evapco®

WATER SAVER™

# Installation, Operation & Maintenance Manual


EVAPCO...*Specialists in Heat Transfer Products and Innovative Treatment Solutions*

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# Introduction

Thank you for your purchase of EVAPCO's Water Saver (EWS), a capacitive deionization pretreatment system. Water Saver systems are constructed using the highest quality materials and workmanship. Evaporative cooling equipment is often the main water consumer for a building or process. The Water Saver improves an evaporative unit's water quality and is designed to provide years of reliable service when properly maintained.

# Safety Precautions

Qualified personnel should use proper care, procedures, and tools when operating, maintaining, or repairing this equipment in order to prevent personal injury and/or property damage. The warnings listed below are to be used as guidelines only.

**The Water Saver is an electrical device. Use caution when working on or near the Water Saver.**

**Electrical Hazard – Service and troubleshooting to be completed by trained and authorized service professionals only.**

# Water Saver System Overview

The Water Saver is an environmentally responsible pretreatment system that offers the following benefits:

- Improves Evaporative Cooling Water Efficiency by Increasing Operating Cycles of Concentration
- Reduces Blowdown and Treatment Chemicals Sent to Drain
- Low Cost of Ownership
- 75-85% Recovery Rate

## Standard Equipment and Operation

The Water Saver system is comprised of a control panel, ion removal cylinders, flow sensor, conductivity probes and interconnecting valves and piping. A nameplate indicating the model number, part number, and serial number is located on the side of the Control Panel. A 12- cylinder Water Saver (EWS-34) is shown in Figure 1.

The Water Saver is available in nine different cylinder arrangements, engineered to produce a target gal/min of lower conductivity makeup water to the evaporative unit. Systems come in 4, 6, 8, 9, 12, 15, 18, 20, 24-cylinder designs. Available voltage configurations are 230V, 3-phase, 3-wire (delta), or 480V, 3-phase, 4-wire (WYE). 480V applications may require a transformer. Refer to Figure 2 for a basic component schematic.

**Figure 1: Evapco Water Saver 12-Cylinder Pretreatment Skid**

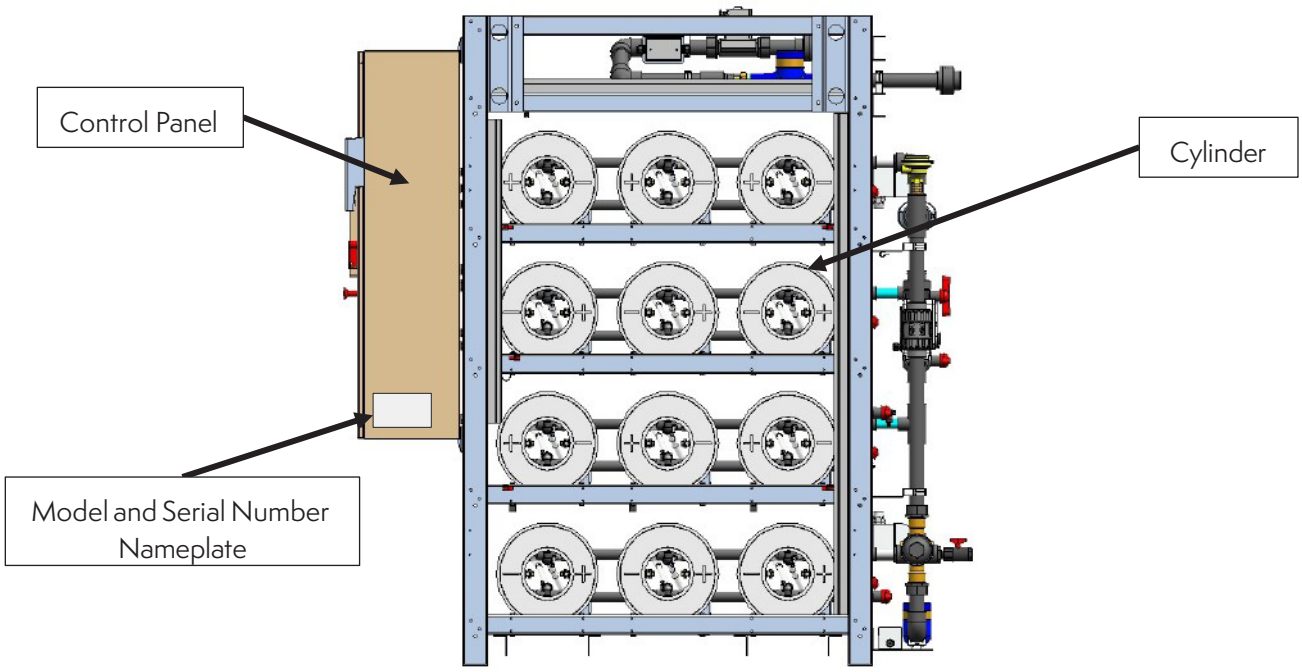



**Figure 2: Basic Components**

Table 1 shows the Water Saver models that are available and their respective mechanical and electrical specifications for field installed models.

| Model Number | Length (in.) | Width (in.) | Height (in.) | Voltage | FLA | # of Cylinders | GPM Clean Makeup |
|---|---|---|---|---|---|---|---|
| EWS-22 | 64 | 46-1/2 | 83-1/4 | 230/480 | 21.5/13.1 | 4 | 6 - 10 |
| EWS-23 | 64 | 46-1/2 | 83-1/4 | 230/480 | 21.5/13.1 | 6 | 9 - 15 |
| EWS-24 | 64 | 46-1/2 | 83-1/4 | 230/480 | 21.5/13.1 | 8 | 12 - 20 |
| EWS-33 | 79 | 46-1/2 | 83-1/4 | 230/480 | 21.5/13.1 | 9 | 13 - 22 |
| EWS-34 | 79 | 46-1/2 | 83-1/4 | 230/480 | 21.5/13.1 | 12 | 18 - 30 |
| EWS-53 | 115 | 46-1/2 | 83-1/4 | 230/480 | 36.5/23.1 | 15 | 22 - 37 |
| EWS-54 | 115 | 46-1/2 | 83-1/4 | 230/480 | 36.5/23.1 | 20 | 30 - 50 |
| EWS-63 | 130 | 46-1/2 | 83-1/4 | 230/480 | 36.5/23.1 | 18 | 27 - 45 |
| EWS-64 | 130 | 46-1/2 | 83-1/4 | 230/480 | 36.5/23.1 | 24 | 36 - 60 |

**Notes:**

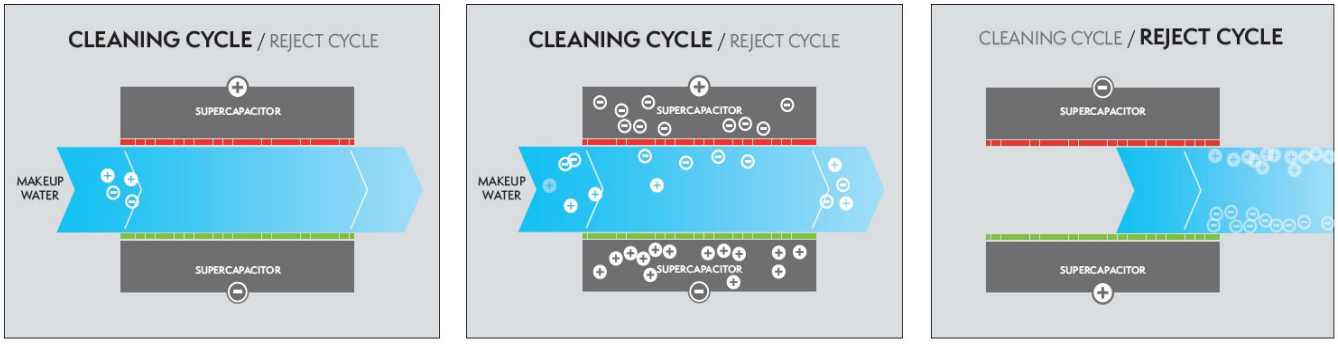
1. Unit is designed for indoor installation
2. A sanitary drain is required to dispose flush cycle water
3. Inlet water pressure requirement: Min = 65 psi; Max = 120 psi
4. Electrical Service requirement: 230 V, 3 ph, 3 wire (delta) or 480 V, 3 ph, 4 wire (wye)
5. "GPM Clean Makeup" capacity for each model is variable within the flow rate range shown, dependent of raw makeup water quality

**Table 1: Factory Assembled Water Saver Models and Specifications**

# Principle of Operation

## Water Saver Pretreatment System

The Water Saver system uses capacitive deionization technology to reduce dissolved ion concentration, thus lowering the makeup water conductivity prior to use in an evaporative cooling system. Makeup water entering the Water Saver passes through individual cylinders which contain oppositely charged supercapacitor surfaces. Dissolved ions (except silica) are removed from the water as they are adsorbed onto the charged capacitor. A 50% ion reduction allows the operating cycles of concentration to be safely doubled without an increase in scale or corrosion potential. Figure 3 describes the capacitive deionization process. Figure 4 shows an up-close view of a cylinder.




