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# TWC1000

## Water Treatment System

Installation, Operation and Maintenance Manual

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# Foreword

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The intent of this manual is to serve as a guide for placing your water treatment system in service and operating and maintaining it properly. This manual is supplemented as required to accommodate any special items that may have been provided for a specific application. The written information contained in this manual, as well as various drawings, are intended to be general in nature. The drawings included in this manual are typical only and may not represent the actual unit purchased. Actual drawings are included with the unit and should be referred to for troubleshooting and servicing of the unit. Additional copies of drawings are available upon request. We strive to maintain an accurate record of all equipment during the course of its useful life.

Specific references to current applicable codes, ordinances, and other local laws pertaining to the use and operation of this equipment are avoided due to their ever-changing nature. There is no substitute for common sense and good operating practices when placing any mechanical equipment into operation. We encourage all personnel to familiarize themselves with this manual's contents. Failure to do so may unnecessarily prolong equipment down time.

It is recommended that good piping practices are followed and that the information in this manual is adhered to. We cannot be held responsible for liabilities created by substandard piping methods and installation practices external to the chiller.

We trust your equipment will have a long and useful life. If you should have any questions, please contact our Customer Service Department specifying the serial number and model number of the unit as indicated on the nameplate.

# Installation

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## Receiving Inspection

Each unit is skid mounted and boxed prior to shipment. Before accepting delivery, check the overall equipment condition for any visible damage. If damage is evident, it should be properly documented on the delivery receipt. Shipping damage is the responsibility of the carrier. In order to expedite payment for damages, it is important that proper procedures are followed and records kept. Photographs of damaged equipment are excellent documentation for your records.

Once the packing is removed, the unit should be inspected for hidden damage. Check for broken lines, damaged controls, or any other major component torn loose from its mounting point.

Any sign of damage should be recorded and a claim filed immediately with the shipping company. Our Customer Service Department will provide assistance in preparation and filing of your claims, including arranging for an estimate and quotation on repairs; however, filing the claim is the responsibility of the receiving party.

## Rigging, Handling, and Locating Equipment

Proper rigging methods must be followed to prevent damage to components. Avoid impact loading caused by sudden jerking when lifting or lowering the unit. Use pads where abrasive surface contact is anticipated. The skid supporting the unit can be used for positioning the unit with a crane or a forklift.

As standard, this unit is designed for indoor use. Unless this unit was specifically ordered with construction for outdoor duty, it should not be installed or even stored in an outdoor location.

Serviceability was a primary concern when designing your unit. Do not compromise this feature by locating the unit in an inaccessible area. If it is necessary to store the unit in an unheated area when not in use, be sure that all water is drained out of the unit.

## Location

Locate the unit as close to the system sump and circulating pumps as possible. The unit should be installed so the chemical feed pumps are four to five feet above floor level.

## Piping

1. Connect the fresh make-up water source to the "Make-Up Inlet" on the water treatment unit.
2. Connect the "Make-Up Outlet" of the water treatment unit to the cooling tower system make-up control valve. It is imperative that all system make-up water passes through the water treatment water meter.
3. Run a ¾ inch pipe from the discharge of the system circulating pump to the inlet sample line of the water treatment unit. It is very important that the system water supply to the water treatment unit meet the following requirements:
  - a. Full sized pipe, equal to or greater than the pipe size of the system water supply connection, without restricting fittings.
  - b. A minimum usable pressure of 25 PSI (172 kPa).
  - c. The water supply to the TWC must be available whenever the cooling tower system is operating.
4. Run a ¾ inch pipe from the water treatment unit sample line outlet to the system sump. If there is no system sump, connect the water treatment unit sample line outlet to the suction side header of the circulating pump(s).

*Note: Over-tightening the plastic connections can lead to the development of water leaks. Use care when connecting the system piping to the unit.*

## Electrical

This unit is fused for a three amp resistive load. Do not attempt to operate a chemical feed pump with a motor larger than supplied for this circuit. The circuit connected to the controller must be live whenever the cooling tower system pump is operating. All of the components of the system are wired to the controller. You need only provide a 120/1/60 VAC outlet for plugging in the controller.

