Ozone Systems

Installation & Operation Manual

SC27P

Corona Discharge Ozone Generator

Tested and certified by
WQA to NSF/ANSI 50 as a
component only.

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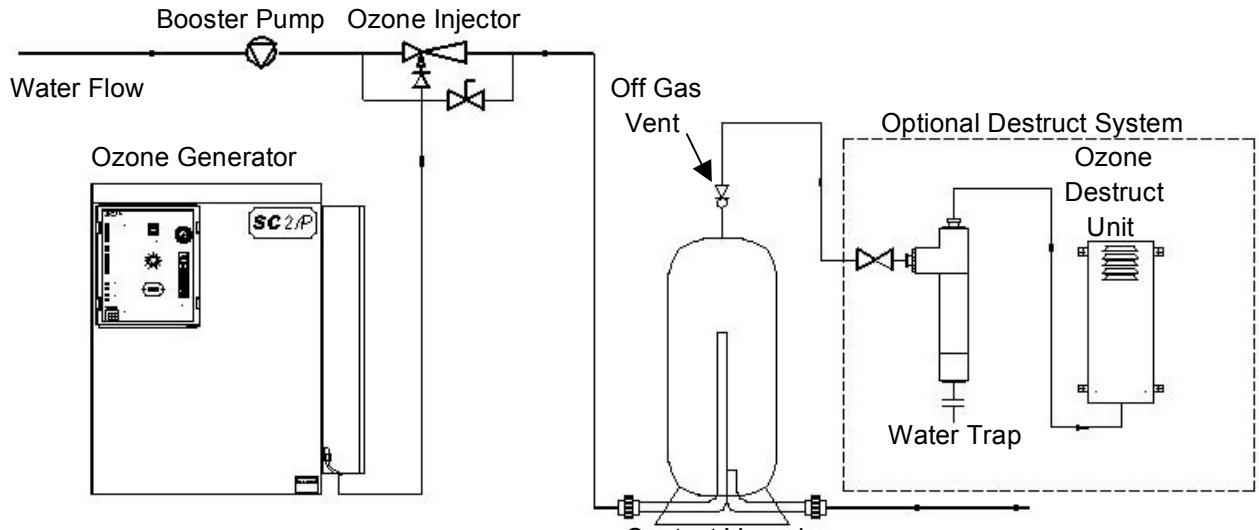
THEORY OF OPERATION/PRODUCT DESCRIPTION CHAPTER 1

ClearWater Tech ozone systems are designed for safe, effective use in a variety of water treatment applications. The SC27P ozone generator have been tested and certified by the Water Quality Association according to NSF/ANSI 50. Each complete, integrated system may include the following components required for reliable, efficient ozone production and can be divided into four general segments:

• Air preparation system • Ozone generator • Ozone injection/contacting • Ozone destruct



Shown: ClearWater Tech SC27P Ozone System

Air Preparation System

The ClearWater Tech SC27P ozone generator requires a source of clean, dry, oil-free, oxygen-enriched air for effective ozone production. To meet that need, the built-in air preparation system employs pressure swing adsorption (PSA) technology with an oil-less compressor to increase the concentration of oxygen and reduce the moisture content in the feed gas (the air supplied to the ozone generator). This substantially improves the output capability of the ozone generator and prevents premature failure of key internal components. These air preparation systems deliver 90%+/-3% oxygen purity at -100°F dew point and at very low pneumatic pressures, minimizing noise and reducing compressor wear.

