INSTALLATION, OPERATION & MAINTENANCE MANUAL

Pulse~Pure™

EVAPCO, Inc.
World Headquarters
PO Box 1300
Westminster, MD 21158
410-756-2600

SAFETY STANDARDS

FCC

This equipment has been verified as complying with FCC requirements for electromagnetic emissions of Title 47 CFR part 18 for Industrial, Scientific and Medical Equipment.

This equipment generates and uses radio frequency energy. If not installed and used properly, in strict accordance with the manufacturer's instructions, it may cause interference to radio communications.

FIFRA

This equipment complies with EPA requirements for Pesticide Programs of Title 40 CFR Subchapter E.

NATIONALLY RECOGNIZED TESTING LABORATORIES

This equipment is constructed in conformance with UL guidelines. This equipment meets both UL and cUL requirements.

HARMONIC DISTORTION

The *Pulse*~Pure™ system has been designed as an electrically efficient system and creates minimal Total Harmonic Distortion (THD).

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INTRODUCTION

Thank you for your purchase of EVAPCO's *Pulse*~Pure™ non-chemical water treatment system. *Pulse*~Pure™ systems are constructed using the highest quality materials and workmanship. *Pulse*~Pure™ systems are designed to provide years of reliable service when properly maintained.

Evaporative cooled equipment is often located in remote locations and periodic maintenance checks are often overlooked. *Pulse*~Pure™ water treatment systems are standard with a one (1) year water treatment service and monitoring agreement. It is important to establish a regular maintenance program and to subsequently follow that plan. A system that is properly monitored and serviced will ensure a longer operating life and a better system operating efficiency.

Pulse~Pure™ System Overview

The *Pulse*~Pure™ system is an environmentally responsible water treatment alternative that offers the following advantages over chemical treatment systems:

- No chemicals to inventory, handle, and administer
- Reduced regulatory requirements
- No chemical overfeeds/underfeeds that can degrade the integrity and efficiency of heat exchangers over time
- Reduced water usage
- Peace of mind that results from using a proven non-chemical technology that requires minimal monitoring and service

Standard Equipment and Operation

The *Pulse*~Pure™ system is comprised of three main components: the **Purification Chamber**, a shielded cable, and the **Pulse Panel**. Nameplates indicating the model number, part number, and serial number are located on the **Purification Chamber** and on the side of the **Pulse Panel**. A standard *Pulse*~Pure™ system is shown in Figure 1.

Pulse~Pure™ systems have **Purification Chambers** that are designed to fit pipe sizes from 3 to 16 inch diameters. The **Purification Chamber** has a flow-through design that does not add pressure drop to the system. The outer shell of the chamber is made of a durable fiberglass that is fire retardant, watertight, and UV resistant. These design features allow for the **Purification Chamber** to be installed indoors, outdoors, horizontally or vertically.

LED's on the chamber cover indicate the operating status of the system. This signal serves as a useful system check when the status lights on the **Pulse Panel** are not visible. The lights flash when the system is in "Operating" mode and turn off in "Standby" or "Fault" modes.

A 16-pin plug connects the shielded cable attached to the **Purification Chamber** to a mating receptacle on the **Pulse Panel**. The shielded cable, plug and receptacle assemblies are all weather resistant.

CAUTION!!!: **Purification Chambers** and **Pulse Panels** MUST share the same model number in order to work properly. Even though most models share the same plug and receptacle, connecting two units with different model numbers will result in a "Fault" indication on the panel and the *Pulse*~Pure™ will not operate until remedied. If a "Fault" indication is present during the initial installation, see the TROUBLESHOOTING section for problem diagnosis and remedy.

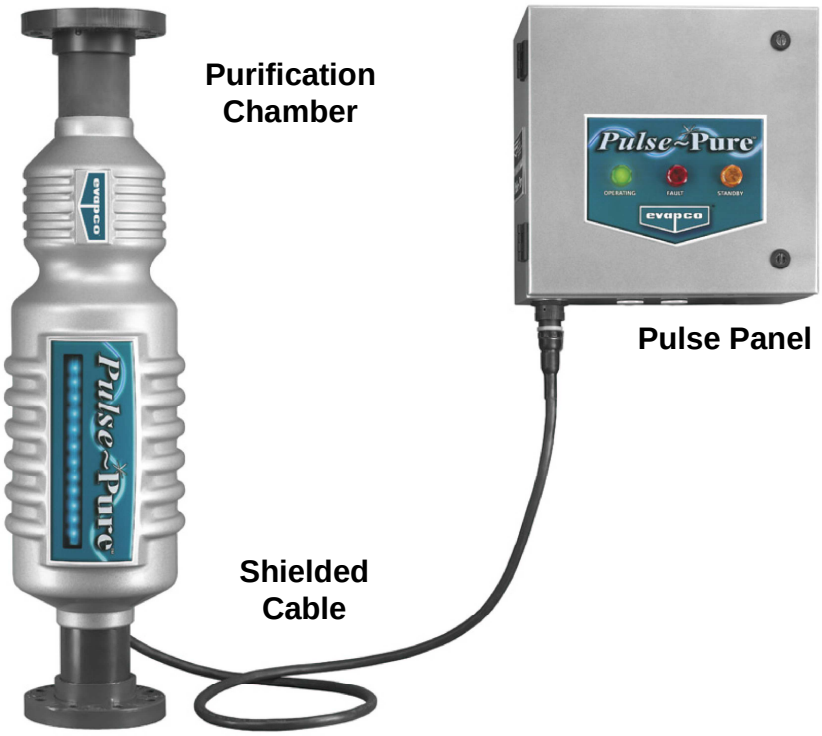


Figure 1 *Pulse*~Pure™ Purification Chamber, Shielded Cable, and Pulse Panel

Standard **Pulse Panels** are NEMA 4 rated, powder coated steel enclosures, configured for 120 volt service. Options include a stainless steel NEMA 4X panel and single-phase 460 volt service. Optional 460 volt panels incorporate a disconnect switch on the front panel that locks the panel closed when turned ON. All panels are 16"H x 16"W x 8"D. Each panel requires the supply voltage to be field wired. Refer to the ELECTRICAL CONNECTIONS section for instructions on how to field wire the **Pulse Panel**.

There are three indicator lights on the front cover of the **Pulse Panel** that indicate the current state of the system: "Operating", "Fault", and "Standby." A microprocessor inside the panel continuously performs a self diagnostic test when the panel is powered AND the control logic indicates there is water flowing through the Purification Chamber. The "Operating" light illuminates when the self diagnostic returns a no fault condition AND the microprocessor receives a signal that water is flowing through the Purification Chamber.

The signal required to satisfy the indication that water is flowing through the Purification Chamber can be generated by the Building Management System (MODBUS protocol over RS-485), by an auxiliary contact on the pump, or by a flow switch. If an auxiliary contact or flow switch is used, it must be connected to the dry contact, "X1 CONTROL", located inside the panel. The "X1 CONTROL" is a dry contact ONLY; therefore, only auxiliary contacts or a jumper should be connected. Use of the "X1 CONTROL" contact and MODBUS protocol are explained in more detail in the ELECTRICAL CONNECTIONS section.

The “Standby” condition is enabled when the microprocessor receives a signal that the system pump is not operating. For example, if the “X1 CONTROL” contact is connected to an auxiliary contact on the pump and the pump turns OFF, the “Operating” light will go out and the “Standby” light will illuminate.

If the microprocessor encounters a fault condition, the “Fault” light turns ON. When the system pump is operating, regardless of a fault condition, the controller continues to check the status of the system. If the system pump turns off during a fault condition the “Fault” light will remain lit as the “Standby” light illuminates. In “Standby” mode, the microprocessor does not run a self diagnostic, so the fault can only be cleared by remedying the problem while the system pump is ON or by cycling power to the panel. Reference the TROUBLESHOOTING section in this manual to diagnose and remedy the cause of a fault.

Optional Equipment

The *Pulse*~Pure™ system is available with optional conductivity control packages. These packages optimize the effectiveness of the *Pulse*~Pure™ system by ensuring that the correct conductivity is maintained. Figure 2 shows a general arrangement of a factory installed *Pulse*~Pure™ system with an optional conductivity control package, which includes a blow down valve, and other ancillary components.

Other additional items available include: corrosion coupon racks, coupons, and water test kits. Consult your local representative for more information.

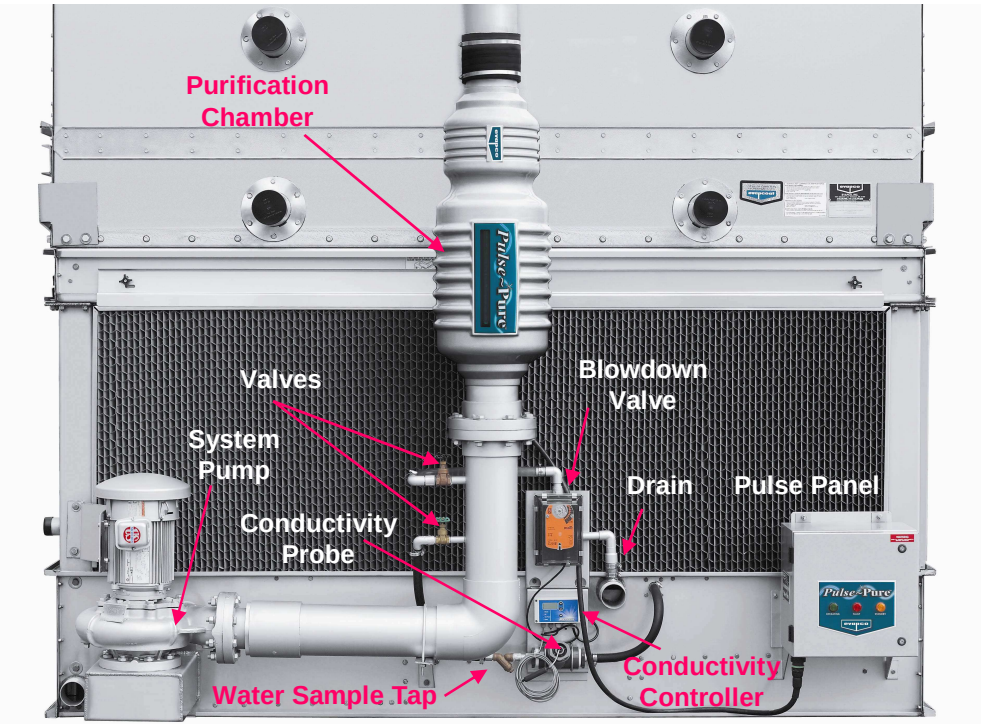


Figure 2 A typical factory installed *Pulse*~Pure™ System with optional conductivity controller

Specifications

Table 1 and Table 2 show the *Pulse*~Pure™ models that are available and their respective mechanical and electrical specifications for factory and field installed models. Dimensions of the **Purification Chambers** are shown along with their respective weight. When field installing a unit, the weight of the device should be sufficiently supported as described in the FIELD INSTALLATION GUIDELINES section. Failure to properly support the unit may result in damage to the **Purification Chamber** and to adjacent pipe work and equipment.