Makeup water flows into a cylinder

Supercapacitors attract oppositely charged ions from the makeup water

**Figure 3: Illustration of EWS Cycles**

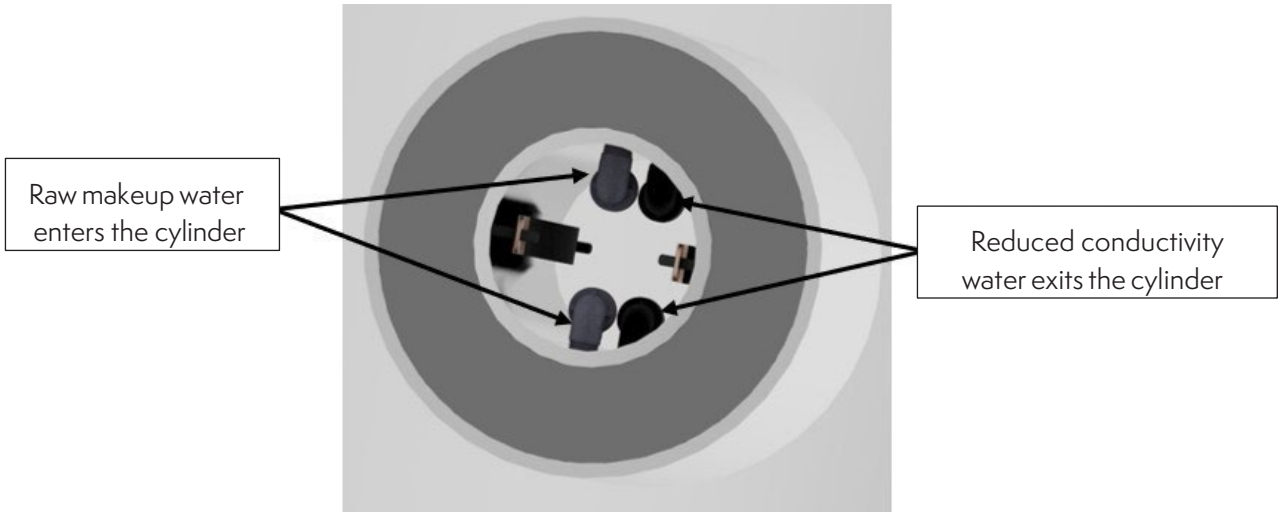



**Figure 4: Illustration of EWS Cylinder**

## Design Considerations

There are multiple standard configurations for field piping and wiring of Water Saver systems based on the evaporative system design and layout.

- EWS piped directly to a single evaporative unit (see Figure 5)
- EWS piped to a makeup water tank with a single evaporative unit (see Figure 6)
- EWS piped to a makeup water tank with multiple evaporative units (see Figure 7)

Each evaporative unit must be equipped with an Electronic Water Level Controller (EWLC). The EWLC starts Water Saver operation when makeup water demand is sensed and stops operation when demand is satisfied (see Figure 5). If the system uses a makeup tank (supplied by EVAPCO), the EWLC (supplied by EVAPCO) on the tank will start and stop Water Saver operation (see Figure 6 or Figure 7). Makeup water bypass piping and control valve are supplied and field installed (by others) and are required to ensure the evaporative unit(s) will always have makeup water available.