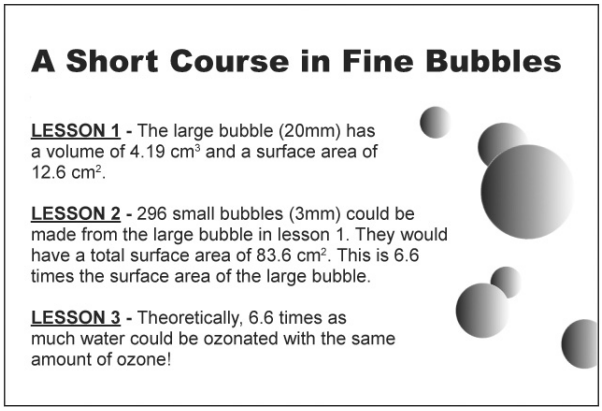
The air preparation system affects ozone production in grams per hour and more importantly ozone concentration, also known as "percent by weight." Since ozone is produced with oxygen, the greater the percent of oxygen that enters the ozone generator will produce more grams per hour and concentration of ozone. Since the SC27P ozone generation system incorporates PSA oxygen concentrator it will yield the highest grams per hour at the highest concentrations. Greater ozone concentration equates to higher solubility of the ozone gas in solution, which will yield a greater oxidation potential.

Ozone Generator

The ClearWater Tech SC27P self-contained pressurized ozone generator is designed to supply high concentrations of ozone gas (up to 10%) at 10 PSI. The oxygen feed gas produced by the air preparation system is supplied to the ozone generator, which flows through the built-in flow meter. A stainless steel needle valve (located under the SC27P), is used to maintain optimum pneumatic parameters inside the ozone reaction chambers. After this point the vacuum created at the ozone injector *draws* the ozone gas into the water line. The ozone generator is equipped with a pressure switch, which prevents operation if pressure within the reaction chambers drops below 9 PSI.

As the feed gas enters the fused, thermally protected reaction chambers inside the ozone generator, some of the oxygen molecules are split while passing through the high voltage electrical field (the "corona"), forming single oxygen atoms (O_1). These oxygen atoms then recombine with other oxygen molecules in the air stream, forming ozone. The modular, multiple reaction chamber design allows the ozone generator to keep working even if one of the chambers requires service. Depending on the application, the ClearWater Tech ozone generator may be interlocked with an ORP controller, PPM controller, pressure switch, timer or circulation pump.

Ozone Injection/Contacting



The ozone injector serves two purposes: One, it creates the vacuum required to safely draw the ozone gas from the ozone generator and two, it provides a means by which the ozone gas can become dissolved in water. A very dynamic injection process is required to effectively dissolve ozone in water.

ClearWater Tech injection systems use only Mazzei® injectors for maximum mass transfer efficiency. The injector produces a cavitation effect, enabling the ozone gas to join the water stream in the form of extremely tiny bubbles. These bubbles must be as small as possible in order to increase the ratio of bubble surface area to the amount of ozone entering the water.

Depending on the application and the water treatment goals, a ClearWater Tech contacting system may also be required. Some oxidation reactions take place so quickly that they are limited only by the rate at which the ozone is dissolved in the water. Other reactions, such as disinfection, may require that proper ozone residual be maintained for a specific amount of time. A correctly-sized contact vessel is used for this purpose.

Ozone Destruct

The ClearWater Tech off-gas destruct systems, consists of two components - the ozone destruct unit (a heated chamber filled with manganese dioxide and copper oxide) and a water trap. Used in conjunction with a ClearWater Tech off gas vent, the ozone destruct system is an effective way to vent the contact vessel(s) when it is impractical to send the off gas to atmosphere or reintroduce it to the water.

SAFETY INFORMATION CHAPTER 2

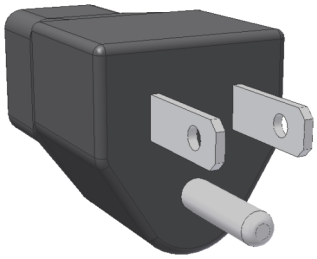
SAFETY WARNINGS

Two aspects of ClearWater Tech ozone generators represent potential dangers – ozone gas and high voltage electricity.

OZONE GAS - <u>WARNING:</u> HIGH CONCENTRATIONS OF OZONE GAS ARE DANGEROUS TO HUMANS. LOW CONCENTRATIONS CAN CAUSE IRRITATION TO THE EYES, THROAT AND RESPIRATORY SYSTEM.

This ClearWater Tech corona discharge ozone generator is designed to operate under a pressure condition. While safety precautions have been taken, entering the equipment area should be avoided if ozone gas is detected. Ozone has a very distinctive odor and is detectable at very low concentrations (0.02 ppm), which is far below OSHA's maximum permissible exposure level of 0.1 ppm.