Table 1 Factory Installed *Pulse*~Pure™ Models and Specifications

Model	Pipe Size [in]	Amps (120V / 460V)	Max Flow [gpm]	Max OD [in]	Length [in]	Weight [lb]	Cable Length [ft]	Pulse Panels	
								120 V Weight [lb]	460 V Weight [lb]
P-3	3	1.3 / 0.3	275	11-1/2	43-1/4	54	8	45	55
P-4	4	1.5 / 0.4	475	11-1/2	43-1/4	63	8	45	55
P-6	6	2.5 / 0.7	1,100	15	48-3/8	89	8	45	55
P-8	8	4.0 / 1.0	1,900	15	48-3/8	113	8	50	60
P-10	10	6.3 / 1.6	3,000	20-1/4	55-1/4	150	8	50	60
P-12	12	7.5 / 2.0	4,200	20-1/4	55-1/4	186	8	50	60
P-14	14	9.6 / 2.5	5,000	23	66	274	25	50	60
P-16	16	11.3 / 2.9	6,700	23	66	340	25	50	60

Table 2 Field Installed *Pulse*~Pure™ Models and Specifications

Model	Pipe Size [in]	Amps (120V / 460V)	Max Flow [gpm]	Max OD [in]	Length [in]	Weight [lb]	Cable Length [ft]	Pulse Panels	
								120 V Weight [lb]	460 V Weight [lb]
P-3	3	1.3 / 0.3	275	11-1/2	43-1/4	56	15 25 (opt.)	45	55
P-4	4	1.5 / 0.4	475	11-1/2	43-1/4	66	15 25 (opt.)	45	55
P-6	6	2.5 / 0.7	1,100	15	48-3/8	94	15 25 (opt.)	45	55
P-8	8	4.0 / 1.0	1,900	15	48-3/8	120	15 25 (opt.)	50	60
P-10	10	6.3 / 1.6	3,000	20-1/4	55-1/4	163	15 25 (opt.)	50	60
P-12	12	7.5 / 2.0	4,200	20-1/4	55-1/4	204	15 25 (opt.)	50	60
P-14	14	9.6 / 2.5	5,000	23	66	274	25	50	60
P-16	16	11.3 / 2.9	6,700	23	66	340	25	50	60

PRINCIPLE OF OPERATION

Pulsed Power Technology in Non-Chemical Water Treatment

The *Pulse*~Pure™ system is based on pulsed-power technology. A pulse-powered system uses Faraday's law to induce varying electromagnetic fields in the water passing through the device. Pulsing this field creates a ringing effect, which induces similar ringing electromagnetic fields in the water. High-frequency and low-frequency coils, arranged on the outside of the water flow, generate these electromagnetic fields.

Scale Reduction

One of the most prevalent issues with evaporative cooling equipment is the formation of scale on the surface of the heat exchanger. Scale fouls the heat transfer surface and degrades the integrity of the material. The phenomenon behind the cooling effect achieved in evaporative cooling equipment is the evaporation of water. However, as water evaporates from an evaporative cooling system, the mineral concentration of the system increases as does the potential for scaling. In order to control the cycles of concentration, a bleed or blow down is typically incorporated. Bleeding water from the system helps control the cycles of concentration and therefore the formation of scale, but it alone does not solve the problem.

With the *Pulse*~Pure™ system, dissolved solids in solution, including calcium carbonate, precipitate as a powder in solution instead of on a surface. The result is that minerals are removed from the water as suspended solids (small particles) instead of forming a scale on the walls and heat transfer surfaces of the unit.

Biological Control

The *Pulse*~Pure™ system also addresses the issue of microbial growth. Biocides used in chemical treatments are poisons. Most of the biological burden on a cooling system is located in a slime layer attached to surfaces. Many of the regulated biocides used today are ineffective against slime layers. The biocides that are most effective against slime layers are strongly regulated by the EPA.

Many biocides are slug-fed because of these restrictions. This allows microbes to flourish for a while before dosing them with a poison to maintain some control. Administering chemicals in this manner will result in, at best, moderate biological control. Therefore the commonly accepted levels of Total Bacteria Count (TBC – method SMEWW 9215B) are less than 100,000 CFU/ml in a chemically controlled cooling tower.

The *Pulse*~Pure™ system not only eliminates the chemical toxins required to achieve low microbial populations, but also provides superior biological control, even when compared to the best chemical systems. TBC tests conducted on cooling towers with *Pulse*~Pure™ systems indicate typical CFU/ml levels between 1,000 and 2,000, which are significantly lower than similarly operated towers using chemical biocide treatments.

Microbial populations are controlled by preventing their reproduction. Pulsed power systems interfere with microbial reproduction in two ways: (1) the effect of bulk solution precipitation, and (2) the effect of high-frequency pulsed electrical fields. Microbes floating in the water attach to the precipitate in the bulk solution and become encapsulated over time as the mineral crystals continue to grow. Once encased, the microbe is trapped in the crystal, severely limiting its ability to reproduce. In addition to the indirect effect of bulk solution precipitation on microbial reproduction, pulsed power systems directly control bacteria reproduction by damaging the microbe's cell wall. The extent of the damage is not enough to kill the microbe, but it can be extensive enough to alter its ability to reproduce.

Corrosion Control

Pulse~Pure™ systems control corrosion indirectly by promoting a system that acts as a natural cathodic corrosion inhibitor. Because the system operates at sufficient cycles of concentration, the system is induced into an alkaline mode at the saturation point of calcium carbonate. Typical systems operating in this regime demonstrate corrosion rates of less than 5 mils per year on carbon steel.

Copper piping operating in association with evaporative cooling units are susceptible to pitting attack from microbial growth or high levels of indiscriminate oxidizers, such as chlorine or bromine. Systems with copper piping that also employ *Pulse*~Pure™ systems will have a distinct advantage over similar systems with chemical water treatment. The *Pulse*~Pure™ allows for these systems to operate without oxidizing biocides, while it also provides excellent control of microbial growth.

ELECTRICAL CONNECTIONS

Pulse Panel

CAUTION: Follow state and local electrical guidelines when wiring the *Pulse*~Pure™ system.

An electrical schematic is provided with every *Pulse*~Pure™ system and should be referred to before wiring the Pulse Panel. **Pulse Panels** require the supply power to be field wired. In all panels, the supply power is protected from electromagnetic interference by a ferrite located on the lead downstream of the power terminals.

All transformers have a secondary circuit that powers the **Purification Chamber**. This circuit is protected by a slow-blow fuse and fuse block in first generation panels and circuit breakers in the latest generation. In 120V and 460V panels, the fuse or circuit breaker located on the secondary side of the transformer is rated for 15A for models P-3, P-4, and P-6 and 30A for P-8, P-10, P-12, P-14, and P-16.

Figures 3 and 4 show correctly wired 120V panels that incorporate a fuse block and a circuit breaker, respectively. The line (black) wire is connected to the circuit breaker and the neutral (white) wire is connected to the terminal block labeled “N”, which is located on the left side of the circuit breaker. The ground (green) wire is connected to the ground lug located below the DIN rail.

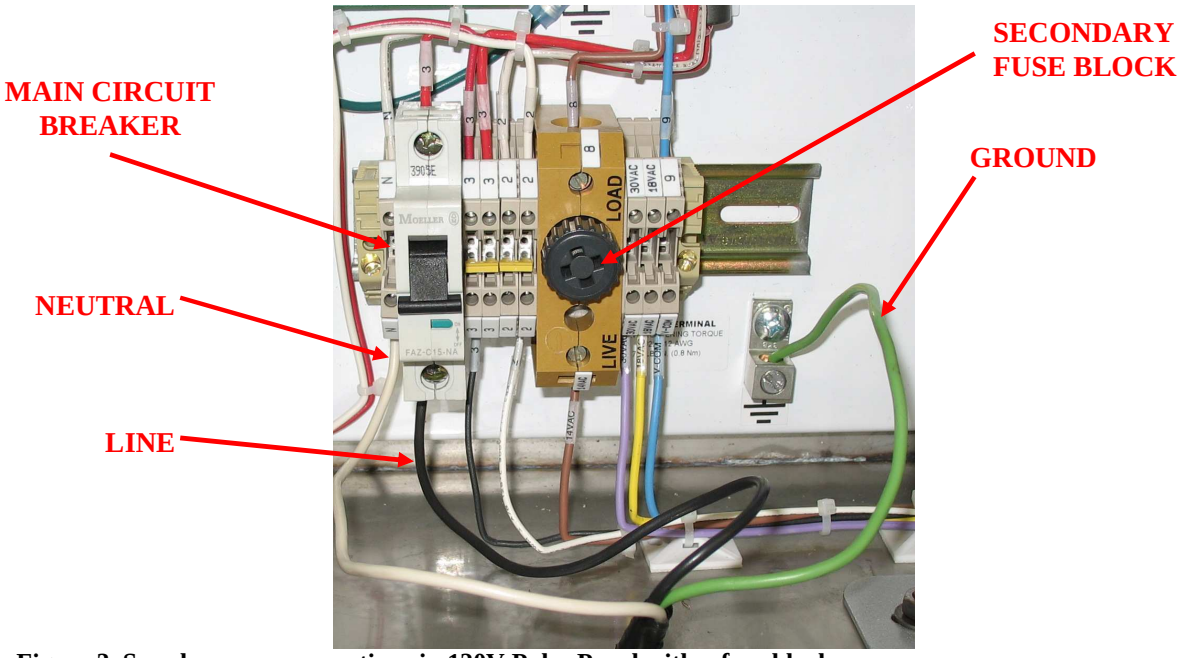


Figure 3 Supply power connections in 120V Pulse Panel with a fuse block

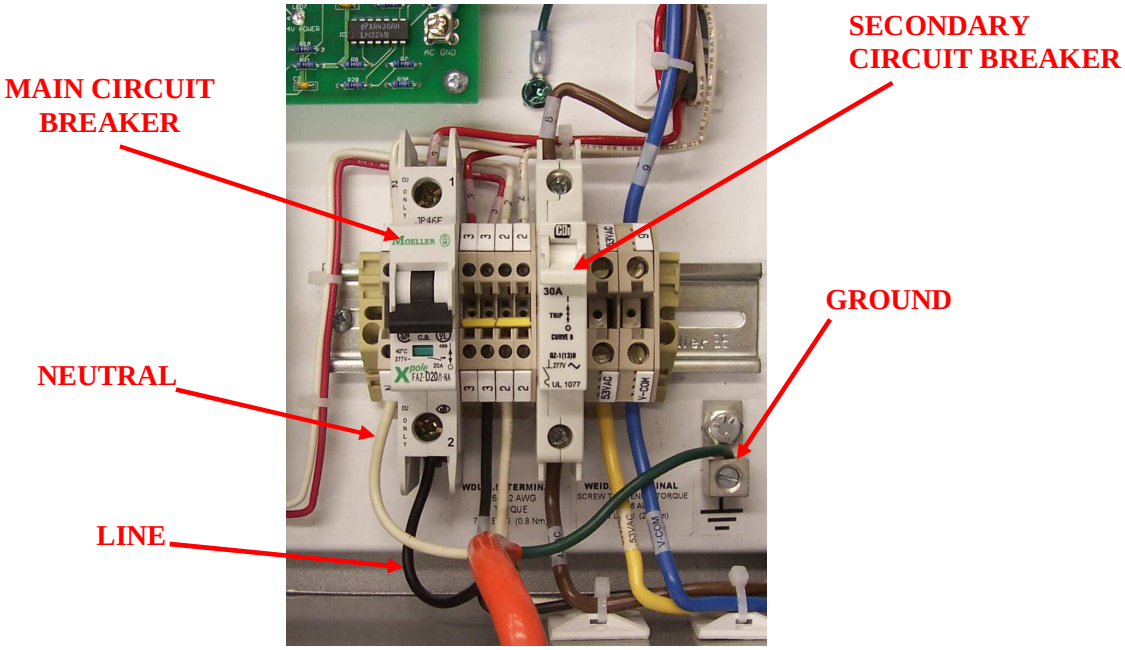


Figure 4 Supply power connections in 120V Pulse Panel with a circuit breaker

The 120V circuit is protected by a 15A circuit breaker on models up to a P-12. For P-14 and P-16 models, the 120V circuit is protected by a 20A circuit breaker. A minimum of 14 gauge wire should be used when wiring the supply power to the terminals for P-3 through P-12 units; a minimum of 12 gauge wire should be used for P-14 and P-16 units.