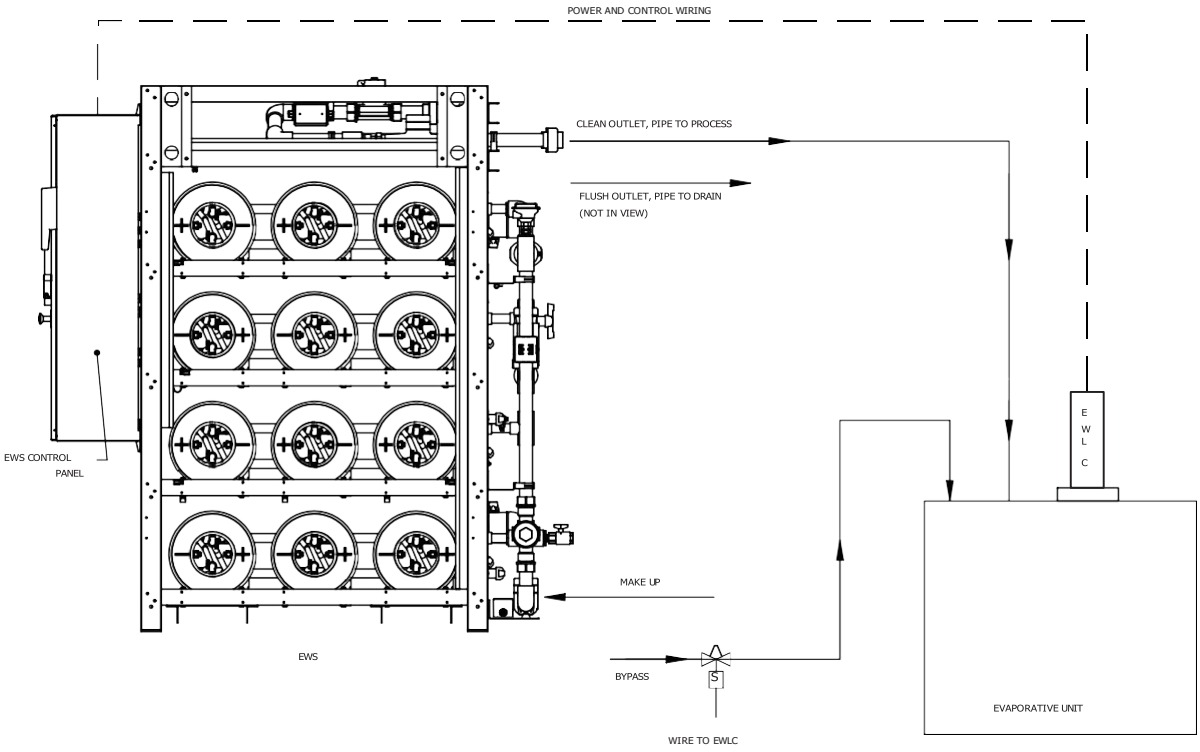



**Figure 5: EWS Field Piping/Wiring for Direct Feed to Single Evaporative Unit**

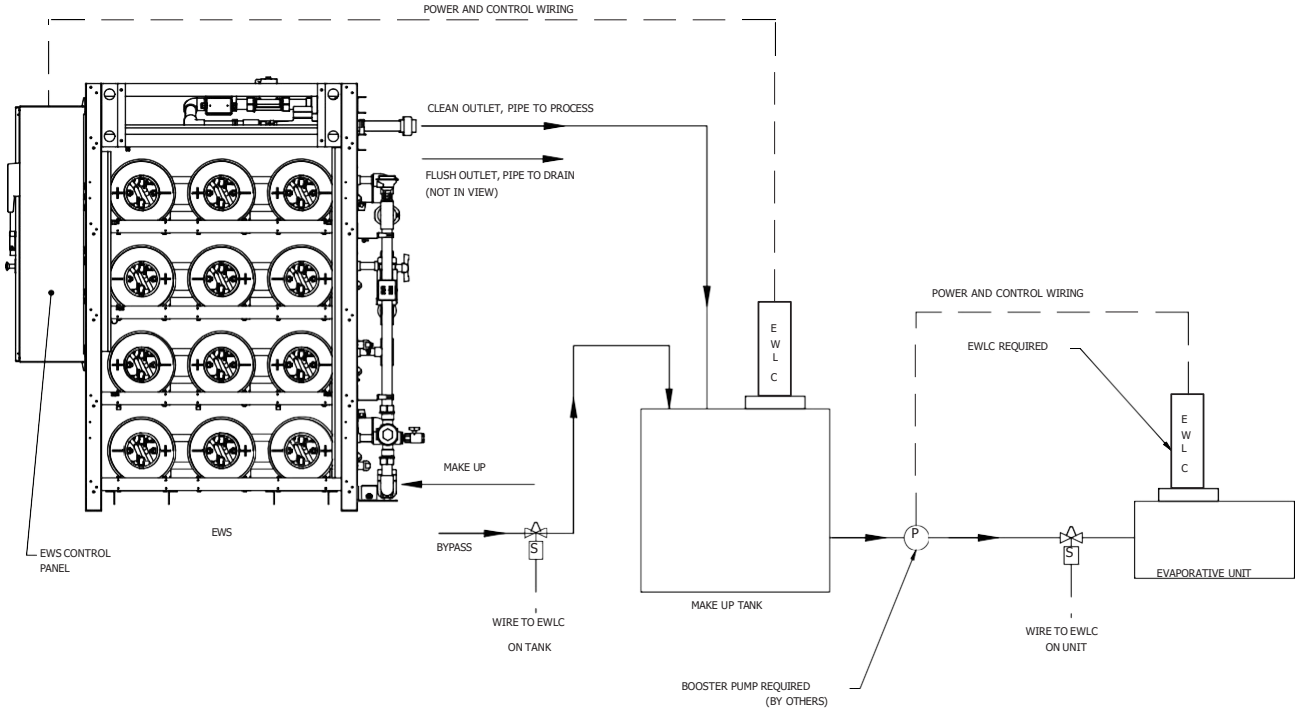



**Figure 6: EWS Field Piping/Wiring for Single Evaporative Unit with a Makeup Tank**

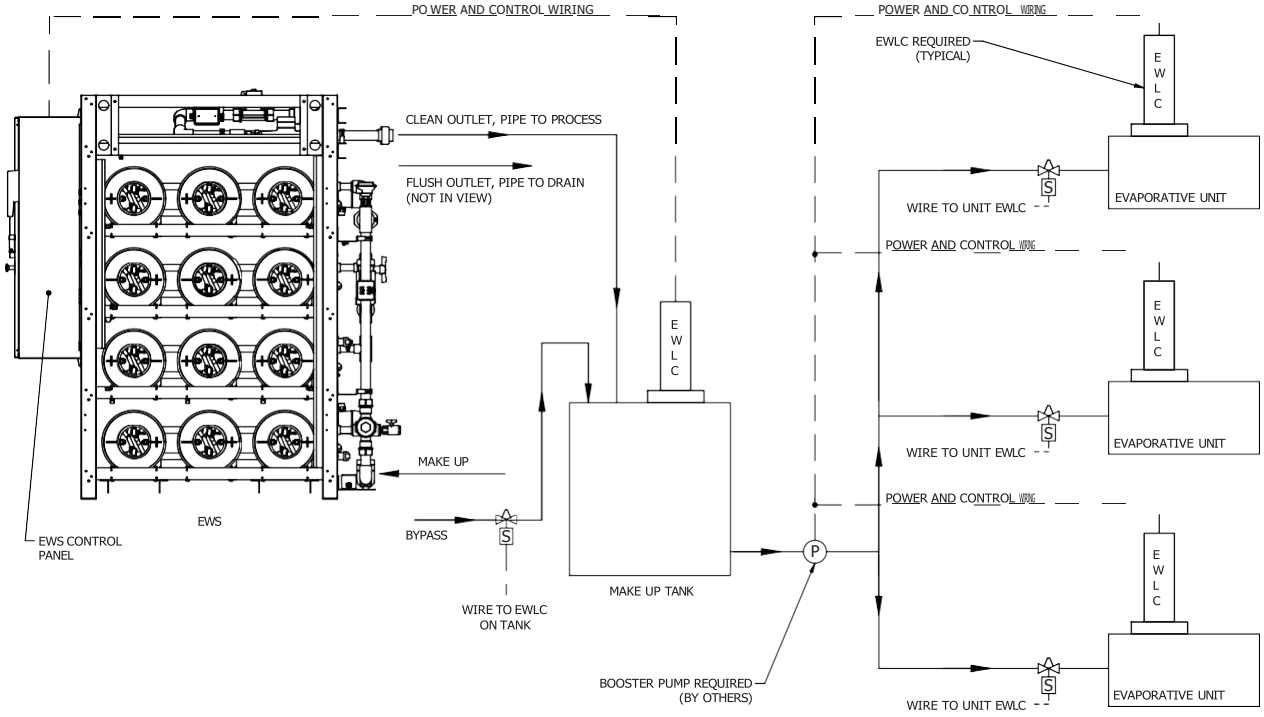



**Figure 7: EWS Field Piping/Wiring for Multiple Evaporative Units with Makeup Tank**

## Makeup Water Tank

As determined by system design, the EWS supplies reduced conductivity water to a makeup water tank. A booster pump (supplied and field installed by others) supplies water from the makeup tank to the evaporative cooling unit(s). Makeup tanks are sized by evaporative unit demand and supplied by EVAPCO. An 850-gallon tank is shown in Figure 8. All makeup tanks supplied with the Water Saver(s) have the following connections:

- 2" FPT connection at bottom of tank to connect makeup line to evaporative unit
- 3" self-aligning connection on top of tank for custom 5 probe EWLC

Clearance above the top of the tank is required for placement of EWLC probes (refer to Table 2 for standard tank sizes). EWS inlet water should be directed downwards, away from the EWLC probes. Depending upon the height of the mechanical room, the 5-probe EWLC may need to be installed prior to moving the tank into the building. Tank overflow piping is recommended. Installation and parts for overflow piping is supplied by others.

| **Make-up Tank** (gallons) | **Tank Clearance** (Minimum) |
|---|---|
| 300 | 79" |
| 500 | 68" |
| 750 | 98" |
| 850 | 112" |
| 1500 | 110" |
| 2000 | 120" |
| 2500 | 82" |

**Table 2: Minimum Clearance Over Makeup Tank**

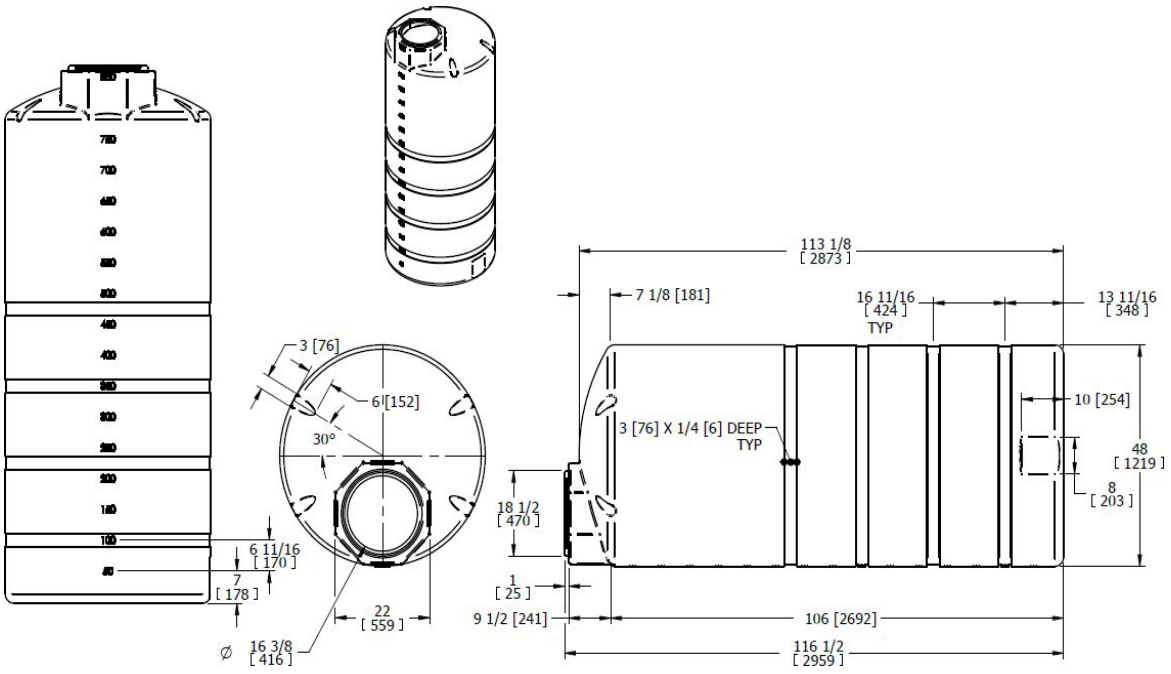



**Figure 8: Makeup Tank 850-gal Capacity**

## Clean-In-Place (CIP)

The Water Saver requires periodic cleaning of the cylinders. CIP equipment supplied with the Water Saver includes a portable cleaning solution tank, submersible pump, and interconnecting flexible tubing. Water Saver CIP plumbing connections are integral to the unit. CIP pump discharge is connected to the Water Saver's CIP inlet. CIP outlet returns to the solution tank. A sanitary sewer drain will be used during the CIP process. The pump comes equipped with standard 120V maleplug. The Water Saver has a GFCI utility outlet for this purpose. Refer to Figure 9 for CIP layout.