HIGH VOLTAGE - <u>WARNING</u>: CLEARWATER TECH OZONE GENERATORS OPERATE AT HIGH VOLTAGE. DO NOT TAMPER WITH OR DELIBERATELY BYPASS THE COVER OR SAFETY SWITCHES BUILT INTO THE OZONE GENERATOR UNLESS INSTRUCTED TO DO SO BY THIS MANUAL. IF CONTACT IS MADE WITH OPERATING HIGH VOLTAGE COMPONENTS, ELECTRIC SHOCK WILL OCCUR.



ClearWater Tech corona discharge ozone generators take line voltage and convert it to 48 VDC. A high voltage transformer then boosts the voltage. While each ozone generator has a door switch and other safety interlocks, proper care must be used by a qualified electrician when making any internal adjustments or performing any maintenance procedures.

IMPORTANT SAFETY INSTRUCTIONS

When installing and using this electrical equipment, basic safety precautions should always be followed, including the following:

1. **READ AND FOLLOW ALL INSTRUCTIONS.**

2. **SAVE THESE INSTRUCTIONS.**

3. **All electrical connections should be made by a licensed, qualified electrician.**

4. **Before attempting any electrical connections, be sure all power is off at the main circuit breaker.**

5. **Install all electrical equipment at least five feet from any open body of water using non-metallic plumbing.**

6. **Install check valves and a vacuum break to prevent water from contacting the electrical equipment.**

7. **The electrical supply for this product must include a suitably rated switch or circuit breaker to open all ungrounded supply conductors to comply with Section 422-20 of the National Electrical Code, ANSI/NFPA 70-1987. The disconnecting means must be readily accessible to the operator(s) but installed at least five feet from any open body of water.**

8. **Be sure to bond (ground) the system using the copper-bonding lug on the bottom of the ozone generator. The system should be bonded with solid copper wire conforming to all local, state and national electrical codes.**

9. **The system should be sized appropriately for its intended use by a qualified professional familiar with the application. This equipment must be validated by the manufacturer for its intended use; failure to do so may void the warranty.**

Unpacking

Compare the ozone system equipment received to the packing list provided. Before beginning any installation procedures, thoroughly inspect all components for damage. If damage is noticed, promptly notify the freight carrier and request an on-site inspection. Inspect all packing materials for small parts before discarding. Inspect all plumbing, fittings and tubing for packing material that may have become lodged in openings.

Equipment Placement

- When placing the ozone system components in the equipment room, make sure to consider safety, maintenance requirements, local building and fire codes, etc. The components should be easily accessible by the operators, including equipment access doors and electrical hook-up boxes. All meters, gauges, indicator lights, and switches should be visible and accessible. Dimensional drawings of each air preparation system and ozone generator are included in Section A of the Appendix.

- The SC27P should be located as close as possible to the point of ozone injection. Ozone is an unstable gas and will begin reverting back to oxygen very quickly. To determine the most favorable ozone injection point, the following items should be considered:
    - Located *downstream* of all other existing water system components.
    - Located *upstream* of the residual sanitizer injection point (if so equipped).
    - In a Sidestream plumbing configuration (see Figure 4-1) with recirculation, the pH adjustment chemical injection point must be located *downstream* of the residual sanitizer injection point (if so equipped).
    - In a Full Flow plumbing configuration (see Figure 4-2) without recirculation, locate *downstream* of the pH adjustment chemical injection point.
    - Adequate protection from weather, dust and excessive heat.
- Like any electronic component, performance and longevity is enhanced by favorable operating conditions. Also, since ozone generator is air-cooled, a relatively dust-free, well-ventilated area is required. No caustic chemicals should be stored in the area surrounding the equipment. A minimum clearance of six inches from the vents on either side of the ozone generator is required.

- The equipment is heavy and requires proper support. Therefore, a clean, dry, level vertical surface should be provided for the SC27P. The system mounting bar should be securely fastened to the surface using the mounting holes provided. Hang the SC27P from the wall mounting bar and level system on the wall with the leveling feet provided on the backside of the system.