Panels configured for 460V single-phase service have an integrated disconnect switch on the panel door. The power disconnect has four terminals that are required to be wired: line 1 (L1), line 2 (L2), line 3 (L3), and ground (G). A minimum of 14 gauge wire should be used when wiring to the terminals. The 460V circuit is protected by a 6A or 10A circuit breaker depending on *Pulse*~Pure size, and is located between the disconnect switch and the primary connections on the transformer. Figure 5 illustrates a correctly wired 460V panel. The three power legs are wired to the top side of the disconnect switch and the ground wire is connected to the ground lug located above the disconnect.

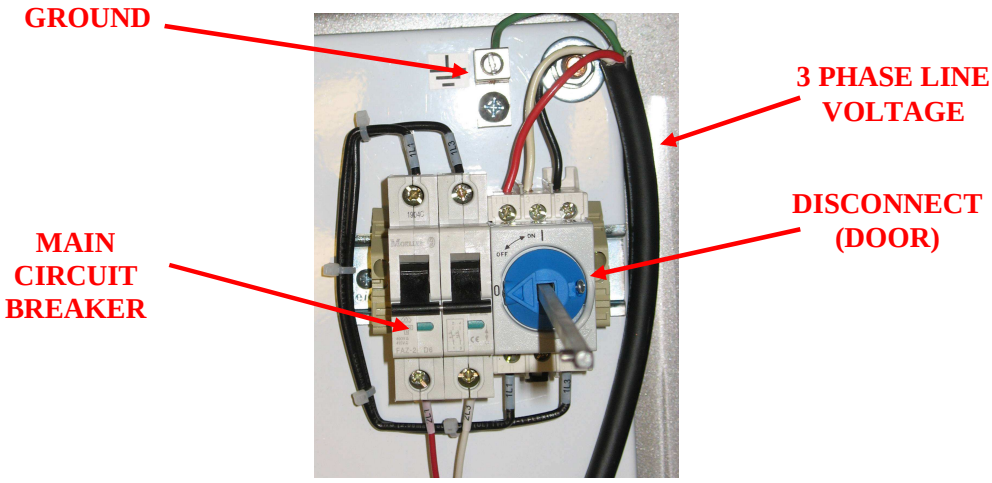


Figure 5 Supply power connections in a 460V Pulse Panel

Transformers used in 460V panels have an auxiliary 120V output protected by a 6A circuit breaker. The 6A-120V circuit provided in the 460V panels can be used to power an external device with a maximum amp draw less than 5A. This circuit allows for devices such as 120V conductivity controllers to be wired to the **Pulse Panel**.

Figure 6 illustrates a 120V device that is properly wired to the 120V power source in a 460V **Pulse Panel**. The 120V secondary power source is located on the terminals between the fuse block and the circuit breaker. The device requiring 120V service shall have the black (line), white (neutral), and green (ground) wires connected to the "3" terminal, "2" terminal, and the ground lug, respectively. A minimum of 14 gauge wire should be used when wiring to this power source.

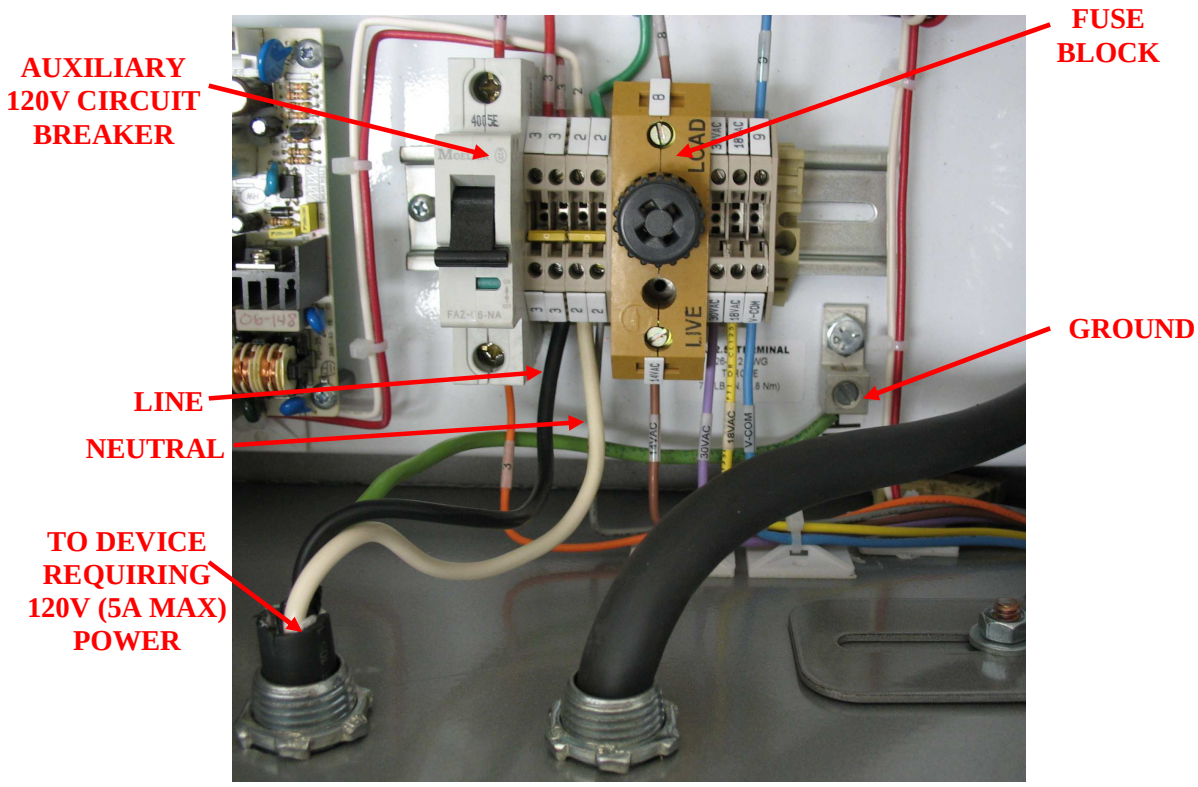


Figure 6 120V supply power connections in a 460V Pulse Panel

User Connections

The *Pulse*~Pure™ system incorporates dry and wet electrical contacts that allow the end user to monitor and control the system locally, remotely, or both. In addition, the built-in RS-485 communications capability, employing the industry standard MODBUS RTU protocol, allows users to connect the *Pulse*~Pure™ system to their Building Management System or any compatible PLC or data acquisition device.

Operation Using "X1 Control" Connection

The CONTROL contact, labeled "X1 CONTROL" on the circuit board, is a normally-open dry contact that controls current to the coils in the **Purification Chamber**. When the contacts are closed, coils in the **Purification Chamber** are energized and the **Pulse Panel** will indicate that

the system is in “Operating” mode. When continuity is interrupted, the coils are de-energized and the system goes into “Standby” mode. A switching device that indicates that water is flowing through the Purification Chamber can be attached to the “X1 CONTROL” contact. Auxiliary contacts on the system pump or a flow switch are examples of devices that can be used to control the operating mode of the system.

The “X1 CONTROL” contact is shown in Figure 7. A jumper wire is shown connected to the terminals. Installing a jumper wire on the contacts will enable the *Pulse*~Pure™ in the “Operating” mode regardless if water flowing through the **Purification Chamber**. *It is not recommended to operate the unit continuously in a no flow situation.*

CAUTION: DO NOT apply voltage to the “X1 Control” contact. This contact is a dry contact.

Operation Using MODBUS RTU Protocol via RS-485

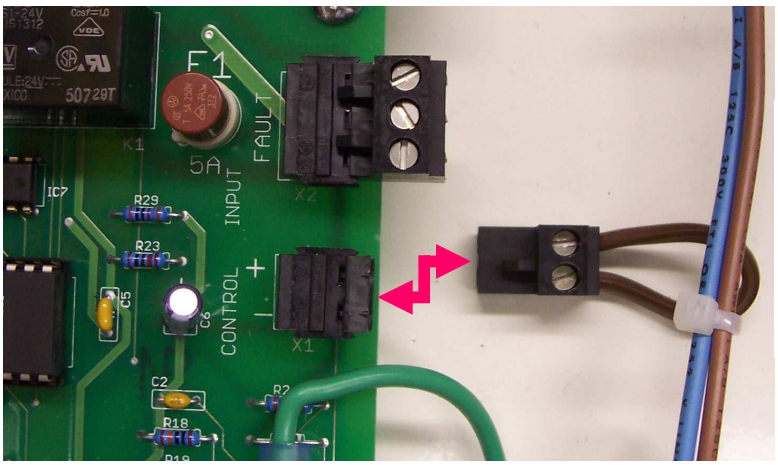
In order to use the MODBUS protocol to operate and monitor the *Pulse*~Pure™ system, the provided jumper must be inserted on the “JP2” pins and the “X1 CONTROL” contacts must either have a jumper wire installed, be connected to an auxiliary contact on the pump or flow switch. When the jumper is removed from the “JP2” terminals it is only possible to *monitor* the system with RS-485 communication. With the jumper removed from the “JP2” terminals, the “X1 CONTROL” contact must be used to control whether the system is in “Operating” or “Standby” mode.

For the Modbus communication protocol to work properly, the termination character has to be configured. This can be accomplished using the “JP1” pins, which enable or disable the terminal character. The termination character is disabled when a jumper inserted on the pins.

The RS-485 connection terminals and the “JP1” and “JP2” pins are identified in Figure 8.

Detailed information regarding the configuration of MODBUS communications settings, Digital I/O, Analog I/O, status, and set points are described in APPENDIX A: MODBUS Communication.

CAUTION: DO NOT run power wires and control wires in the same conduit.