# Start-Up

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## Trial Water Flow

Turn on the cooling tower water supply to the TWC by opening the isolating valve. Check that water flows freely through the unit and returns to the cooling tower system sump.

## Powering the Unit

The microprocessor has been preprogrammed at the factory and does not require any initial programming or setup. Connect the power cord to an appropriate wall outlet. This will display the start-up screen (see Controller Operation section for more details).

## Priming the Chemical Feed Pumps

There are two chemical feed pumps, both of which will need to be properly primed prior to placing the unit into operation. The Scale Inhibitor pump is controlled by relay 2 (RLY2) and the Biocide pump is controlled by relay 3 (RLY3). Both pumps are primed according to the following steps.

1. Turn on main power to the TWC.
2. Prime chemical pumps.
  - a. Fill the suction tubing of the chemical pump with water.
  - b. Place the suction foot valve of the chemical pump in water.
  - c. Press ENT on the controller keyboard then press 2 to select the inhibitor pump relay (RLY2). The inhibitor pump output relay will activate and the chemical pump will pulse for five minutes and prime itself. After sequencing, the system will return to automatic specifications.

*NOTE: If pump does not prime, refer to "Priming" in the Chemical Pump section of this manual.*

- d. Press ENT on the controller keyboard then press 3 to select the biocide pump relay (RLY3). The biocide pump output relay will activate and the chemical pump will pulse for five minutes and prime itself. After sequencing, the system will return to automatic specifications.

*NOTE: If pump does not prime, refer to "Priming" in the Chemical Pump section of this manual.*

- e. To deactivate the relay before five minutes have elapsed, simply press the relay number on the keypad.

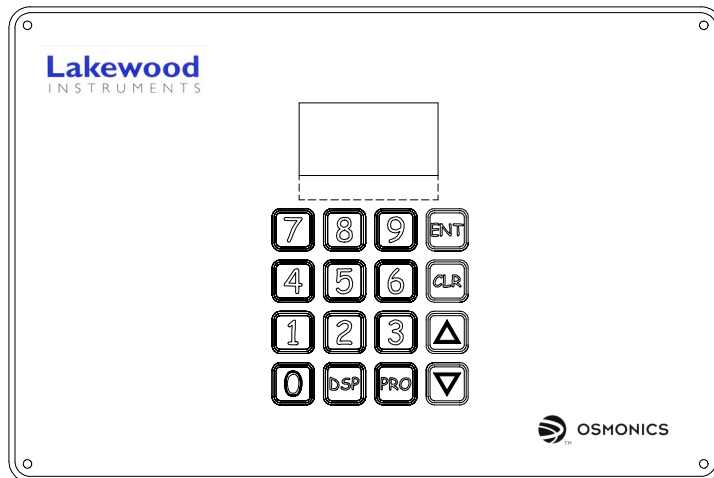
## Blowdown Solenoid Valve Test

1. At the relay display, press 1 on the controller. The blowdown relay will activate and the solenoid valve will open for five minutes. After sequencing, the system will return to automatic operation.
2. Check the flow of water to the drain. When the relay times out, the solenoid valve will shut off and water flow will cease.

# Controller Operation

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Figure 1 – Control Panel

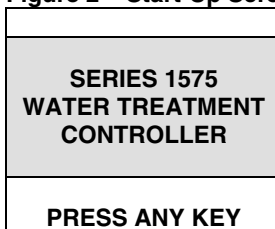


## Initial Start-up Screen

The microprocessor controller has been programmed at the factory and does not require any initial adjustments or changes prior to use. After the unit has been in operation for a while and you have begun gathering water sample analysis information, it may be necessary to modify the factory program to allow for the unique nature of the water in your cooling tower system.

When power is first turned on, the controller will show the following.

Figure 2 – Start-Up Screen



When this screen is displayed it indicates that power has been applied to the controller and no one has touched the keypad. This will also happen anytime there is a power outage and power has been returned to the controller. Once this menu is displayed:

1. Press any key on the keypad and you will see the PROCESS screen.
2. Press CLR once on the keypad and you will see the MAIN MENU on the screen.
3. Use the **↑** and **↓** arrow keys to move through the menu. There are eight items in total but only six will be displayed at a time.