- The SC27P system is designed for specific voltage requirements, withstand typical outdoor elements and frequent (though *not* constant) wash down, though should *not* be subjected to outdoor extremes including contact internally with water and/or temperature extremes. Therefore, the equipment must be installed in an environment consistent with the following operating parameters:
    - Ambient temperature range: 20°F to 95°F continuous. If the temperature around the equipment consistently exceeds 95°F, additional air-cooling must be provided.
    - Humidity: 0 – 90% relative humidity, non-condensing environment
    - Line voltage: +/-10% of rated input

    <u>Note:</u> Equipment installed in extreme environmental conditions will void manufacturer's warranty.

    - Allow room for the peripheral equipment (booster pump, injector manifold, contact vessel, etc.).

INSTALLATION PROCEDURES – Plumbing CHAPTER 4

The ozone system should be plumbed using either a sidestream or full flow configuration. The sidestream loop method takes *a portion* of the water from the main flow (see Figure 4-1) and diverts it into a sidestream *downstream* of the filter (if so equipped). Ozone is introduced into the sidestream water and is allowed contact time with the water before it is returned to the main flow at a point downstream of all other equipment (heaters, solar panels, etc., if so equipped) in the circulation system. A booster pump is usually employed to compensate for the flow restriction caused by the sidestream loop and the injector manifold. If a halogen-type residual sanitizer is utilized, its injection point should be as far downstream as possible from the point at which the sidestream water returns to the main flow. In a full flow configuration, the same system components are usually involved and appear in the same order with respect to the direction of flow. However, *all* the water in the main flow is allowed contact time with the ozone (see Figure 4-2). A booster pump may be necessary to maintain proper flow requirements. If employed, the booster pump is located *upstream* of the point at which the ozone injector manifold is installed.

NOTES:

- **Adequate use of unions and isolation valves is strongly recommended to facilitate maintenance and repairs.**
- **Use Schedule 80 PVC for all plumbing connections wherever possible. Plumbing size requirements are dictated by the water flow characteristics of the system.**
- **Make sure to use proper plumbing practices and secure all plumbing and system equipment according to local codes.**
- **Ozone is a powerful oxidizer and will degrade certain materials. Use ozone-compatible plumbing materials for section(s) of the system that will come in contact with ozone dissolved in water. The following is a list of materials that are compatible with ozone:**
  - **PVC**
  - **CPVC**
  - **Kynar**
  - **Teflon**
  - **Stainless Steel (300 series)**
  - **Viton**
  - **EPDM**
  - **Concrete**
- **Depending on the application, other components (psi gauge, flow meter, etc.) may be installed to assist in monitoring system parameters.**

Step 1: Arrange the ozone system equipment (booster pump, injector and contact vessel) according to mechanical print or as dictated by equipment layout and serviceability considerations. Do not secure booster pump and contact vessel to housekeeping pads at this point. Dry fit plumbing as appropriate to insure proper fit and location before making permanent connections.

Step 2: Install a tee or plumbing saddle into the main water line after the filter (if so equipped) and before the flow diversion mechanism. The purpose of the mechanism is to restrict water flow so water is diverted into the sidestream (see Figure 4-1). If such a mechanism is not present in the system (such as a heater bypass valve, etc.), it will require installation of a valve (butterfly, gate or ball) or a flow controller.

Step 3: Plumb a line from the tee or plumbing saddle to the booster pump. For serviceability of the equipment in the sidestream loop, be sure to install an isolation valve between the tee or saddle and the booster pump.

Step 4: Plumb from the booster pump to the injector manifold. Make sure to note the correct direction of flow, indicated by a blue arrow on the inlet side of the manifold body. The check valve assembly is strapped to the manifold using wire ties. Remove the assembly; using Teflon® tape; install it onto the top opening of the injector.