THE X1 CONTACT CAN BE CONFIGURED USING:

(1) A JUMPER WIRE
or
(2) AN AUXILIARY CONTACT ON THE SYSTEM PUMP
or
(3) A FLOW SWITCH

Figure 7 User connections in the Pulse Panel for monitoring and control using RS-485 protocol.

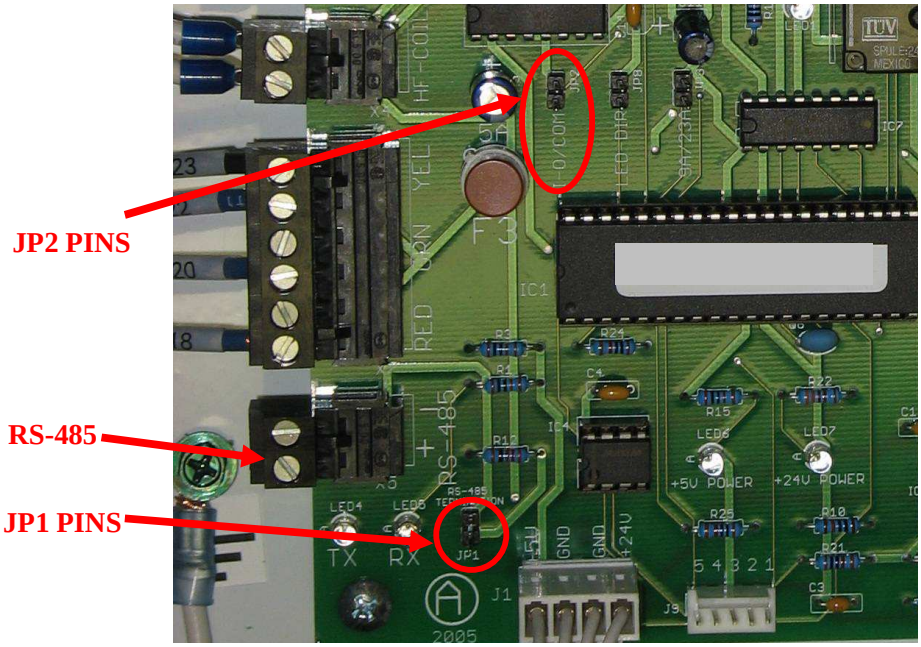


Figure 8 User connections in the Pulse Panel for monitoring and control using RS-485 protocol.

Fault and Coil ON/OFF Contacts

The status of the system can be monitored using the FAULT and Coil ON/OFF contacts regardless of which communication method is configured ("JP2" terminal configuration). **Please note that terminal #1 is the COMMON terminal for both contacts. These contacts are each protected by a 5A fuse located downstream of the contact**. The state of the contacts during "Operating", "Standby", and "Fault" conditions is shown in Table 3. The location of the contacts on the circuit board is shown in Figure 9.

Table 3 Configuration of the I/O contacts

Contact		Operate	Standby	Fault
Fault	COM – NC	Closed	Closed	Open
	COM – NO	Open	Open	Closed
Coil On/Off	COM – NC	Open	Closed	Closed
	COM – NO	Closed	Open	Open

The FAULT contact, labeled "X2 FAULT" on the circuit board, is a 5A fused contact that can be configured as normally open (NO) or normally closed (NC) depending on the terminals used. During normal operation, "Operating" or "Standby" modes, the contacts are in their normal state. During a "Fault" condition, the NO contact closes and the NC contact opens.

The Coil ON/OFF contact, labeled "X3 Coil ON/OFF" on the circuit board, is a 5A fused contact that can be configured as NO or NC depending on the terminals used. The coils are only energized in the "Operating" mode and in this mode the contacts are in their normal state. When the system is in a "Fault" or "Standby" mode, the NO contact closes and the NC contact opens.

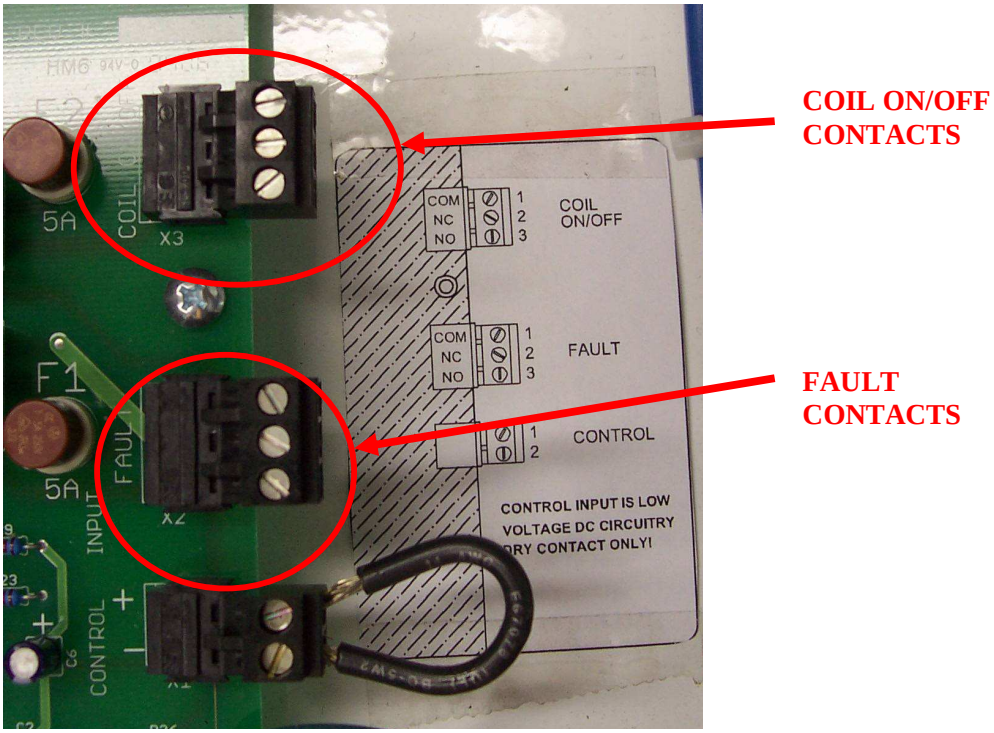


Figure 9 User connections in the Pulse Panel for monitoring coil operation and fault conditions.

SYSTEM OPERATION

The *Pulse*~Pure™ system is designed to provide years of reliable operation given that it is properly installed and maintained. Guidelines given below describe the proper start-up procedure and suggested maintenance items and schedules.

Once the unit is installed and the evaporative cooling unit is operating normally, it is important that the *Pulse*~Pure™ operates every day with water running through it for some period of time. The length of this operation should be sufficient enough to turn over the water volume of the system at least twice each day. This will ensure that microbial populations are not flourishing in an inactive system. Water should be circulated daily through ALL condenser water piping including plate/frame heat exchangers, lead and lag chillers.

For evaporative cooling systems full of water that have been idle for more than a few days, it is important that the system is started with only the pump and *Pulse*~Pure™ operating. The system should operate in this mode for a period of time before the fans are turned ON. Microbial populations thrive in inactive water systems and this method of start-up reduces the chance that they will be transported out of the system by drift. If the biological condition of the system is unknown, microbial tests should be conducted at intervals during this procedure to determine when biological levels stabilize.

An important aspect of day-to-day operation is to frequently monitor the status lights on the **Pulse Panel**. This is especially important if the fault outputs on the *Pulse*~Pure™ system are not integrated into a system that has the ability to record and track fault occurrences, such as a building management system. Ignoring the system's fault light may result in problems operating the evaporative cooling system, high biological levels and corrosion rates, and heat exchanger fouling.

Start-up Procedure

To ensure that the *Pulse*~Pure™ system operates flawlessly for years, it is important to follow the proper start-up procedure and to continuously monitor the system thereafter. A trained Evapco *Pulse*~Pure™ technician should be onsite during start-up. For *Pulse*~Pure™ systems that are installed on new evaporative cooling units, the start-up procedure will vary depending on whether the evaporative cooling unit is constructed from galvanized steel or stainless steel.

Follow the procedures and guidelines provided in the **Initial Site Visit Monitoring Checklist, *Pulse*~Pure form PPF 3.0**, included in Appendix B of this IO&M and available from EVAPCO for proper system start-up.

Prior to start-up, the new evaporative cooling unit needs to be properly cleaned and flushed to remove any dirt, residual debris from construction, and residual oil on the surfaces. Evaporative cooling equipment constructed of galvanized steel requires an additional conditioning period explained below.

CAUTION: Proper safety measures should be followed when entering evaporative cooling equipment. Refer to OSHA guidelines before entering any confined space.

The below procedures are to be followed as part of the Initial Site Visit Monitoring Visit:

Procedures*

*Water must be circulating through chamber/probe assembly for proper evaluation. If any of the following procedures are not completed, explain why in the notes section.

	Completed
1. Note unit materials of construction (galvanized sheet-metal, galvanized coils and stainless steel if applicable) and check appearance of materials **(include photographs)**. Record results in notes section below.	□
2. Visually inspect the basin water for debris or unusual characteristics.	□
3. Verify installation of all Pulse~Pure components meet EVAPCO's specifications, including:	
a. Inspect Pulse~Pure™ Water Treatment System for damage including conductivity control system.	□
b. Purification chamber is mounted downstream of the system pump.	□
c. Verify all lights are working properly on the purification chamber and pulse panel.	□
i. With Pumps On: Purification Chamber lights should be flashing. Green Light on Pulse Panel should be illuminated.	
ii. With Pumps Off: Yellow "Stand-by" light on Pulse~Panel should be illuminated. Purification Chamber lights should not be flashing.	
d. Verify weep holes are drilled in the proper location.	□
e. Verify probe assembly with conductivity and pH probes (if applicable) are located in the high pressure side of the system (on discharge side of pump) and drains into the system reservoir or a low pressure line.	□
f. Verify blowdown valves operated by the conductivity controller are located in the high pressure side of the system (on discharge side of pump) and terminate in a drain line.	□
g. If the purification chamber is installed on a riser pipe above the water level when the pump is not operating, the Pulse~Pure™ should be configured to go into "Standby" mode when the pump turns off.	□
h. If a conductivity controller flow switch is provided, verify that switch	□

interlocks with the blow down function.

i. Verify that pipe work attached to the purification chamber is adequately supported and anchored. □

J. Verify that all non-draining piping for conductivity control system is insulated and heat traced (applies to low ambient locations). □

k. Check that conductivity probe is cleaned and calibrated. □

l. Verify there is water flow through the conductivity probe, pH and flow switch (if applicable). □

m. Verify that blow down and isolation valves are operating properly. □

4. Perform make-up water analysis and record results below. Compare to initial make-up water sample analysis provided by EVAPCO on form **PPF 1.0 Water Sample Analysis.** Perform twice during length of Service Contract (1st and 4th Visit) □

	Initial EVAPCO PPF1.0 Analysis	**Current Make Up Analysis**
Conductivity (µS/cm)	_____	_____
pH	_____	_____
Total Hardness (mg/L as CaCO3)	_____	_____
Calcium Hardness (mg/L as CaCO3)	_____	_____
Magnesium Hardness (mg/L CaCO3)	_____	_____
Alkalinity (mg/L CaCO3)	_____	_____
Chloride (mg/L as Cl-)	_____	_____
Silica (mg/L as SiO2)	_____	_____

5. Program conductivity set point on controller per recommendations provided in **PPF 1.0 Water Sample Analysis**. For units installed on galvanized equipment the Galvanized steel must be conditioned for a 6 week period by keeping the pH between 6.5 and 8.0 per the method selected under Section V of the monitoring contract. □

Conductivity Set Point _____

6. Verify recirculating water pH for passivation and address any additional passivation requirements. □

pH_____

7. Perform microbial count using a dip slide. Record results on next **Monitoring Checklist (Form PPF 4.0)**. □

8. Review Pulse~Pure™ Water Treatment System operational requirement with owner (Periodically run Pulse~Pure during system shutdown). □

9. Provide a copy of this form, **Pulse~Pure™ Monitoring Checklist form PPF 3.0,** to the owner and EVAPCO. □

Detailed start-up procedures for various situations are described in *Pulse*~Pure™ Technical Bulletins on "System Start-up". Contact your local Evapco sales representative to receive a copy of these procedures.