Press CLR to return to a previous screen. Repeated use of CLR allows you to return to the Main Menu from anywhere in the program. The factory settings are shown in Table 1.

**Table 1 – Factory Settings of Microprocessor**

Item	Controller Device Setup Description	Variable	Programmed Value
Blowdown Solenoid Valve Timer Relay	The BLOW relay is energized based on setpoint. Blowdown valve is a solenoid valve	SETPOINT	1000
		DEADBAND	30
		TIMEOUT	3:00
Inhibitor Chemical Feed Pump Timer Relay	The RLY2 relay is energized based upon water meter volume	FEED AFTER GALS/LTR	50
		MINS:SEC TO FEED	1:00
Biocide Chemical Feed Pump Timer Relay	The RLY3 relay is energized based upon a feed schedule	FEED SCHEDULE	BY CYCLE CALENDAR
		CYCLE DAY	04
		START TIME	10:00
		COND SETPOINT	800
		BLOW DURATION	00:30
		FEED DURATION	01:00
Alarm Relay	The RLY4 relay is set to activate upon any alarm	LOCKOUT TIME	02:00
Water Meters	The MTR1 input is for a contacting head water meter connected to the make-up water line	ALARM RELAY	Selected
		WATER METER TYPE	AUTOTROL 1" TURBINE
		GALLONS OR LITERS PER CONTACT	50
Clock	Clock is set to Central Standard Time	Day, Time	Central Standard Time
Security Level	No password is active	None	TECHNICIAN LEVEL

## Changing Chemical Feed Pump Settings

The controller controls the amount of scale and corrosion chemical that is fed into the system in direct proportion to the amount of make-up water that is added to the system. From the factory the controller is programmed to energize the Scale Inhibitor chemical feed pump for one minute after 50 gallons of make-up water have been added to the system. The Biocide chemical feed pump has been programmed to energize once a week for a one-hour period of time. Based on actual water test results, the setting for the Scale Inhibitor chemical feed pump may need to be adjusted to compensate for your water conditions. Your supplier of water treatment chemicals will advise you of the changes that may be required. Make changes only if they recommend it. If the Scale Inhibitor chemical feed timer needs to be adjusted you should perform the following:

1. Press the CLR key until you return to the MAIN MENU.
2. Press 2 to select "RELAYS" and then press the ENT button.
3. Press 2 to select "RLY2" and then press the ENT button.
4. Press 3 to select "WATER METER" and then press the ENT button.
5. Press 1 to select the "MTR1" and then press the ENT key.
6. Press the ENT key again to accept the 50 gallons per contact setting.
7. Now enter the new pump time in MIN:SEC as recommended by your supplier of Scale Inhibiting chemicals and then press the ENT to accept the new settings.
8. Press the CLR key to return to the previous screen. Continue pressing the CLR key until you return to the Main Menu.

# Operation

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The water treatment system is assembled and programmed to automatically operate a complete water treatment program including scale and corrosion control chemical feed, biological control chemical feed and bleedoff.

## Scale and Corrosion Control

A scale and corrosion control chemical is fed in direct proportion to the amount of make-up water added to the cooling tower system. This chemical is designed to keep minerals in the water in solution (dissolved in the water) and prevent them from precipitating out of solution (becoming a solid like scale or sludge) which can plug the system. The chemical typically allows the mineral concentration to be about three times as much as would normally be possible in untreated water. This allows the amount of bleedoff to be greatly reduced. Another function of this chemical is to keep the water from becoming acidic or basic (these conditions are corrosive). From the factory the system is programmed to energize the chemical feed pump for one minute once 50 gallons of makeup water have been added. Based upon actual test results of a cooling tower system, it may become necessary to increase or decrease the duration of time the chemical feed pump is energized. This will increase or decrease the amount of chemicals present in the cooling tower system.

## Biological Control

A biocide chemical is fed into the cooling tower system once a week. From the factory the system is programmed to energize the chemical feed pump for 60 minutes. During this period of time the blowdown valve is disabled to prevent the treatment chemicals from being lost to the drain.