Step 5: Plumb from the injector manifold to the inlet side of the contact vessel. To reduce possible backpressure to the injector, minimize the number of elbows between the injector manifold and contact vessel. The contact vessel is a specified size, determined by water flow requirements. ClearWater Tech contact columns and the 30, 40, 80, and 120-gallon contact tanks have inlet *and* outlet fittings on the bottom of the vessel and are designated with arrows showing the direction of flow**. Note: The inlet and outlet arrows on the contact tanks are under the base of the tank.** The inlet on the 264, 463 and 850-gallon tanks is located at the top with the outlet at the bottom.

Step 6: Using a tee or plumbing saddle, plumb from the outlet of the contact vessel back into the main water line. For serviceability of the equipment in the side stream loop, be sure to install an isolation valve between the outlet fitting on the contact vessel and before returning to the main water line.

Step 7: Secure the booster pump and contact vessel to solid mounting surfaces using appropriate hardware and according to local codes. If installing a ClearWater Tech contact column, use a ClearWater Tech contact

column mounting kit and install according to the instructions below. If installing a contact tank, secure to a solid horizontal surface using mounting flange or feet.

Step 8: Install the contact vessel venting system into the top of the vessel. If using the ClearWater Tech contact column, the vent kit supplied includes fittings, a control valve and Teflon® tubing. The contact tank venting system includes an air relief valve, fittings and a length of Teflon® tubing. Depending on conditions, the vented gas may be directed to an ozone destruct system, to atmosphere or to the low-pressure side of the water system. **Note: Do not direct the tubing to the *suction* side of any pump in the system.**

Contact Column Installation (if so equipped)

Step 1: Make sure the following hardware items are included in the contact column mounting kit:

- 'L' bracket
- 1/2" concrete anchors
- 6" clamp assembly
- Unistrut bar
- Protective end cap
- Mounting hardware

Step 2: Referring to Figure 4-3, mark the two holes for mounting the 'L' bracket to the wall. The bracket should be located so that the 6" clamp assembly will be approximately 12" from the top of the contact column. Drill a 1/2" hole at each of the marks, about 3 1/2" deep. Insert a concrete anchor into each hole with the threaded end facing outward. Slip the 'L' bracket over the threaded ends of the anchors, followed by a washer for each anchor. Secure the bracket to the wall by threading a nut onto each anchor and tightening.