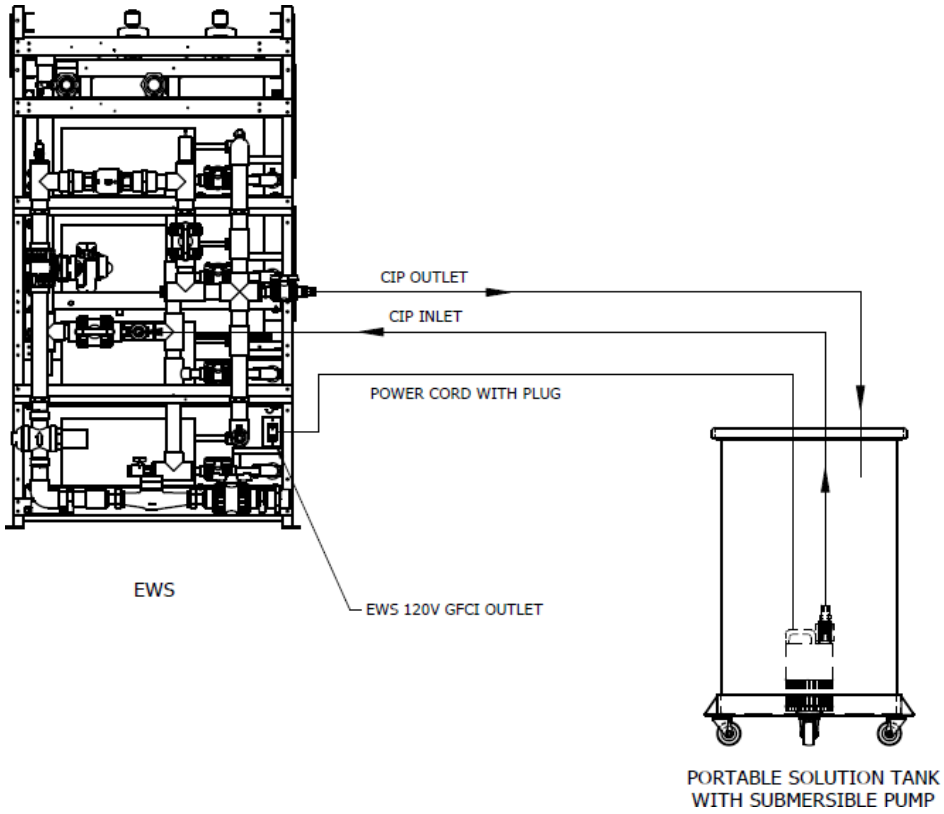



**Figure 9: CIP Equipment**

## Operational Chemical Feed

The Water Saver may require a chemical feed addition as part of the operating program to maintain performance. A small chemical feed pump and 5-gallon pail of chemistry is supplied when chemical feed addition is necessary (chemistry is dependent on makeup water quality and decided by EVAPCO). The pump is powered by the Water Saver.

# Field Installation Guidelines

The following needs to be completed in the field prior to starting up the EWS.

## Moving the EWS

**Forklift Slots**
The Water Saver is equipped with forklift slots, hanger brackets, and mounting plates.
If using a forklift, only use the slots marked "FORK HERE" to lift. Equipment damage may result if EWS is lifted from the frame. Use caution when moving the EWS. The control panel is heavy and can cause the skid to tip.

**Lifting Brackets** are located on each corner of the frame.

**Mounting Foot Plates**
Lagging the Water Saver to the mechanical room floor is recommended. Mounting foot plates with ¾" holes are located on the EWS frame.

Refer to Figure 10 for lifting and mounting locations.


**Figure 10: Lifting and Mounting Locations**

## Plumbing the EWS

**Inlet (Supply) Piping** – see Figure 11

Inlet pipe connections vary by EWS model size. Consult Figure 11 for inlet pipe size. Supply piping (installed and supplied by others) to EWS inlet must be sized to provide sufficient flow rate and pressure. The minimum inlet pressure is 65 psi. Do not exceed 120 psi inlet pressure. Schedule 80 PVC supply piping is preferred. Supply piping must not be copper.

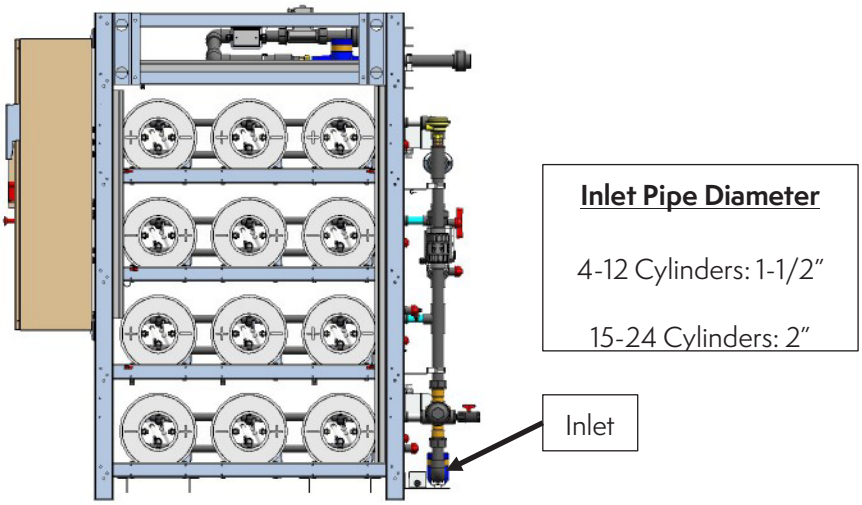



**Figure 11: Makeup Inlet Plumbing**

### Clean Outlet

The reduced conductivity (clean) outlet water flow from the EWS is plumbed to either the evaporative unit or the makeup tank. Due to pressure drop across the EWS (up to 15 psi), some installations may require an inline booster pump (supplied by others) to get the outlet water flow to the desired destination. A booster pump (supplied by others) is required when a makeup tank is used to supply makeup to the evaporative unit(s). A totalizing water meter is factory installed prior to shipment.

### Flush Outlet

Flush outlet shall be plumbed to a sanitary drain near the EWS. Refer to Figure 12 below for the outlet locations.

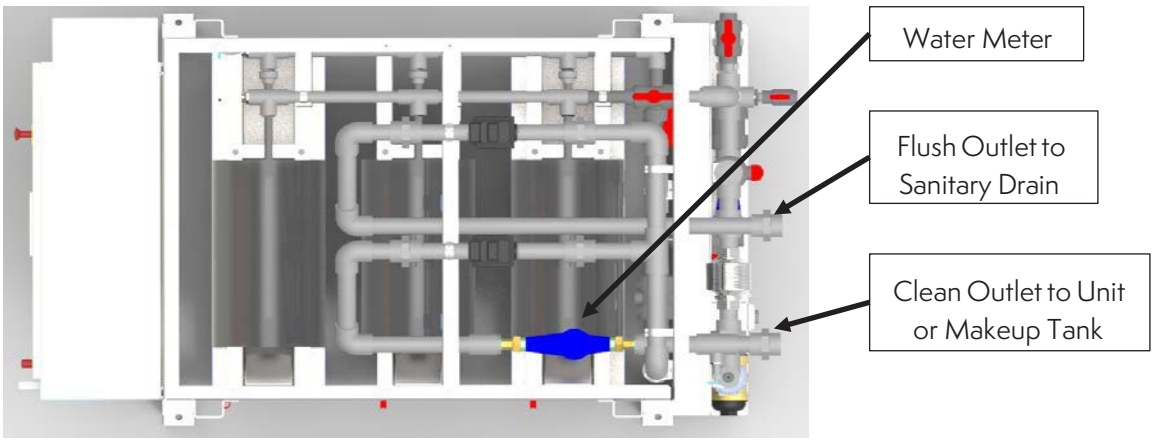



**Figure 12: Outlet Plumbing (Plan View)**

## EWS Bypass Loop

The bypass engages when the water reaches the "By-Pass On" probe of the EWLC. The EWS system is designed to continue to operate even if bypass is engaged. Maintaining inlet water pressure and flow during bypass is important.

Install bypass piping around the EWS (piping and valve by others) using the following recommendations.

- The bypass line shall be separate to the makeup line going to the EWS and the EWS clean outlet line
- Bypass piping diameter shall be equal to or smaller than Inlet (Supply) piping diameter
- In most applications, the recommended cycle time for the bypass valve is 15-25 seconds (line size and pressure may affect recommended cycle time)
- On the outlet side, the bypass line must run all the way to the tower for configurations without a makeup tank

See Figure 5-Figure 7 for examples of typical bypass piping configurations. Wire the bypass valve to the 5 probe EWLC as shown in Figure 14. Bypass operation is controlled by EWLC.

## Wiring Power to the Control Panel

The EWS has the following electrical options:

1. 230V, 3 phase, 3 wire (delta)
2. 480V, 3 phase, 4 wire (wye)

Refer to Figure 13A - C for supply voltage connections.