Retrofitting Systems Previously Using Chemical Treatment

For cases in which evaporative cooling systems previously using chemical treatment are retrofitted with a *Pulse*~Pure™ system, the start-up includes a procedure for transitioning to a non-chemical water treatment system. The three most common situations are: a drained system, a system not drained, and one-at-a-time installation for a multiple cell system.

A system that has been drained down completely is the best method for transitioning to a non-chemical system. After the system is drained, clean the system with an approved cleaner, then flush the system, and lastly install the *Pulse*~Pure™ system and fill with fresh water. Proceed with the start-up guidelines above once the system is clean.

There are also situations when it is not possible to shutdown, drain, and clean a unit operating with chemicals, such as a unit in a critical application or one that has poor accessibility. For these instances, the *Pulse*~Pure™ system can be installed before the chemicals are purged from the system. Chemicals can be purged from the system by discontinuing chemical treatments and

maintaining a high bleed rate. The period of time required to purge the system will depend on the volume of the system. Consult EVAPCO for more information. Once the chemicals are purged from the system, proceed with the start-up guidelines above.

Systems containing multiple evaporative cooling units that are interconnected and only allow for part of the system to shut down at one time can also be converted to a *Pulse*~Pure™ system. This is accomplished by installing the *Pulse*~Pure™ system on each unit as permitted, while maintaining the regular chemical treatments to the entire system until all units are equipped. Once all of the units are converted, follow the routine above for systems that are not drained.

Relocating the Pulse~Pure™ System

When relocating the *Pulse*~Pure system be sure to follow the proper installation instructions for field installation. Systems that have been previously commissioned will have weep holes located on the shell of the **Purification Chamber**. It is imperative that these holes, once the chamber is installed, allow for water to drain out of the chamber shell. Otherwise, water may collect in the shell and electrical damage to the coils or other electrical devices may occur. For more information regarding the location and installation of weep holes see the Field Installation Guidelines section.

Winterization and Shutdown Procedures

Proper winterization and shutdown procedures should be followed for evaporative cooled equipment and the *Pulse*~Pure™ system.

Winterization

For applications where the *Pulse*~Pure system is subject to freezing conditions, it is necessary to properly heat trace all ancillary *Pulse*~Pure components that may contain water, specifically those components in the conductivity control loop. The Purification Chamber does not have to be heat traced or insulated, however pipework above and below the Purification Chamber should be heat traced and insulated. **NOTE: The motorized ball valve must be heat traced or otherwise positively drained.** Failure to properly heat trace these components can lead to damage to pipes, valves and other components in the system.

Shutdown

During periods where the evaporative cooled system is shutdown (winter, repair, etc.) and the system is NOT drained, it is important to cycle the water volume of the system through the *Pulse*~Pure™ system at least twice per day. This will ensure that microbial activity is controlled over the shutdown period.

For remote sump systems that have been shutdown for the winter, but are not drained, a bypass loop containing a *Pulse*~Pure™ system could be used to allow for the system's water volume to be turned over without the threat of a pipe freezing.

Maintenance

In addition to properly starting-up the *Pulse*~Pure™ system, following a routine maintenance schedule will ensure that the system operates at maximum efficiency and achieves a long service life. Establishing a service contract with an authorized EVAPCO *Pulse*~Pure™ contractor will guarantee that your system is thoroughly monitored and serviced at regular intervals.

Monitoring Contract and Schedule

Pulse~Pure monitoring contracts are a simple way to ensure that the system operates at peak efficiency over its lifetime. Contracts are offered at yearly intervals through Evapco trained and authorized technicians. During the first year of operation there are 10 maintenance/service visits assuming a twelve month cooling season.

1. Start-up
2. 2 weeks after start-up
3. 6 weeks after start-up
4. 10 weeks after start-up
5. 16 weeks after start-up
6. 22 weeks after start-up
7. 28 weeks after start-up
8. 34 weeks after start-up
9. 40 weeks after start-up
10. 46 weeks after start-up

Systems operating on shorter cooling seasons will have a revised schedule.

Maintenance Checklist

Maintenance checklists for the *Pulse*~Pure™ system are provided in APPENDIX B: Maintenance Checklists. These checklists should be used during scheduled maintenance checks.

Passivation, Algae, and Legionella

Passivation

New evaporative cooling equipment containing galvanized steel should be thoroughly cleaned prior to passivation. This includes the removal of any oils, dirt, mill-scale, and residual debris from construction. Typically, a clean system can be achieved by first flushing the system, then cleaning the system with a recommended chemical cleaner, and lastly flushing again.

CAUTION: Cleaners that are high or low in pH may adversely affect the integrity of galvanized steel.

Passivation is the formation of a protective layer of zinc carbonate on the surface of galvanized steel. The zinc surface is protected from corrosion by the zinc carbonate layer. Although this layer is effective in protecting galvanized steel from corrosion, it can become damaged by pressure washing or even by walking on the layer.

Heavy mill galvanizing provides an excellent corrosion resistant barrier for the substrate steel on an evaporative cooling unit. The zinc finish is both a barrier coating and a sacrificial anode that protects the steel substrate. To enhance the barrier protection the zinc carbonate must be allowed to form.

Steel mills producing galvanized steel perform a chemical passivation wash after processing the steel. However, this mill applied passivation is only a temporary passivation program. **The unit must also be passivated during the unit start up.** Passivation of the galvanized steel surface is critical to prevent the formation of “white rust” and to extend the life of evaporative cooling equipment.

The passivation program should operate for a period of 45 to 60 days with minimal or no load on the system. The pH of the circulating water must be between 6.5 and 8.0; calcium hardness

measured as CaCO3 should be between 50-300 ppm; and alkalinity measured as CaCO3 should be between 50-125 ppm. The Pulse~Pure Technical Bulletin regarding Passivation covers applications with pH's greater than 8.0 and passivating with a load applied to the evaporative cooled unit. Contact your local sales representative for a copy of this document.

If white zinc deposits (white rust) form on the galvanized steel surfaces after the pH is returned to normal operating levels, it may be necessary to repeat the passivation process. In general it is best to not remove these deposits with pressure washing, wire brushing or by any other mechanical means. For more information, please request a copy of EVAPCO's Engineering Bulletin 36 on White Rust.

Algae

Algae are plants that require sunlight and minerals to grow. In evaporative cooling equipment, ambient airborne dirt and nutrients that are drawn into the equipment and then absorbed into the cooling water also help promote algae growth. Presence of algae is not an indication of biological activity and it is relatively harmless by itself, although it is normally considered an aesthetically undesirable possibility in evaporative cooling equipment. The *Pulse*~Pure™ water treatment technology will control bacteria within industry guidelines but it may not control algae growth. Low bacteria counts are a validation that *Pulse*~Pure™ is rendering a biologically inactive system regardless of whether algae is present.

Simple dosing with algaecide tablets during periods of undesirable algae bloom is an acceptable algae reduction solution for a *Pulse*~Pure™ treated system. However, an algaecide may not be totally effective during an intense algae growth season for installations that are highly prone to algae. Under these conditions, algae growth may occur regardless of whether the system is treated by chemicals or *Pulse*~Pure™. Use of a filtration system or manually cleaning the algae and dirt in the evaporative cooling equipment, or both are also possible algae reduction solutions. **The most effective algae reduction solution is to eliminate sunlight exposure to the cooling water.**

EVAPCO has taken great care to prevent sunlight exposure to the cooling water in the design of its evaporative cooling equipment. Although a slight amount of algae may form on equipment exterior splash areas, **EVAPCO's counterflow equipment designs virtually eliminate heavy algae growth** on the inside of the equipment due to the absence of direct sunlight on the circulating cooling water. Conversely, **crossflow units are inherently prone to algae growth** because their design allows direct sunlight exposure onto the cooling water.

If a *Pulse*~Pure™ water treatment device is to be installed on crossflow evaporative cooling equipment, the purchaser and operator should be aware that the presence of algae may occur on wet areas that are exposed to sunlight. As stated above, this is not necessarily a problem and actions can be taken to minimize the algae growth. However, these actions will not normally be required for EVAPCO counterflow equipment designs operated with an EVAPCO *Pulse*~Pure™ water treatment device.

Legionella

Legionella bacteria are present in almost all raw water. Human exposure and subsequent infection is based on several concurrent factors. Drift that can emit from evaporative cooling equipment may provide a convenient mode of transportation of Legionella bacteria to humans. Entrained in the drift, the bacteria may easily make its way into a human host. Although, at this point, infection still is dependant on various factors such as the host's immune system, the level of contamination, and the virulence of the bacteria.

The *Pulse*~Pure™ system does not kill bacteria; instead bacteria such as legionella are controlled by limiting their reproduction. The result of this approach is a system with a low microbial population and biological activity, which **may** help reduce the potential for Legionella

infection. EVAPCO makes no claims, through the use of the *Pulse*~Pure™ system, to eliminate the presence of Legionella in water or control the potential risk factors for human infection.

There are many effective practices that should be followed to reduce the potential for Legionella infection. For more information, see ASHRAE Guideline 12-2000, "Minimizing the Risk of Legionellosis Associated with Building Water Systems".

TROUBLESHOOTING

Typically problems with the operation of the *Pulse*~Pure™ system can be resolved by referring to the troubleshooting chart below in Table 4. However, if consulting Table 4 does not result in a solution to the problem or if the issue is intermittent, please call your local Evapco *Pulse*~Pure™ representative or the Evapco factory for assistance.