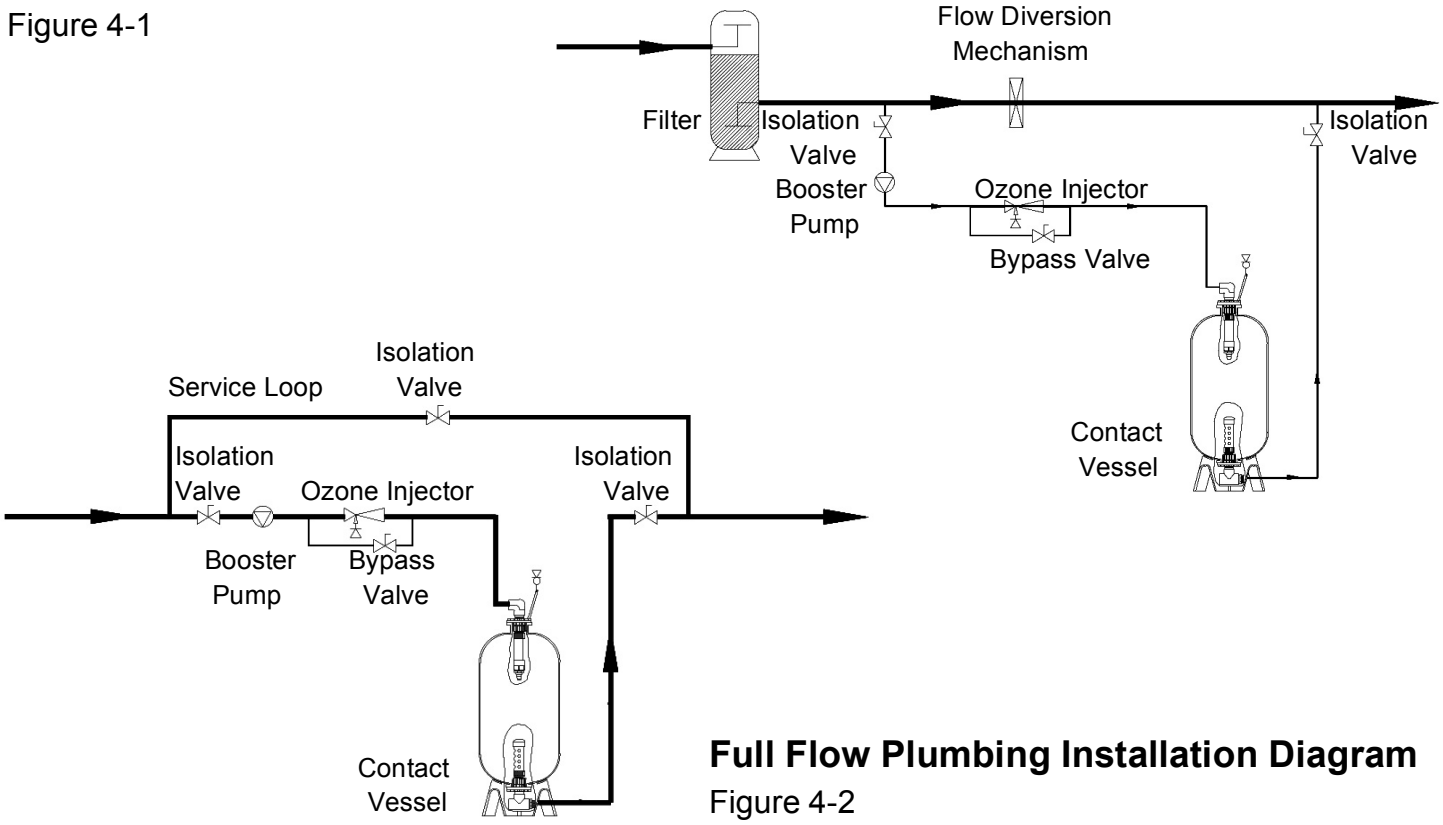
Step 3: Cut the unistrut bar to the desired length and attach it to the 'L' bracket using hardware provided.

Step 4: Slip the two sides of the 6" clamp into the unistrut bar and then around the contact column. Tighten the retaining bolt, securing the contact column to the unistrut bar.

Step 5: Slip the protective end cap over the exposed end of the unistrut bar.