## Bleedoff Control

Although the Scale Inhibitor chemical will keep the minerals in the water in solution at levels much higher than normally possible, it is still necessary to purge the system of this concentrated water to prevent the over-concentration of dissolved solids which could lead to scale, sludge and plugged lines. This valve is energized based upon the conductivity of the cooling tower water. Conductivity is a measurement of how well an electrical current can be transmitted through the water. As the amount of dissolved minerals in the water increases, the conductivity will increase. From the factory the controller is programmed to open the bleedoff valve when the conductivity reaches 1000 Meg Ohms. The valve will remain open until the water conductivity drops below 1000 Meg Ohms.

# Preventive Maintenance

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The maintenance of the water treatment system is important in order to ensure consistent performance and proper treatment of the cooling tower system water. Failure to perform this maintenance may lead to improper treatment of the cooling tower system water that can result in formation of scale, silt and biological growth. These can cause significant down time due to the cleaning, repair or total replacement of heat exchangers or other components in the cooling tower water system.

## Conductivity Sensors

The controller has fouling compensation that reduces the need for sensor cleaning. The fouling alarm will sound when the sensor is too fouled to provide accurate readings. The sensor must be cleaned at that time. To clean the sensor, perform the following.

1. Valve off flow to the sensor assembly.
2. Unlock the red lock ring and remove the sensor.
3. Use a soft brass brush or a coarse rag and gently clean the sensor tips.
4. Clean off the "O" ring and then apply silicone base lubricant to keep the "O" ring moist.
5. Replace the sensor and make sure the red lock ring is secured.
6. Turn sample flow back on.
7. Calibrate the controller, then allow the controller to operate several hours in order to stabilize the electrodes. The controller can then be re-calibrated for best accuracy.

## Flow Switch Clean Out

1. Valve off flow to the sensor assembly.
2. Unlock the red lock ring and remove the flow sight.
3. Remove the float with your fingers.
4. Gently use a bottlebrush on the float, flow sight and the flow switch assembly to remove any residue.
5. Replace the float, long stem upward.
6. Clean off the "O" ring and then apply silicone base lubricant to keep the "O" ring moist.
7. Make sure to lock down the red lock ring after the components are replaced.
8. Check for leaks once the inlet flow is turned backed on.

## Chemical Feed Pumps

The chemical feed pumps are peristaltic type metering pumps. The primary maintenance that needs to be performed is an annual replacement of the tubing assembly by following the steps shown below.



*Always wear protective clothing and safety glasses when working on the chemical pump and refer to the chemical manufacturers' safety precautions.*

### Tubing Assembly Removal

1. Remove the power to the pump and flip the toggle switch off.
2. Relieve system pressure and drain discharge and suction tubing.
3. Loosen coupling nuts and remove the tubing from suction and discharge ports.
4. Remove the back check valve from the discharge port.
5. Remove the two thumbscrews holding on the pump head cover.
6. Remove pump head cover.
7. Remove the pump head tube assembly by removing both connector fittings and pulling tubing straight out of the pump head.



*Tubing may still retain a small amount of chemical.*

8. Remove rotor assembly by pulling straight out of pump head.
9. Clean any tubing debris from the rotor head assembly and pump head

### Tubing Assembly Installation

1. Reinstall the rotor assembly by aligning the cross in the rotor to the drive shaft cross and fully insert into pump head.
2. Flip the toggle switch from on to off to align the rotor assembly.
3. Insert one connector end of the tubing assembly into the right retaining slot in the pump head. Insert the tube through the guide slot in the rotor. Using caution, flip the toggle switch from on to off several times while feeding the tube around the pump head as the guide slot rotates. When the rotor is positioned, switch the pump off. Insert the other connector into its retaining slot.
4. Align the pump head and cover bearing bore with the rotor shaft and press into place.
5. Loosely reinstall the two thumbscrews.
6. Turn the pump on and run the pump for several revolutions and then fully tighten the thumbscrews to hand tight (**DO NOT OVERTIGHTEN**).

## Water Meter

The water meter is an Autotrol Flow Turbine with a Hall-effect transducer that sends pulses to the controller. There is no required routine maintenance required for this component.