Table 4 Troubleshooting Chart

Issue	Possible Cause	Remedy
LIGHTS ON PANEL DO NOT ILLUMINATE	Supply power may not be properly wired.	• Disconnect power from the device and then check that each supply power wire is properly connected to the correct terminal with the correct polarity.
	Disconnect or circuit breaker on supply power may not in the ON position.	• Check that all circuit breakers upstream and downstream of the power terminals in the panel are in the ON position, including those in the panel. • If the panel is a 460V panel, make sure disconnect on the front of the panel is in the ON position and is correctly latching.
	Bulbs (s) have failed.	• Disconnect power and measure resistance across each light. Replace bulb if measurement indicates a non-continuous circuit.
UNIT STAYS IN STANDBY MODE	X1 Control Contact not closed	• Check the integrity of connections to the X1 Control Contact terminals in the panel and at auxiliary contact terminals. • Check the integrity of wire used to connect auxiliary contact to X1 Control Contact. • Confirm that auxiliary contact is working properly by measuring continuity across the circuit when the pump is operating.
	RS-485 communication problem	• Ensure that a jumper is located on the "JP2" terminals – activating RS-485 control. •Ensure that the X1 Control Contact is jumpered. • Confirm whether a jumper is required on the "JP1" terminals – RS-485 terminate. • Check the integrity of connections to the RS-485 terminals in the panel and at remote device. • Check the integrity of wire used to connect RS-485 terminals to the remote device.
FAULT LIGHT IS ILLUMINATED	Cable is not properly connected	• Check if cable is connected. If so, disconnect cable and then re-connect the plug to the receptacle.
	The **Purification Chamber** and **Pulse Panel** are not compatible.	• Check that the model numbers on the Purification Chamber and Pulse Panel are the same. Units with mismatched model numbers are not compatible.
	Circuit board failure	• Call your local Evapco representative or the factory.

	Defective fuse or Power surge or Lightning strike	• Check fuses for continuity and replace if necessary. Contact factory if fuse repeatedly fails.
	Moisture infiltration to the electronics or Defective wire or cable or Short circuit	• Call your local Evapco representative or the factory.

WARRANTY

EVAPCO warrants all components of the *Pulse*~Pure™ system against failure caused by defects in materials and workmanship for a period of one year from the date installation is completed in accordance with good engineering practices, but in no event shall such warranty period exceed twenty-four (24) months from the date the unit is shipped by EVAPCO. Included in this warranty are the Purification Chamber, Pulse Panel, and cable assembly. Optional equipment, if purchased as part of the *Pulse*~Pure™ system, including conductivity controllers, conductivity probes, pH probes, and motorized blowdown valves are also covered by this warranty.

All other expenses or implied warranties of any kind whatsoever, including without limitation any warranties of merchantability or that the unit and equipment are fit for any particular purpose and any warranties that might otherwise arise out of a course of dealing between the parties or usage of trade, are hereby excluded. The sole remedy for breach of the warranties set out above shall be repair or replacement of the equipment by EVAPCO at its option. Under no circumstances shall EVAPCO be liable for lost profits, lost savings, personal injuries, incidental damages, economic loss, property damage, or other consequential, incidental, special or contingent damages, even if EVAPCO has been advised of the possibility of such damages. In addition, EVAPCO shall not be responsible for any injuries or damages of any kind whatsoever under any theory of tort to the extent caused by misuse of the product by buyer or any third party.

A warranty claim may be filed by contacting your EVAPCO representative or the factory. Equipment covered under this warranty may be repaired on-site or at an EVAPCO facility depending on the type of repair required. It is EVAPCO's decision whether or not the repair is performed on-site or at an EVAPCO facility. A Return Material Authorization number will be provided for any equipment that must be returned to the factory for repair.

Equipment shipped back to EVAPCO must be properly packaged to prevent damage while the package is in transit. Contact EVAPCO for packaging recommendations. The RMA number must also be marked on the package or noted on the packing slip. The customer is responsible for shipping charges to the EVAPCO facility and assumes all risk of freight damage or loss of freight if package is not insured. Once the repair has been made, EVAPCO will ship the unit prepaid to the customer, provided the shipping address is in the continental United States. All other shipments outside the continental United States will be made freight collect.

FIELD INSTALLATION GUIDELINES

Pulse~Pure™ systems are easily field installed regardless of the application. Adding the **Purification Chamber** to a system or piping to it can be accomplished with minimal effort. The chamber can be located indoors or outdoors and oriented in any direction.

EVAPCO Field Assembly Procedure (FAP) #57 and #58 should be referenced for specific field installation instructions. FAP #57 covers the field installation of Pulse~Pure™ systems on coil products without remote sumps. FAP #58 covers the field installation of Pulse~Pure™ systems on all tower products and coil products with a remote sump.

CAUTION: Follow proper industry rigging procedures when installing the *Pulse*~Pure™ Purification Chamber. Purification chambers are heavy and improper handling of the device may result in damage to the chamber, damage to surrounding equipment, and serious injury.

A number of standard installations are discussed below. For special installations not covered in this manual, please consult the factory. Some general installation guidelines are:

1. The **Purification Chamber** shall be mounted downstream of the system pump and upstream from any flow disturbance.
2. The **Purification Chamber** does not have a specific flow direction, however, when mounting it vertically the power cord should exit at the bottom of the chamber to avoid stress on the cord.
3. Recirculation lines for the measurement of conductivity and pH should be located in the high pressure side of the system (after pump) and should drain either into the system reservoir or a low pressure line including a drainage line. Please note that the recirculation line requires only a small amount of flow (~1 gpm). This ensures that the conductivity and pH (optional) probes see indicative samples of the water circulating in the unit.
4. Blowdown valves operated by a conductivity controller should be located in the high pressure side of the system (after pump) and should terminate in the drainage line.
5. If it is necessary to install the **Purification Chamber** on a riser pipe above the water level when the pump is not operating, the *Pulse*~Pure™ should be configured to go in to “Standby” mode when the pump turns off. This will prevent the coils on the **Purification Chamber** from operating, and unnecessarily running warm, when there is not flow through the device. The CONTROL contact or RS-485 protocol can be used to switch the device from “Operating” mode to “Standby”. Both are described in the ELECTRICAL CONNECTIONS section.
6. Pipe work attached to the **Purification Chamber** should be adequately supported with brackets, hangers or both. These supports should be installed in accordance with local building and plumbing codes. When installing the **Purification Chamber** into a steel pipe system, the system pipe must be firmly anchored to eliminate stress on the **Purification Chamber.** If steel pipe work is not properly supported, the weight of the pipe in addition to torsional loads on the chamber may result in damage to the chamber.
7. It is recommended that additional supports are located on the bare PVC pipe midway between the flange and fiberglass body on both ends of the unit. Additional supports, brackets or hangers, should be added regardless of the orientation of the chamber to relieve the **Purification Chamber** of external stresses. Figure 10 indicates the suggested location of these supports for a horizontally mounted chamber.

8. The Final step in the installation of the **Purification Chamber** is to drill 3/16" weep holes in the chamber housing. These will allow for the drainage of any condensate build-up that may occur. Refer to the appropriate Evapco *Pulse*~Pure™ FAP for the proper location and quantity of weep holes.

Figure 10 Recommended support locations for a horizontally mounted Purification Chamber

Installations Involving a Single Evaporative Cooling Unit

A schematic of a field installed *Pulse*~Pure™ system in a system that includes an evaporative cooling unit with an integral basin and a process heat exchanger is shown in Figure 11. In this particular system the **Purification Chamber** should be located downstream of the pump, on either side of the process heat exchanger. During the winter, evaporative cooling units in this arrangement that reside outside on a roof may be drained down below the roof line so that pipes do not freeze. For these situations, if the complete system cannot be drained, it is recommended to open the bypass valve and circulate the water through the *Pulse*~Pure™ for a period long enough to turn the system volume over at least twice a day. This will maintain control of biological activity.

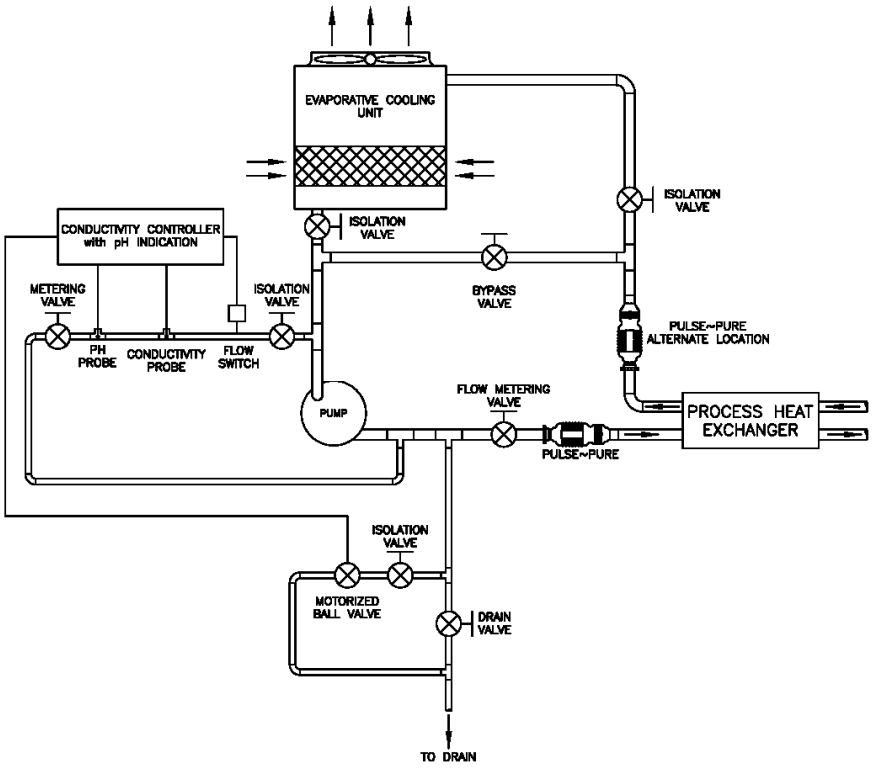


Figure 11 General field installed arrangement of the *Pulse*~Pure™ system in a system with a single evaporative cooling unit with integral basin.

The system illustrated in Figure 12 is the same as shown in Figure 11 with the exception that it depicts a remote sump application. In a remote sump application, the **Purification Chamber** can also be installed before or after the process heat exchanger. As previously stated, during dormant winter operation, the bypass valve should be opened and water should be circulated through the *Pulse*~Pure™. However, an alternative bypass arrangement involving a small recirculation loop on the remote sump could be used to treat the water. In this case, a second, smaller *Pulse*~Pure™ would be installed on the recirculation line. The advantage of the alternative bypass arrangement is the potential for power savings, since the flow and head pressure requirement would be minimal compared to the requirement for the entire system.