Sidestream Plumbing Installation Diagram

Figure 4-1

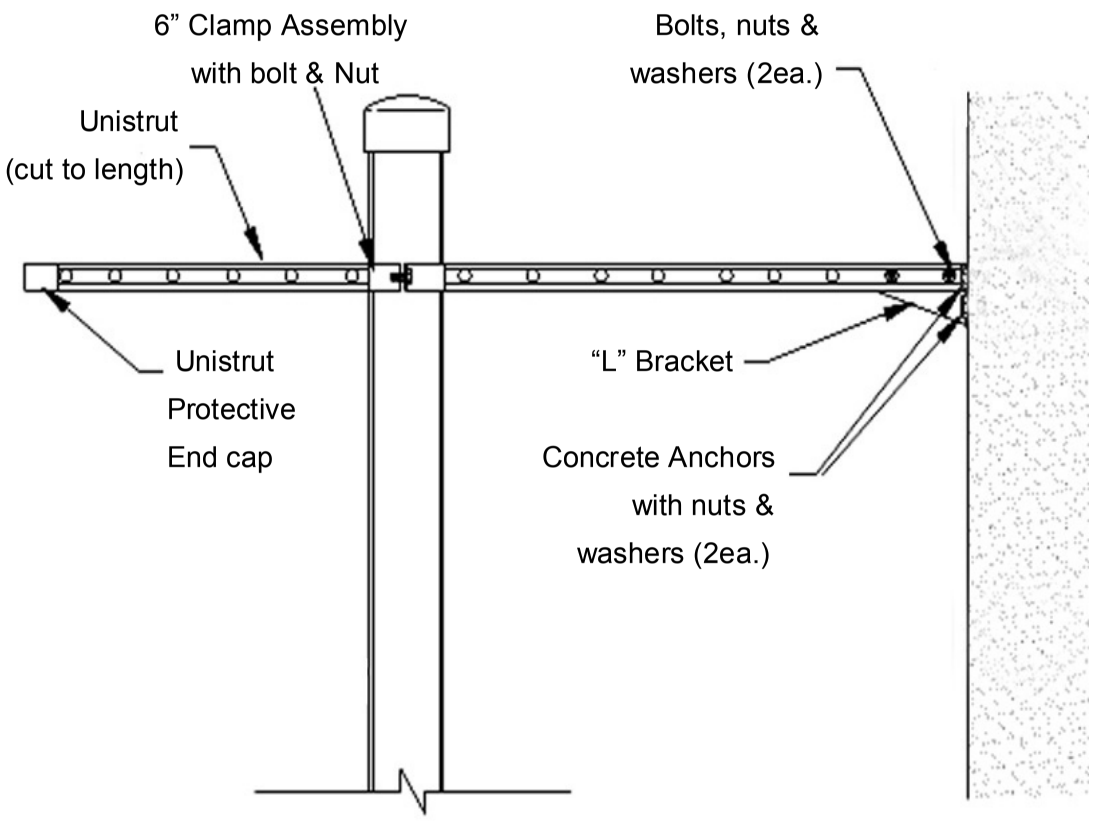


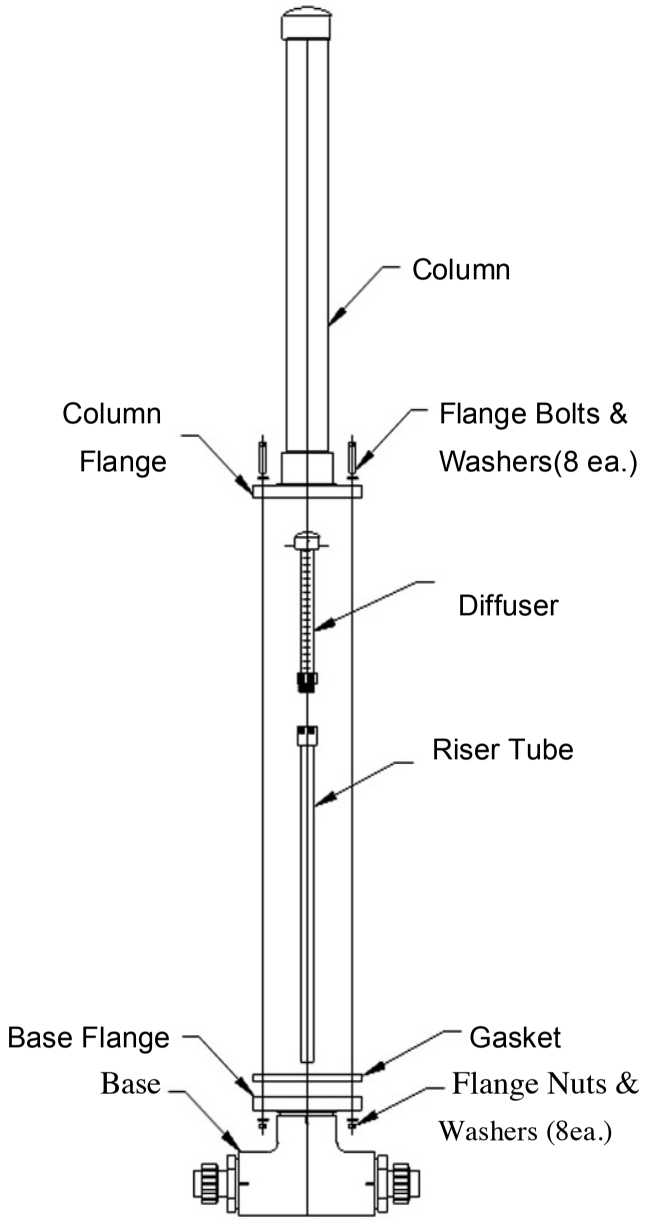
Full Flow Plumbing Installation Diagram

Figure 4-2

Contact Column Installation Diagram

Figure 4-3





Contact Column Exploded View

Figure 4-4

INSTALLATION PROCEDURES – Electrical CHAPTER 5

The SC27P ozone generation system is designed to hard wire to the main power source with specific input voltage requirements. All possible pre-wiring has been completed at the factory. Logic Schematics have been provided in the Appendix-Section C.

