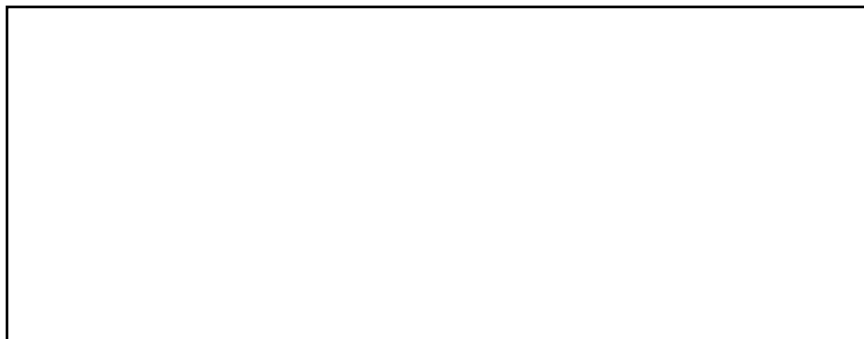
### Dip Switch Positions:

DS1: _____	} on CPU Board
DS2: _____	
DS3: _____	
DP1-1: _____	} on I/O Board
DP1-2: _____	
DP1-3: _____	
DP1-4: _____	
DP1-5: _____	
DP1-6: _____	
DP1-7: _____	
DP1-8: _____	

### Notes:

Please send a copy of any maintenance data sheets to Yazaki Energy Systems, Inc., at the address, FAX number, and/or email address listed on the last page of this document.

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  
Fax: 469-229-5448  
Email: [yazaki@yazakienergy.com](mailto:yazaki@yazakienergy.com)  
Web: <http://www.yazakienergy.com>



This symbol on the product's name plate means it is listed by  
UNDERWRITERS LABORATORIES, INC.

Yazaki reserves the right to discontinue, or change at any time,  
specifications or designs without notice and without incurring obligations.

WFCUL-OI-1A2-0413