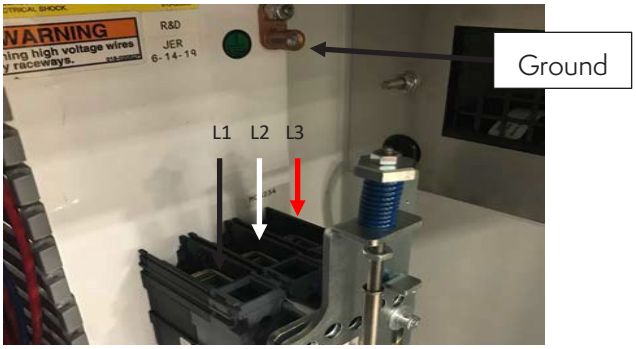



**Figure 13A: Supply Voltage 230V, delta**

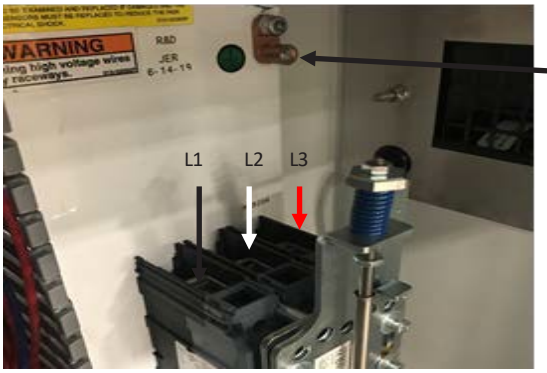



**Figure 13B: Supply Voltage 480V, wye**

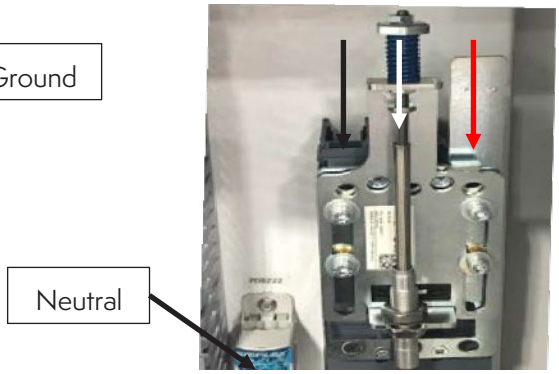



**Figure 13C: Neutral 480V, wye**

## Wiring the EWLC and Bypass Solenoid

Figure 14 shows wiring for a single EWS running off a single EWLC. Internal wiring to be done by others. For other configurations, please contact your local Evapco Representative.

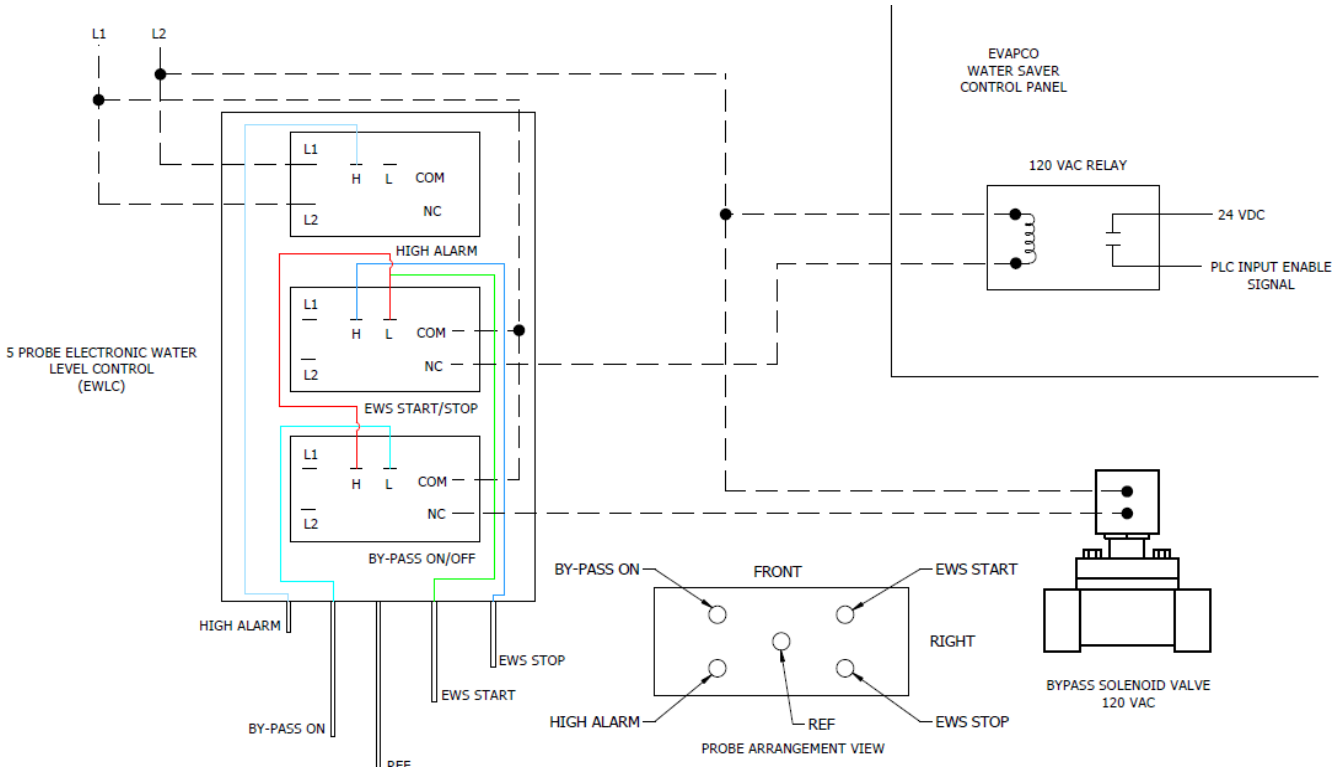



**Figure 14: EWLC Wiring Diagram for a Single EWS Running off a Single EWLC**

## Components

Figure 15 depicts the sensors, valves, and other components on the side of the EWS.

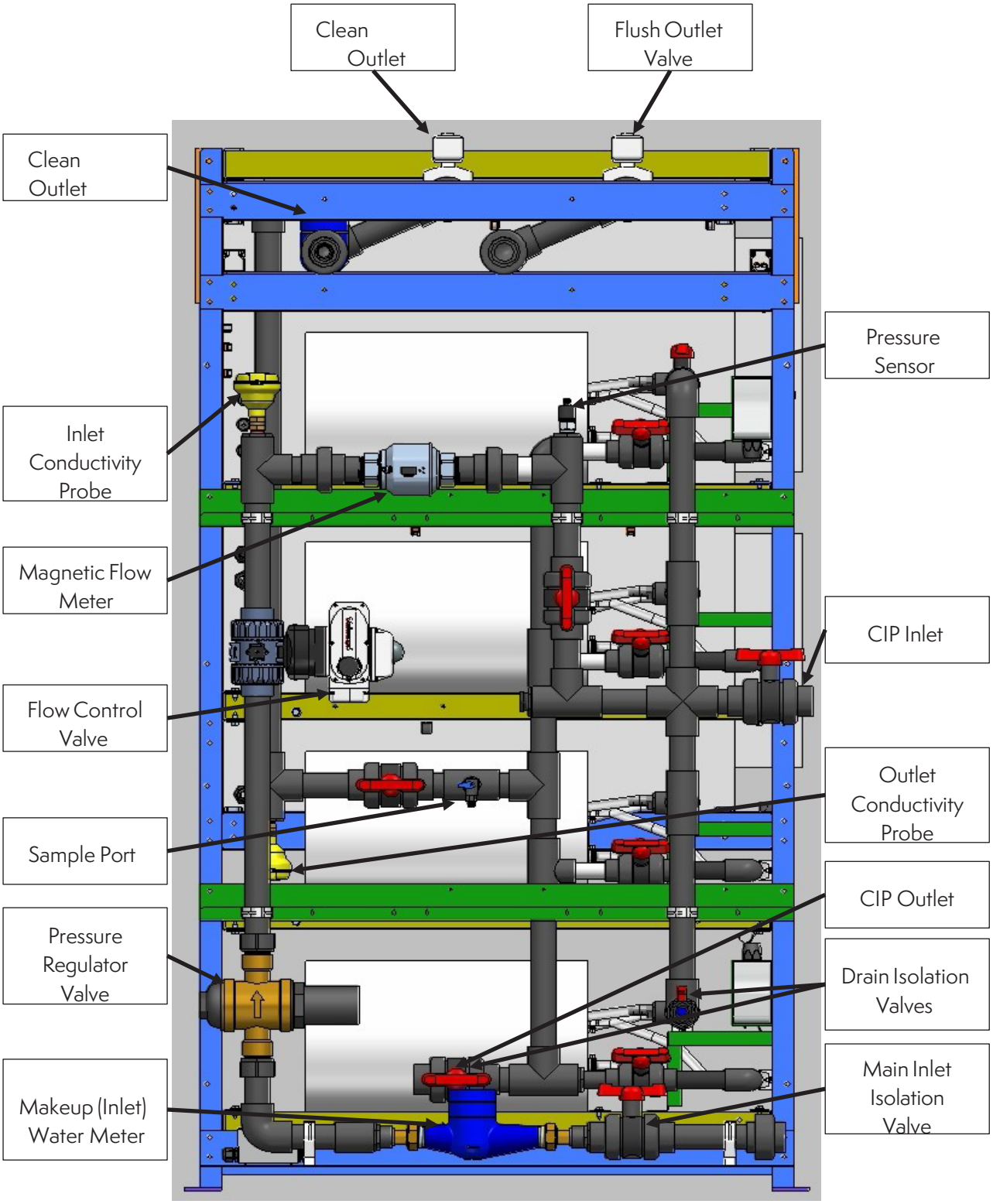



**Figure 15: EWS Components**

## Water Flow Path

Figure 16A-Figure 16B show the water flow path through the EWS. The green dotted arrows show the ion reduced (clean outlet) water path, and the blue dashed arrows show the makeup (inlet) path.