## **Bleed-Off Solenoid Valve**

The bleed-off solenoid valve is a heavy-duty industrial grade valve. It opens when energized by the controller and closes when commanded by the controller. No differential pressure is required to open the valve. Should the valve become clogged, it can be cleaned very simply as follows:

### **Unclogging the Solenoid Valve**

1. Remove electrical power to the solenoid valve by unplugging it from the bottom of the controller.
2. Isolate the water treatment system from cooling tower water by closing the valve on the cooling tower water supply.
3. Remove the solenoid coil from the stem.
4. Loosen and remove the four screws in the solenoid valve body.
5. Remove the diaphragm. Inspect and clean debris as necessary.

*Note: There is a small hole in the valve diaphragm to allow for pressure equalization. This hole is necessary and is not a sign of wear or damage.*

6. Replaced the diaphragm and spring.
7. Assemble the body.
8. Replace the coil and cap.
9. Return to operation.

# Troubleshooting

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
{ Alarm Flashing } "CONDUCTIVITY HIGH".	<i>Conductivity is too high with respect to the high alarm setpoint. Also opens up Bleed Valve (useful during FEED SCHEDULE lockout).</i>	<ol style="list-style-type: none"> <li>1. See {BLOWDOWN TIMEOUT}.</li> <li>2. Change the High Alarm Value.</li> </ol>
{ Alarm Flashing } "CONDUCTIVITY LOW".	Conductivity is too low with respect to the low alarm setpoint.	<ol style="list-style-type: none"> <li>1. Check blowdown setpoint and deadband.</li> <li>2. Verify blowdown valve is not stuck open.</li> <li>3. Change the Low Alarm Value.</li> </ol>
Water meters not accumulating.	There may be a problem with the wiring or the reed switch in the meter may be bad.	Approximately 5 volts DC should be present at the input terminal when the water meter contact is closed. That should change to zero VDC when the contact opens. Check these voltages and for correct wiring.
{ Alarm Flashing } "FEED SEQUENCE ACTIVE".	This simply indicates that a feed schedule relay is active.	No action necessary.
Display is blank.	Open the front panel.	<ol style="list-style-type: none"> <li>1. Check the fuse. Replace with 5 x 20 mm, 10A, 250V, fast blow fuse.</li> <li>2. Check the supply power source and verify the unit has power.</li> <li>3. If there is power to terminals AC and ACC on P1, call our Customer Service Department for more information.</li> </ol>
"NO FLOW" alarm.	Flow input switch is not closed.	<ol style="list-style-type: none"> <li>1. The flow switch float may be stuck or no flow is present.</li> <li>2. Flow switch may be bad. Replace reed switch in plumbing assembly.</li> </ol>

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
{ Alarm Flashing } “BLOWDOWN TIMEOUT”.	This indicates that the controller has been trying to reduce the conductivity for longer than the user-programmed time and is unable to reach the setpoint.	<ol style="list-style-type: none"> <li>1. Check for proper operation of the blowdown valve. Use the manual relay control to help.</li> <li>2. Check that the blowdown valve is not stuck closed or restricted.</li> <li>3. Check for proper makeup flow.</li> <li>4. Verify blowdown timeout time is properly set for your application (see item #2 or RELAYS in MAIN menu).</li> </ol>
{ Alarm Flashing } “OPENED TC”.	Temperature compensator not being properly read.	<ol style="list-style-type: none"> <li>1. Check wiring.</li> <li>2. Replace conductivity sensor.</li> </ol>
{ Alarm Flashing } “SHORTED TC”.	Temperature compensator not being properly read.	<ol style="list-style-type: none"> <li>1. Check wiring.</li> <li>2. Replace conductivity sensor.</li> </ol>
Motorized ball valve functions, but will not remain “open” or “closed” as expected.	The motorized ball valve is not indicating to the controller that it has actually reached the open or closed position.	<i>Adjust the limit switch for the motorized ball valve.</i>
Chemical levels improper	The pump timers are set too low, the pump valves or hoses are clogged, the chemical drums are empty, the pumps are malfunctioning or there has been siphoning of chemical.	<ol style="list-style-type: none"> <li>1. Adjust timer.</li> <li>2. Clean pump valve or hose.</li> <li>3. Replenish chemical.</li> <li>4. Test for suction or vacuum at the injection point and install anti-siphoning device if required. Contact our Customer Service Department for assistance.</li> <li>5. Check pump tubing and motor and repair or replace as necessary.</li> </ol>