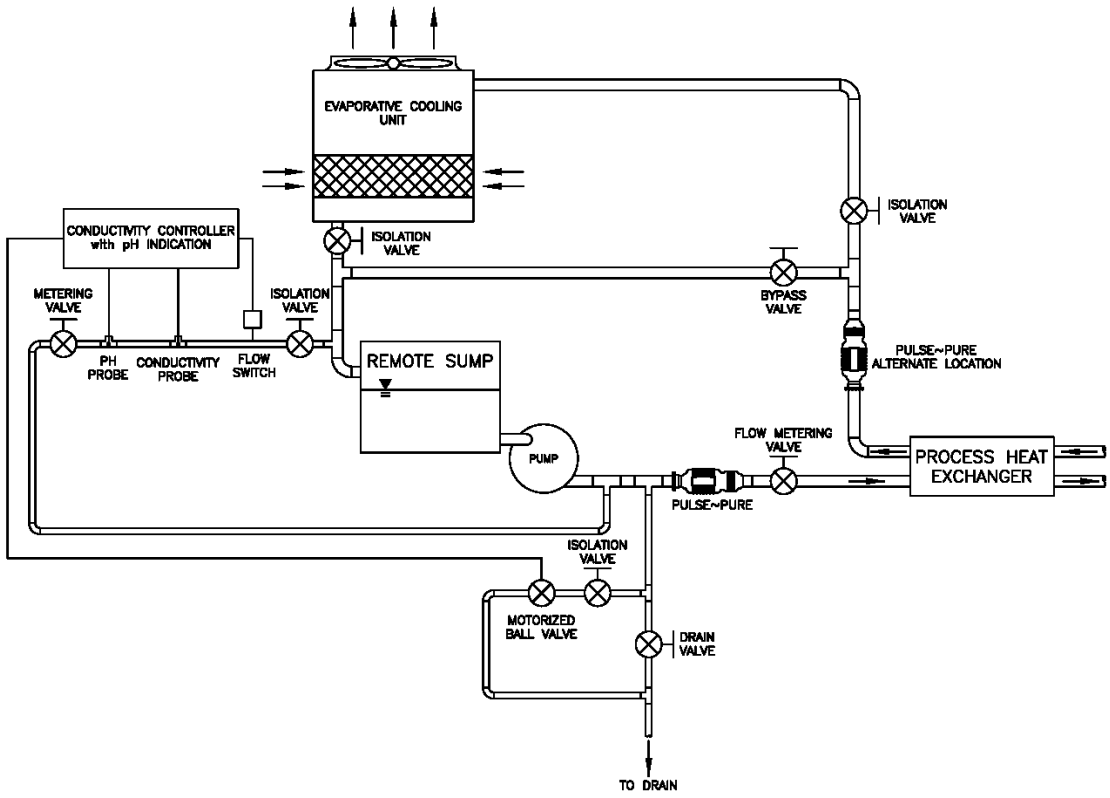


Figure 12 General field installed arrangement of the *Pulse*~Pure™ system in a system with a single evaporative cooling unit with remote sump.

Installations Involving Multiple Evaporative Cooling Units

Systems containing multiple evaporative cooling units can be equipped with one or more *Pulse*~Pure™ systems. Figure 13 shows a process cooling system with three evaporative cooling units and one *Pulse*~Pure™ for the entire system, while Figure 14 shows one *Pulse*~Pure™ per evaporative cooling unit for the same system.

In Figure 13, the **Purification Chamber** is located where all the water in the system is treated regardless of which pump is ON. In this installation, the *Pulse*~Pure™ system should be wire to operate if any of the system pumps turn ON.

Figure 14 shows a system in which each subsystem, or evaporative cooling unit, has a dedicated *Pulse*~Pure system. For this setup, each device could be wired to operate when the corresponding valve on the tower inlet is opened. This could be accomplished by using an electronic valve with an auxiliary contact or by installing a flow switch on the line.

It is important to note the location of the recirculation line for the conductivity controller. The location indicated in both figures ensures that the water flowing past the probes is a representative sample of the water flowing in the system regardless of which tower is operating. Placing the conductivity controller in a location that is not indicative of the systems water chemistry could result in several problems including poor performance from the *Pulse*~Pure™ system.

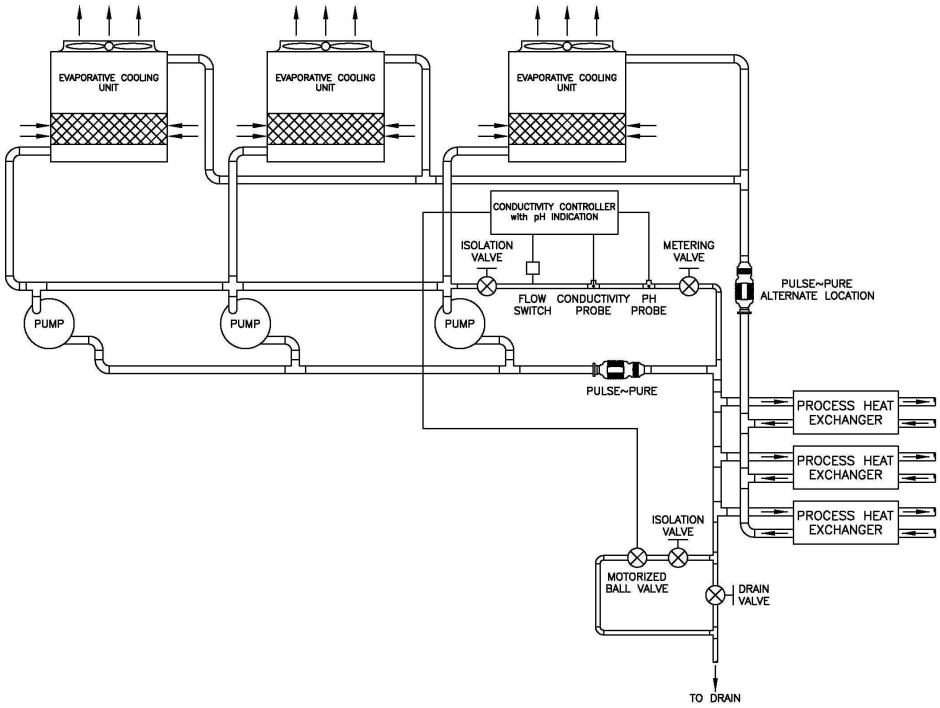


Figure 13 General field installed arrangement of a single *Pulse*~Pure™ system in a system with multiple evaporative cooling units.

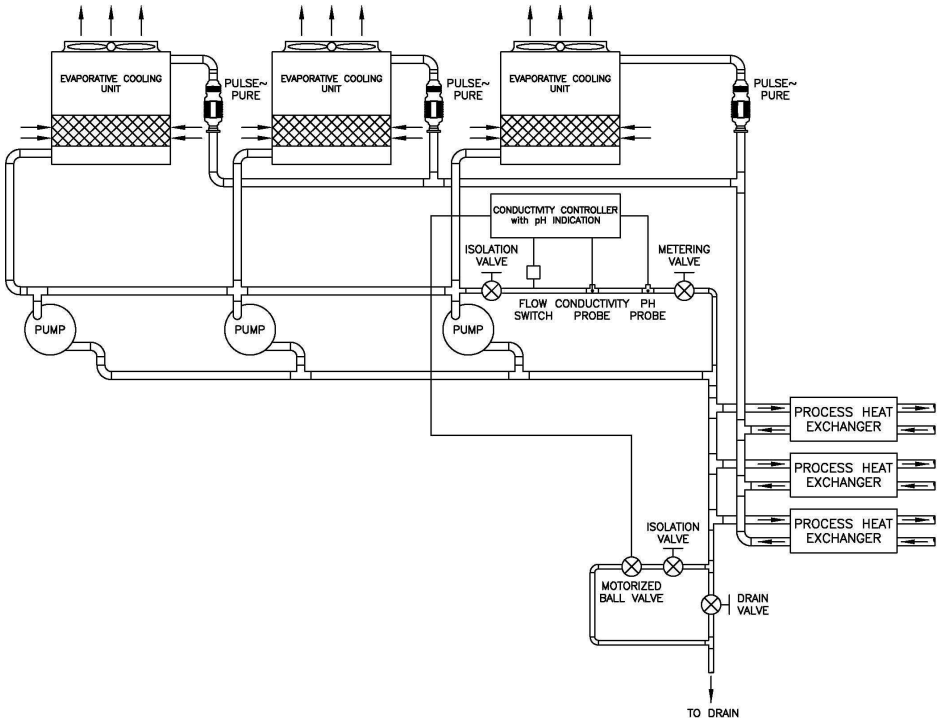


Figure 14 General field installed arrangement showing multiple evaporative cooling units each with a dedicated *Pulse*~Pure™ system.

Installation of Pulse Panel

The **Pulse Panel** may be mounted on any flat surface that is within reach of the **Purification Chamber** cable (15' standard length). If mounting the **Pulse Panel** on an area of the evaporative cooling unit in which water will come into contact with mounting hardware, it is necessary to properly seal the interior hardware. Figure 15 displays **Pulse Panel**s for 120V and 460V service and their respective mounting hole locations.

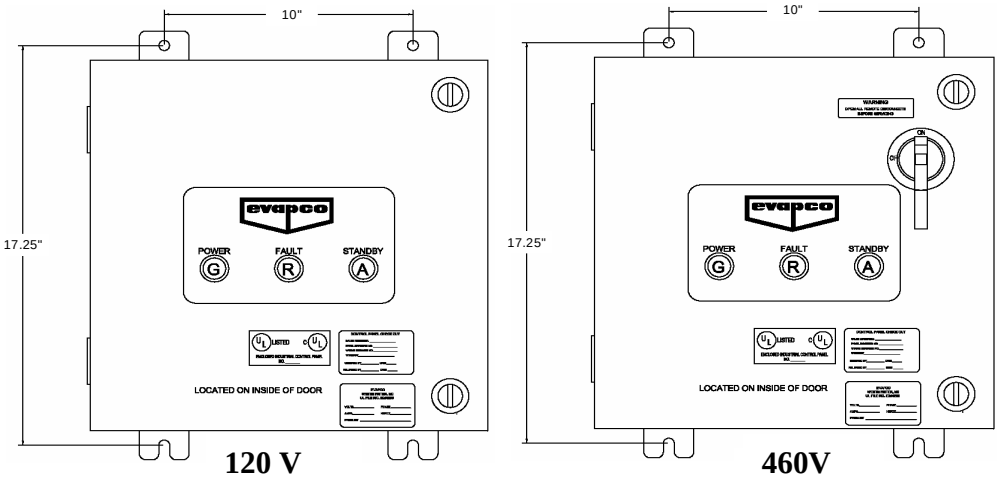


Figure 15 120 V (left) and 460 V (right) Pulse Panels.

APPENDIX A: MODBUS Communication

The Evapco *Pulse*~Pure™ Microprocessor Control utilizes a communications format, based on Modbus protocol, to interface to supervisory control systems. The physical interface is RS-485 which utilizes Modbus RTU protocol. To enable the Modbus protocol, the X1 Control Contact must be jumpered or connected to a flow switch or pump auxiliary contact.

The following pages will describe the communications functionality and the "code sets" related to the data and set-points within the *Pulse*~Pure™ Micro.