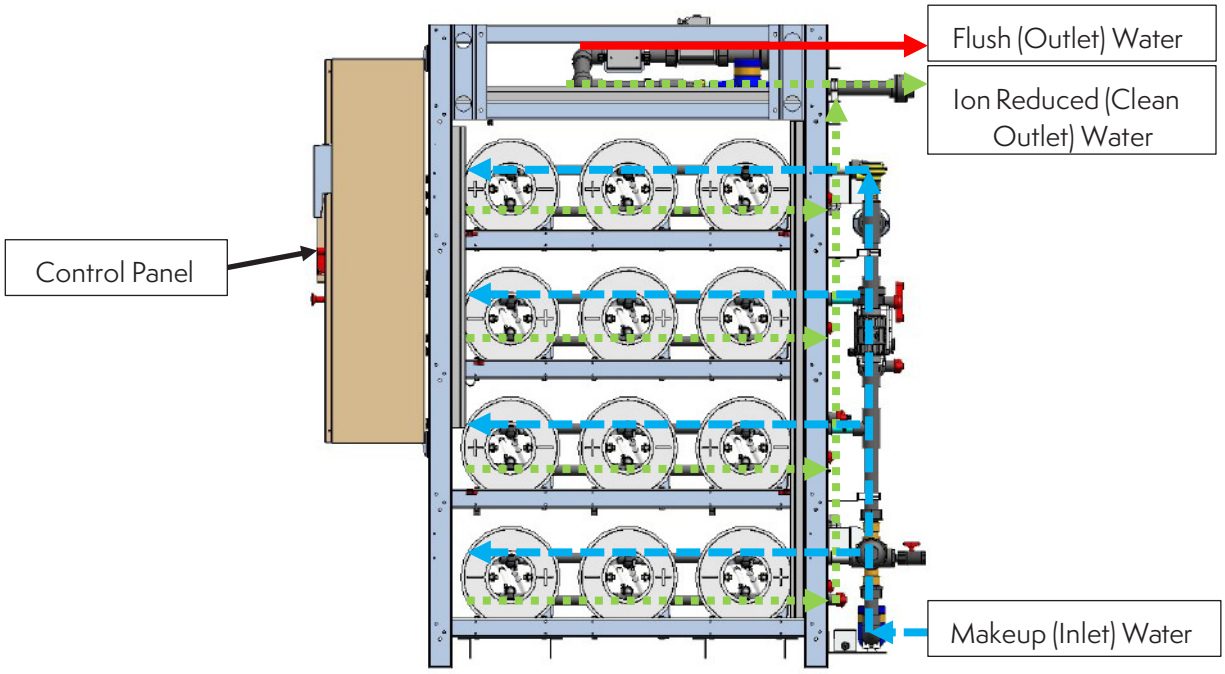



**Figure 16A: EWS Water Flow Path (Cylinder Plumbing)**

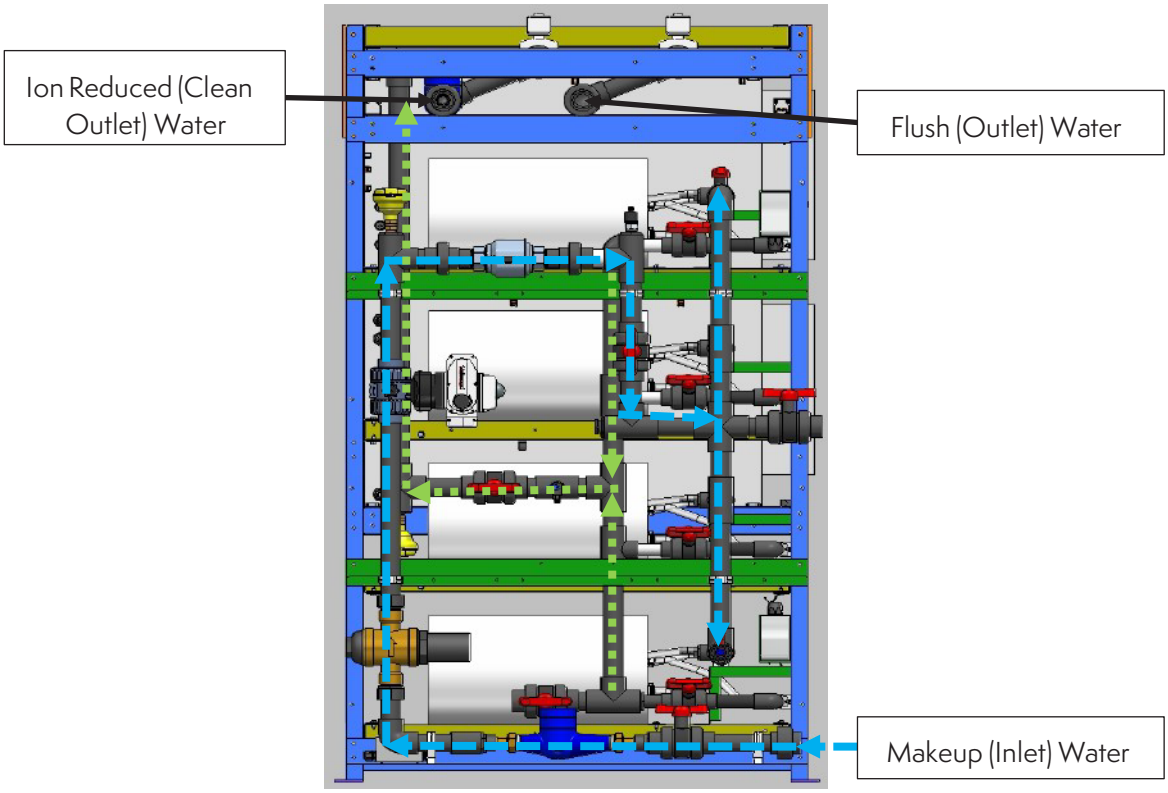



**Figure 16B: EWS Water Flow Path (Inlet/Outlet Piping)**

## Pressure Regulator Valve

The valve has been preset at the factory to 45 psi. Inlet supply pressure for your location may require field adjustment of the regulator valve to achieve desired flow rate. This shall be discussed with the Factory Authorized Service Provider and approved by EVAPCO to avoid damage to the system. Clean outlet flow rate directly correlates to inlet pressure and flow. Minimum inlet pressure is 65 psi. Do not exceed 120 psi inlet pressure.

## Water Meters

Meter is installed horizontally with register facing up. N/O reed switch set at 10 gallons per count is mounted on the dial face and connected to the control panel.

## Conductivity Probe

The EWS comes with an Inlet Conductivity Probe and an Outlet Conductivity Probe. See maintenance requirements in Table 4.

## Panel Wiring Locations

In Figure 17, Valve Connections refer to the "Flush Output" and "Clean Output" solenoid valves. Sensor Connections refer to the Inlet and Outlet Conductivity Probes, the Water Pressure Sensor, and the Inlet Flow Meter.