# Drawings

Figure 1 – General Unit Diagram

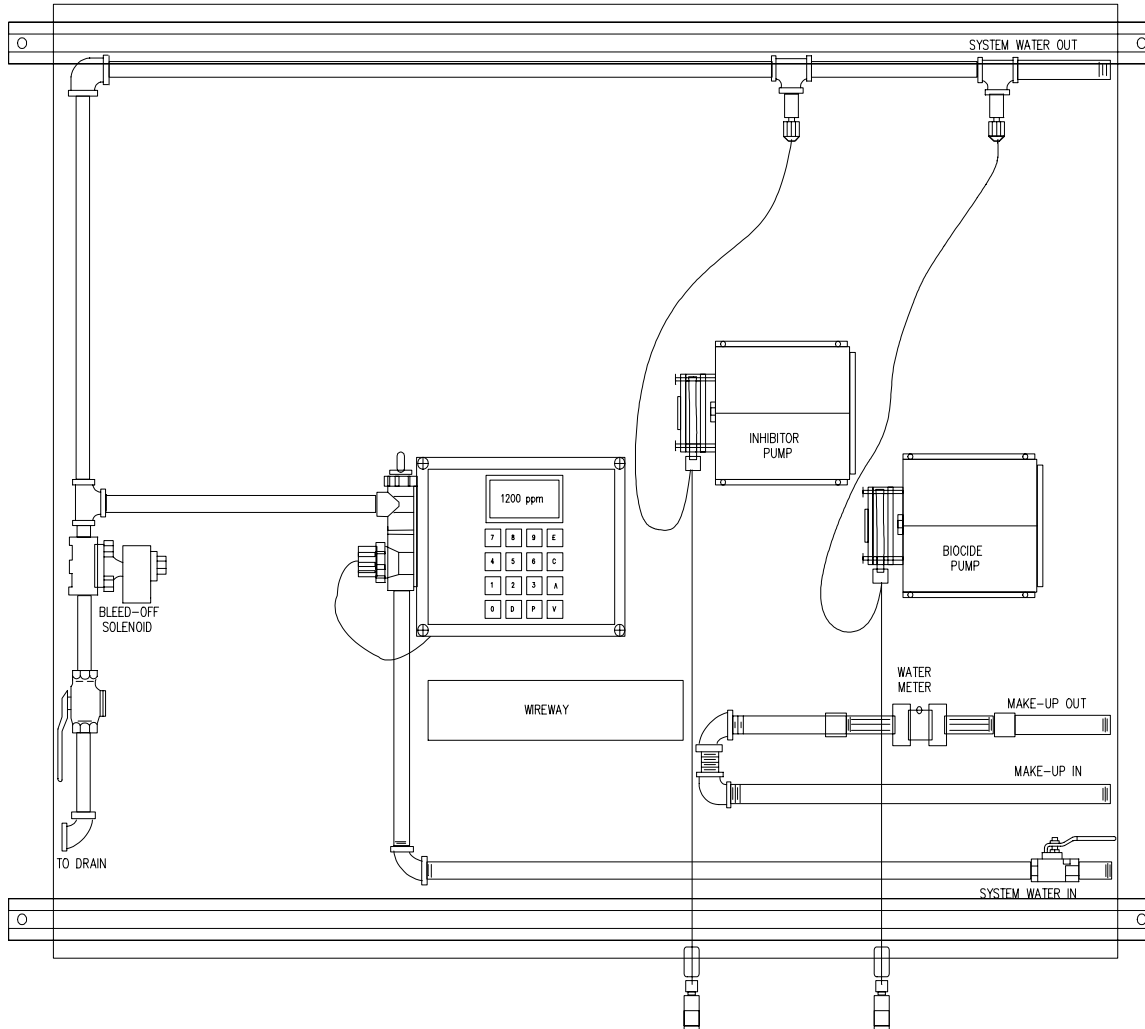


Figure 2 – General Piping Drawing