Communications Settings:

- The communications protocol is MODBUS-RTU over RS-485. This screen selects the device address on the network for this panel. Device address range is 0 to 15.
- Only one address can be accessed at a time. There is no block read/write.
- Selecting the device address:
  - With the power on, switch the control input on and off three times within the first five seconds.
  - The unit enters the set-up mode and flashes the yellow "Standby" lamp rapidly three times, then flashes the count for the MODBUS address on the green "Operating" lamp.
  - When the flashing stops, you have 5 seconds to toggle the control input.
  - If the control input is toggled, the MODBUS address will increment by one count and the unit will flash the yellow "Standby" lamp rapidly three times, then flash the new MODBUS address on the green "Operating" lamp.
  - Turning the power off within five seconds after the new MODBUS address is displayed will save the new address.
  - The above process can be repeated until the desired MODBUS address is obtained.
  - If the power is not turned off within 5 seconds after the new MODBUS address, the old address will be retained and the unit will resume normal operation.
- Baud Rate – Selects the data transfer rate.
  - 9600 baud.
- Data bits – Selects the number of data bits.
  - 8 bits.
- Parity – Error checking based on parity.
  - None
- Stop Bits – Number of stop bits.
  - 1

Digital I/O (Read Only)

Modbus Address	Description	TYPE	VALUE
43001	Control	Input	0 = Standby 1 = Run
43002	Fault	Output	0 = Normal 1 = Fault
43003	Power Coil	Output	0 = Off 1 = On
43004	Hi Freq Coil	Output	0 = Off 1 = On
43005	Blinking Lights (on coil)	Output	0 = Off 1 = On
43006	Operating lamp	Output	0 = Off 1 = On
43007	Fault lamp	Output	0 = Off 1 = On
43008	Standby lamp	Output	0 = Off 1 = On
43009	Remote-I/O Jumper	Input	0 = Off (Control input) 1 = On (RS-485)
43010	Current Range Jumper	Input	0 = Off (9 amps) 1 = On (23 amps)
43011	LED Direction Jumper (Blinking Lights on /Coil)	Input	0 = Off (Common Cathode) Default 1 = On (Common Anode)
43012	Future		0 = Off 1 = On
43013	Future		0 = Off 1 = On
43014	Future		0 = Off 1 = On
43015	Future		0 = Off 1 = On
43016	Future		0 = Off 1 = On

Analog I/O (Read Only)

Modbus Address	Description	TYPE	VALUE	RANGE
43017	Power coil current	Input	7/22 Amps	0-40 Amps
43018	Hi Frequency Coil	Output	30 Khz	0-40Kz
43019	Future			
43020	Future			
43021	Future			
43022	Future			
43023	Future			
43024	Future			
43025	Future			
43026	Future			

Status

Modbus Address	Description	TYPE	VALUE	RANGE
43027	Future	Read Only		
43028	Future	Read Only		
43029	Future	Read Only		
43030	Future	Read Only		
43031	Future	Read Only		
43032	Future	Read Only		

Set Points (Read / Write) and (Read Only)

Modbus Address	Description	TYPE	VALUE	RANGE
43033	Remote On	Read/Write	0=Off 1=On	*
43034	9A Hi current	Read Only	13	0-40 Amps
43035	9A Lo current	Read Only	4	0-40 Amps
43036	23A Hi current	Read Only	28	0-40 Amps
43037	23A Lo current	Read Only	10	0-40 Amps
43038	Future	Read/Write		
43039	Future	Read/Write		
43040	Future	Read/Write		
43041	Future	Read/Write		
43042	Future	Read/Write		
43043	Future	Read/Write		
43044	Future	Read/Write		
43045	Future	Read/Write		
43046	Future	Read/Write		
43047	Future	Read/Write		
43048	Future	Read/Write		
43049	Future	Read/Write		

43050	Future	Read/Write		
43051	Future	Read/Write		
43052	Future	Read/Write		
43053	Future	Read/Write		
43054	Future	Read/Write		
43055	Future	Read/Write		
43056	Future	Read/Write		
43057				
43058				
43059				
43060				

* The “Control” input must be energized in order for the remote control via RS-485 to operate. If the control input is de-energized, remote control via RS-485 is disabled.

APPENDIX B: Maintenance Checklists

Initial Site Visit Monitoring Checklist

PPF3.0A

Initial Site Visit Monitoring Checklist

Site Visit Service Provided by: _____
Project Name: _____
Jobsite Contact: _____
Unit Model Number: _____
Unit Serial Number: _____
Contract Number: _____

Jobsite Location: _____
Jobsite Contact Phone #_____
Remote Sump Application: Yes or No
Pulse~Pure™ Model Number: _____
Pulse~Pure ™ Serial Number: _____
Visit Date: Start Up Date:

Procedures*

*Water must be circulating through chamber/probe assembly for proper evaluation. If any of the following procedures are not completed, explain why in the notes section.

	Completed
2. Note unit materials of construction (galvanized sheet-metal, galvanized coils and stainless steel if applicable) and check appearance of materials **(include photographs)**. Record results in notes section below.	☐
2. Visually inspect the basin water for debris or unusual characteristics.	☐
3. Verify installation of all Pulse~Pure components meet EVAPCO's specifications, including:	
a. Inspect Pulse~Pure™ Water Treatment System for damage including conductivity control system.	☐
b. Purification chamber is mounted downstream of the system pump.	☐
c. Verify all lights are working properly on the purification chamber and pulse panel.	☐
i. With Pumps On: Purification Chamber lights should be flashing. Green Light on Pulse Panel should be illuminated.	
ii. With Pumps Off: Yellow "Stand-by" light on Pulse~Panel should be illuminated. Purification Chamber lights should not be flashing.	

d. Verify weep holes are drilled in the proper location. ☐

e. Verify probe assembly with conductivity and pH probes (if applicable) are located in the high pressure side of the system (on discharge side of pump) and drains into the system reservoir or a low pressure line. ☐

h. Verify blowdown valves operated by the conductivity controller are located in the high pressure side of the system (on discharge side of pump) and terminate in a drain line. ☐

i. If the purification chamber is installed on a riser pipe above the water level when the pump is not operating, the Pulse~Pure™ should be configured to go into "Standby" mode when the pump turns off. ☐

h. If a conductivity controller flow switch is provided, verify that switch interlocks with the blow down function. ☐

i. Verify that pipe work attached to the purification chamber is adequately supported and anchored. ☐

j. Verify that all non-draining piping for conductivity control system is insulated and heat traced (applies to low ambient locations). ☐

k. Check that conductivity probe is cleaned and calibrated. ☐

l. Verify there is water flow through the conductivity probe, pH and flow switch (if applicable). ☐

m. Verify that blow down and isolation valves are operating properly. ☐

4. Perform make-up water analysis and record results below. Compare to initial make-up water sample analysis provided by EVAPCO on form **PPF 1.0 Water Sample Analysis.** Perform twice during length of Service Contract (1st and 4th Visit) ☐

	Initial EVAPCO PPF1.0 Analysis	**Current Make Up Analysis**
Conductivity (µS/cm)	_____	_____
pH	_____	_____
Total Hardness (mg/L as CaCO3)	_____	_____
Calcium Hardness (mg/L as CaCO3)	_____	_____
Magnesium Hardness (mg/L CaCO3)	_____	_____
Alkalinity (mg/L CaCO3)	_____	_____
Chloride (mg/L as Cl-)	_____	_____
Silica (mg/L as SiO2)	_____	_____

5. Program conductivity set point on controller per recommendations provided in **PPF 1.0 Water Sample Analysis**. For units installed on galvanized equipment the ☐

Galvanized steel must be conditioned for a 6 week period by keeping the pH between 6.5 and 8.0 per the method selected under Section V of the monitoring contract.

Conductivity Set Point _____

7. Verify recirculating water pH for passivation and address any additional passivation requirements. ☐

pH_____

7. Perform microbial count using a dip slide. Record results on next **Monitoring Checklist (Form PPF 4.0)**. ☐

8. Review Pulse~Pure™ Water Treatment System operational requirement with owner (Periodically run Pulse~Pure during system shutdown). ☐

9. Provide a copy of this form, **Pulse~Pure™ Monitoring Checklist form PPF 3.0,** to the owner and EVAPCO. ☐

Notes:

Signature:_____ Print Name: _____

White=Copy to be faxed or e-mailed to EVAPCO at 410-756-6450 or jtichy@evapco.com
Canary=Customer Copy

Monitoring Checklist

PPF4.0A

Monitoring Checklist
Site Visit No. _____

Site Visit Service Provided by: _____ Jobsite Location: _____
Project Name: _____ Jobsite Contact Phone # _____
Jobsite Contact: _____ Remote Sump Application: Yes or No
Unit Model Number: _____ *Pulse*~Pure™ Model Number: _____
Unit Serial Number: _____ *Pulse*~Pure™ Serial Number: _____
Contract Number: _____ Visit Date: Start Up Date:

Procedures*

*Water must be circulating through chamber/probe assembly for proper evaluation. If any of the following procedures are not completed, explain why in the notes section.

Completed

1. Check appearance of materials **(include photographs)**. Record results in notes section below. ☐

2. Visually inspect the basin water for debris or unusual characteristics. ☐

3. Verify installation of all Pulse~Pure components meet EVAPCO's specifications, including:

a. Inspect Pulse~Pure™ Water Treatment System for damage including conductivity control system. ☐

b. Verify all lights are working properly on the purification chamber and pulse panel. ☐

i. With Pumps On: Purification Chamber lights should be flashing

Green Light on Pulse Panel should be illuminated

ii. With Pumps Off: Yellow "Stand-by" light on Pulse~Panel should be illuminated

Purification Chamber lights should not be flashing

c. If a conductivity controller flow switch is provided, verify that switch interlocks with the blow down function. ☐

d. Check that conductivity probe is cleaned and calibrated. ☐

e. Verify there is water flow through the conductivity probe, pH and flow switch (if applicable). ☐

f. Verify that blow down and isolation valves are operating properly. ☐

4. Record conductivity and pH readings. Verify that passivation is complete.

a. Record conductivity and pH readings from conductivity controller and handheld device. ☐

b. If passivating, verify proper recirculating water pH (Typically site visit #2, 2nd Week visit) ☐

c. If passivation is complete, reprogram conductivity set-point as advised in form **PPF1.0 Water Sample Analysis, (**typically after site visit number 3, 6th week visit.) ☐

5. Perform make-up and recirculating water analysis, record on the **Pulse~Pure™ Monitoring Checklist Form (PPF 4.0)** compare to initial water sample analysis provided on form **PPF 1.0 Water Sample Analysis, record below.** ☐

	Make Up (handheld)	**Recirculating Water (handheld)**	**Controller**
Conductivity (µS/cm)	_____	_____	_____
pH	_____	_____	_____
Total Hardness (mg/L as CaCO3)	_____	_____	_____
Calcium Hardness (mg/L as CaCO3)	_____	_____	_____
Magnesium Hardness (mg/L CaCO3)	_____	_____	_____
Alkalinity (mg/L CaCO3)	_____	_____	_____
Chloride (mg/L as Cl-)	_____	_____	_____
Silica (mg/L as SiO2)	_____	_____	_____

Make-up and recirculating water analysis will be performed twice during length of Monitoring Service Contract- typically during the 1st and 4th Site Visits, and more importantly after the set point was changed since the previous site visit.

6. Perform microbial count using a dip slide. Record results on next **Monitoring Checklist (Form PPF 4.0)**. ☐

7. Provide a copy of this form, **Pulse~Pure™ Monitoring Checklist form PPF 4.0,** to the owner and EVAPCO. ☐

Notes:

Signature:_____ Print Name: _____

White=Copy to be faxed or e-mailed to EVAPCO at 410-756-6450 or jtichy@evapco.com
Canary=Customer Copy

EVAPCO, Inc.
World Headquarters
PO Box 1300
Westminster, MD 21158
410-756-2600