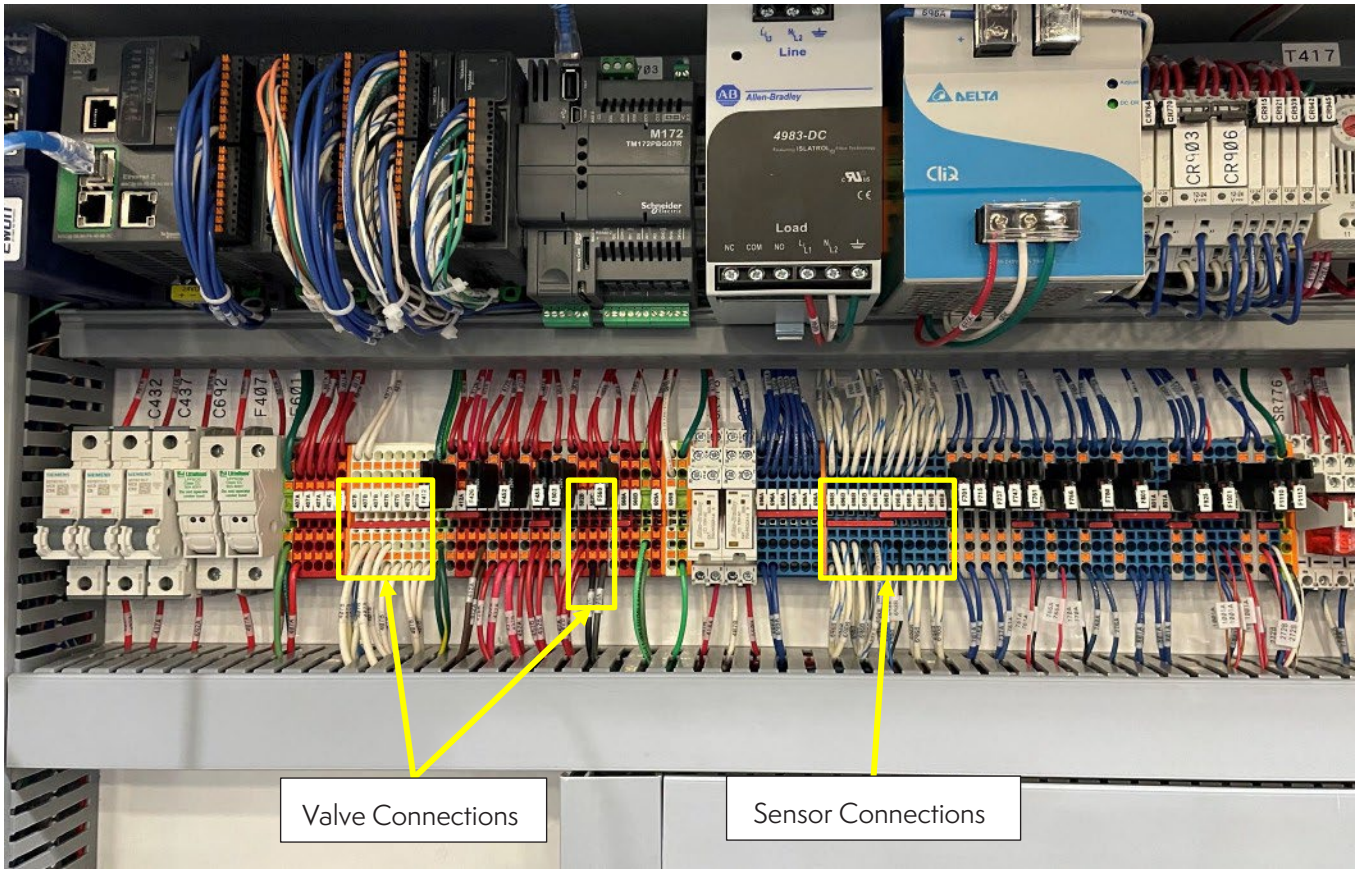



**Figure 17: Inside Panel Wiring**

# Operation

The Water Saver has three sub programs.

1. Startup program
2. Main program
3. Shutdown program

Each program is comprised of multiple steps. Transition from program to program and step to step is controlled by the PLC. Programming of individual steps is performed at the factory.

## Startup Program

The purpose of Startup is to prepare the cylinder's conducting capacitors for ion removal. Once Startup program has completed, the PLC automatically engages the Main program.

## Main Program

The Main program supplies ion reduced makeup water to a tank or directly to the evaporative unit's cold-water basin. The Main program loops through a series of steps. The two primary steps in the Main program are "Clean" and "Flush". During the "Clean" step, ions are removed as water flows through the cylinders. Reduced ion water is directed to the makeup tank or directly to the evaporative cooling unit. To maintain efficient ion removal, collected ions must be periodically purged. "Flush" step(s) purge the collected ions. Water flow during the "Flush" step(s) is directed to drain. Other steps are also part of the Main program. These steps maximize "Clean" water recovery. The Main program repeats until a stop signal is received.

## Shutdown Program

The purpose of the Shutdown program is to prepare the superconducting capacitors for Standby status once water demand has been satisfied. The Shutdown program consists of multiple steps to purge collected ions from the superconducting capacitors. The Shutdown program automatically engages when the Water Saver receives a signal from the EWLC that water demand has been satisfied. Once Shutdown steps are complete, the Water Saver awaits a signal to restart (Standby). If a start signal is received by the Water Saver during the Shutdown steps, the Shutdown program will complete before the Water Saver restarts.

## Five-Probe Electronic Water Level Control

Electronic water level control device has five probes and an electrical enclosure. The probes are threaded into connections of the enclosure. Probes are connected to relay cards that control the operation of the Water Saver and bypass valve.

Water level is sensed in the makeup tank or evaporative unit by the probes. Each probe has a unique length. One probe is used as reference. Reference probe tip is always submerged. When the tips of the reference and another probe are submerged, an electrical circuit is completed resulting in a change of relay status. The water level in the tank triggers action of the devices connected to the level sensor control.

| Makeup Tank Size (gal) [ltr] | Ref Length (in) [mm] | Bypass On Length (in) [mm] | EWS Start Length (in) [mm] | EWS Stop Length (in) [mm] | High Alarm Length (in) [mm] |
|---|---|---|---|---|---|
| 300 [1136] | 77 [1956] | 62 [1575] | 50 [1270] | 16 [406] | 12 [305] |
| 500 [1893] | 59 [1499] | 47 [1194] | 38 [965] | 16 [406] | 12 [305] |
| 750 [2839] | 89 [2261] | 71 [1803] | 54 [1372] | 17 [432] | 13 [330] |
| 850 [3218] | 103 [2616] | 79 [2007] | 63 [1600] | 17 [432] | 13 [330] |
| 1500 [5678] | 101 [2565] | 83 [2108] | 63 [1600] | 19 [483] | 15 [381] |
| 2000 [7571] | 108 [2743] | 105 [2667] | 78 [1981] | 21 [533] | 17 [432] |
| 2500 [9464] | 73 [1854] | 66 [1676] | 51 [1295] | 24 [610] | 20 [508] |

**Table 3: EWLC Probe Lengths**

### EWS Start/Stop

When the water level drops and the EWS START electrode is completely exposed a signal is sent to the EWS to begin operation. EWS operation continues until the tip of the EWS STOP probe is submerged.

**Note: EWS responds to electronic water level control signals only when in Automatic Mode**

### EWS Bypass

In the event the EWS cannot keep up with water demand, makeup water will flow through the bypass to maintain evaporative cooling system operation. Bypass valve will open (powered) if the water level falls below the "Bypass On" probe tip. The bypass valve remains open until water level rises to the EWS Start probe.

**Note: Bypass water has not been treated by the EWS and may affect desired cycles of concentration**

### Hi Level Alarm (By Others)

The 5-probe EWLC is equipped with a high-water level relay and probe. High water level is sensed when the high alarm probe tip is submerged. The high alarm relay can be connected to a user supplied device such as a warning light or audio alarm.

**Note: Refer to Troubleshooting section if high level alarm frequently occurs**

## User Display

### Touch Screen Display

A backlit LCD touch screen is mounted under a protective cover on the Water Saver Control Panel. The screen displays operating status and data. Select the desired item by pressing the icon on the screen.

### Home Screen

The Home Screen displays the present operating mode (Auto or Manual), current operating status (Operating, Standby), and Active program. The display also provides icons to view other screens.

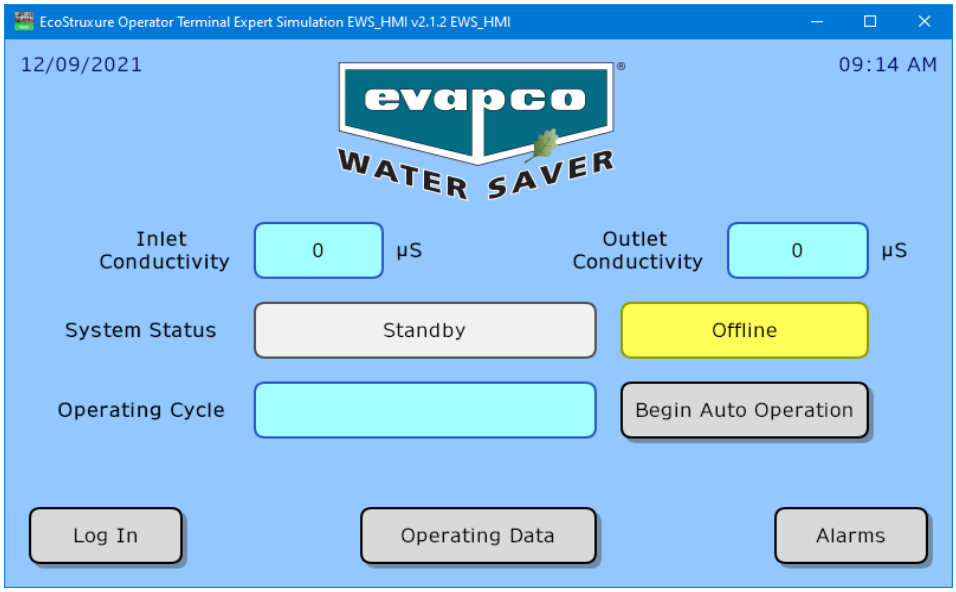



**Figure 18: Sample Home Screen**

## Operating Data Screen

The Operating Data screen can be accessed from the bottom center of the home screen. No login is required to access the data. It shows conductivity, ion reduction, recovery, water meter, operating mode, system status, and valve status. Return to the home screen by hitting the "Back" button at the bottom right.

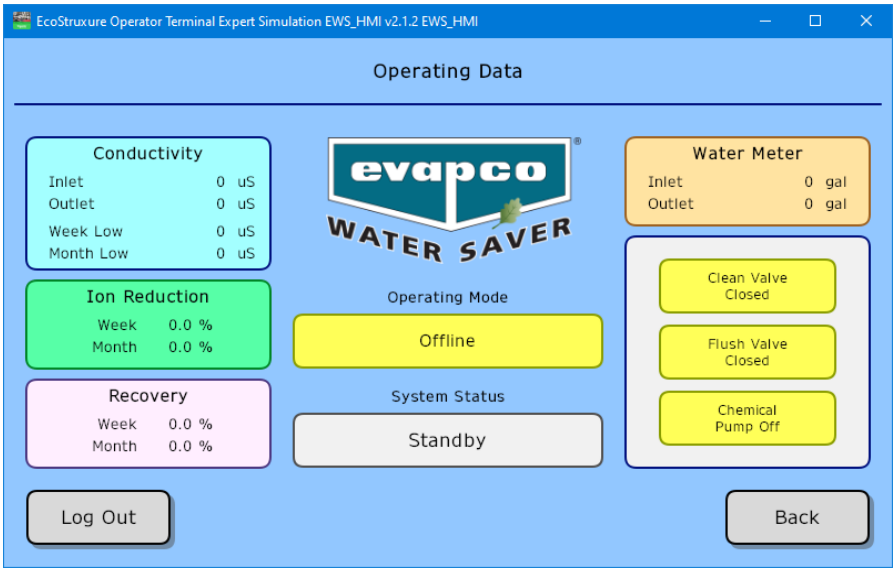



**Figure 19: Sample Operating Data Screen**

## Alarms Screen

The Alarms screen displays alarm history. When an alarm condition occurs a pop-up window alerts the user of a new alarm. To acknowledge a current Alarm, select the "Acknowledge" icon. The new alarm is added to the Alarm History. Alarms can be reset by selecting the "Reset" icon.

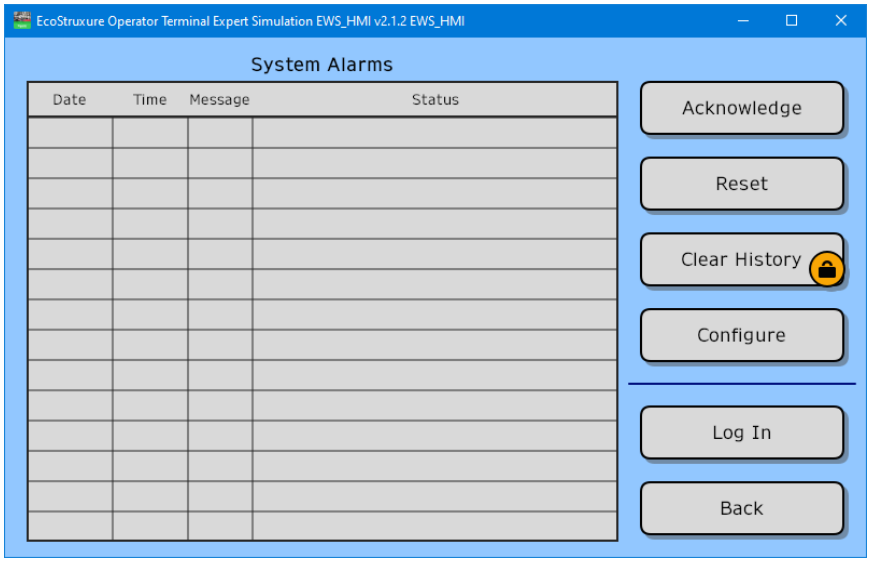



**Figure 20: Sample Alarm Overview Screen**

## Alarm Configuration

Alarms are preset from the factory for seven operating attributes to alert users of system changes or equipment malfunction: Inlet Conductivity, Outlet Conductivity, System Pressure, Flow Rate, Water Temperature, Power Supply Current Output (Amps). Some alarms will shut down the EWS to minimize damage to the system.

# Data Logs

The EWS records system operational data and stores it on USB drive as a .csv file. Periodically a window will appear indicating that data is being written to the drive. For most systems the USB drive has enough capacity to record operation data for 2 – 3 years.

# Startup and Shutdown

## Startup Procedure

Contact your Factory Authorized Service Provider two weeks prior to needing Water Saver startup.

## Shutdown Procedures

**Temporary Layup or Shutdown**
The Water Saver must be flushed when it has been idle (standby) for 7 consecutive days.

**Extended Layup or Shutdown**
For extended periods of inactivity (seasonal) EWS plumbing and cylinders should be flushed to prevent fouling. Cylinders must be kept wet during layup. **DO NOT** drain or layup the system dry. Damage to cylinders may result. Contact your Factory Authorized Service Provider to arrange for extended layup treatment.

**Turning Off Power to EWS**
To turn off the Water Saver, perform the following:

- Move the service disconnect handle on the Control Panel to the OFF position

**Restarting Power**
To restart the Water Saver, perform the following:

- Move the service disconnect handle on Control Panel to the ON position.
- Wait for the Home screen to be displayed (~ 20 seconds)
- Place system in Automatic Mode
    - Select "Begin Auto Operation" icon

# Maintenance

Routine maintenance is required to maintain EWS system performance over time. Keep panel, piping and components clean by wiping with a soft damp cloth, as needed. Do not use solvents or cleaners unless directed.

| Description | Service Interval |
|---|---|
| Control Panel Air Filter Cleaning | Quarterly or as needed |
| Pressure Regulator Valve Cleaning | Quarterly or as needed |
| Inlet Water Meter Cleaning | Quarterly or as needed |
| Outlet Water Meter Cleaning | Quarterly or as needed |
| Verify In-Line Conductivity Probes | Monthly |
| Conductivity Probe Calibration | Quarterly or as needed |
| Clean in Place (CIP) | Every 2-4 months |

**Table 4: Maintenance Requirements**

# Troubleshooting

| Symptom | Probable Cause | Suggested Action |
|---|---|---|
| **Makeup tank overflow (High Alarm)** | Water Saver not receiving stop signal | Confirm EWLC wiring |
| | | Confirm EWS is in Auto Mode |
| | User supplied device malfunction | Check function of device |
| **Bypass line continuously engaged** | Water Saver not operating | Confirm EWS is in Auto Mode |
| | No or reduced inlet flow | Check makeup flow supply and pressure |
| | Plugged pressure regulator valve | Clean pressure regulator valve |
| | Plugged water meter strainer | Clean water meter strainer |
| | Booster pump flow rate to evaporative coolers greater than EWS output | Check/confirm booster pump flow rate setting |
| **"Clean" conductivity value close to makeup conductivity value** | Conductivity probe(s) out of calibration | Calibrate probe(s) |
| | Conductivity probe(s) fouled | Clean probe(s) |
| | EWS power supply off | Reset power supply. Turn off main power for 1 minute then restart (refer to Turning Off Power to EWS) |
| | Cylinder fouling | CIP Required. Contact Factory Authorized Service Provider |
| **Dark display screen** | Screen display in "sleep" mode; EWS continues to operate | Tap screen |
| | No supply power to EWS | Check supply voltage |
| | | Check that panel disconnect is ON. |
| | | Check fuses inside EWS panel; replace with same type/rating |
| | | Clean fan filter and reset power |
| **Water meter values do not change** | Plugged strainer | Backwash meter |
| **Water leak at EWS components** | Component water leak | Contact Factory Authorized Service Personnel |

# EVAPCO® STANDARD EXPRESS WARRANTY FOR EVAPCO WATER SAVER™

## EXPRESS WARRANTY

EVAPCO warrants all components of the Water Saver™ System against failure caused by defects in materials and workmanship for a period of twelve (12) months from the date installation is completed in accordance with good engineering practices or eighteen (18) months from the date of shipment, whichever occurs first. Included in this warranty are all standard and accessory components shipped with the system. All defective parts to be repaired or replaced shall be delivered to EVAPCO, shipping prepaid, with return shipment to the Buyer by EVAPCO to be made F.O.B. the factory, shipping prepaid by the Buyer.

**The product warranty is predicated on system installation, operation, and maintenance in accordance with EVAPCO's recommended operation and maintenance procedures**. Failure to follow EVAPCO's recommended installation, operation, and maintenance procedures will void these warranties. **Labor costs associated with any repair work performed under the terms of the warranties are NOT included within the warranty.** The Buyer assumes responsibility for compliance with any regulations, codes, standards or ordinances applicable to the installation, location, operation or maintenance of the products. No person, agent, or dealer is authorized to enlarge upon the warranties set out herein or the obligations of EVAPCO hereunder.

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