- **All electrical connections should be made by a licensed, qualified electrician. All local, state and national codes must be observed.**
- **Make sure all power is off at the main circuit breaker before making any electrical connections.**

Step 1: Conforming to all local, state and national electrical codes, ground the ozone generator to a true earth ground. Use solid copper bonding wire (usually #8 AWG) from the copper-bonding lug located on the bottom of the ozone generator to the grounding point.

Step 2: **Main Power:** Wire main power to the Electrical Hook-up Box located on the left side of the SC27P with specified input voltage, either 120VAC 60Hz (L1-Black and Neutral-White) or 220VAC 50Hz (L1-Red and L2/Neutral-Black), single phase (1ø). Using #12 AWG, wire L1 main power to terminal #1. Using #12 AWG, wire a system neutral to terminal #4. Using #12 AWG, wire a system ground to terminal #6. See Figure 5-1 for Electrical Hook-up Box Terminal Strip Diagram. See Appendix-Section A for Electrical Terminal Strip location.

Power Consumption		
Input Voltage	120VAC 60Hz	220VAC 50Hz
SC27P	9 amps	4.5 amps

Step 3: **MCI (Motor Control Interlock) Power:** The MCI is a fused factory-wired interlock, which may be used to energize or de-energize the SC27P with other electrical component(s) via an input signal. If the MCI is used, remove the factory-wired jumper between L1, terminal #1 and the MCI, terminal #2, of the Electrical Hook-up Box Terminal Strip. Using #18 AWG, wire a 120VAC power signal (1 amp max) for a 120VAC 60Hz system or a 220VAC power signal (1amp max) for a 220VAC 50Hz system to the top of the MCI, terminal #2. If so required, a MCI Neutral may also be wired, using a #18 AWG wire to terminal #5. See Figure 5-1 for Electrical Hook-up Box Terminal Strip Diagram. See Appendix-Section A for Electrical Terminal Strip location. **Note: The SC27P will not function without an input signal to the MCI, terminal #2.**

Step 4: **External Contactor Signal:** The SC27P is equipped with an external contactor output signal. The output voltage will be 120VAC (2 amp max) for a 120VAC 60Hz system or 220VAC (2 amp max) for a 220VAC 50Hz system. Using a #18 AWG, wire from the External Contactor, terminal #3 of the Electrical Hook-up Box Terminal Strip, to the coil side of a contactor. If so required, an External Contactor Neutral may also be wired, using a #18 AWG wire from the Auxiliary Neutral, terminal #5 to the coil side of the contactor. See Figure 5-1 for Electrical Hook-up Box Terminal Strip Diagram. See Appendix-Section A for Electrical Terminal Strip location.

Step 5: **External Loop:** The external loop is a true dry contact interface. **Note: The term 'dry contact' means that this loop does not supply output nor accept input voltages. Warning: Supplying voltage to the external loop will cause damage to the ozone generator and void warranty.** Under normal operation, the external loop will effectively interrupt the ozone output when the loop has lost continuity; this will also illuminate "External Loop" LED and turn off the "Ozone Output" LED(s) located on the control panel of the system (see Appendix-Section A). **Note: When the external loop has lost continuity main power to the ozone generator will remain "ON" giving power to the rest of the systems components.** When continuity is present through the external loop, ozone output will continue. This continuity will effectively turn "OFF" the "External Loop" LED and will again illuminate the "Ozone Output" LED(s).

The external loop is located on the left side of the system, positions #9 and #10 on the terminal block (see Appendix - Section A), and can be interfaced to any control device, i.e., pressure switch, vacuum switch, flow switch, float switch, ORP controller, PPM controller, or timer. If the control device used supplies an output voltage a single pole single throw (SPST) normally-open relay may be used to create a dry contact interface (see Figure 5-2, "External Loop Electrical Interface").

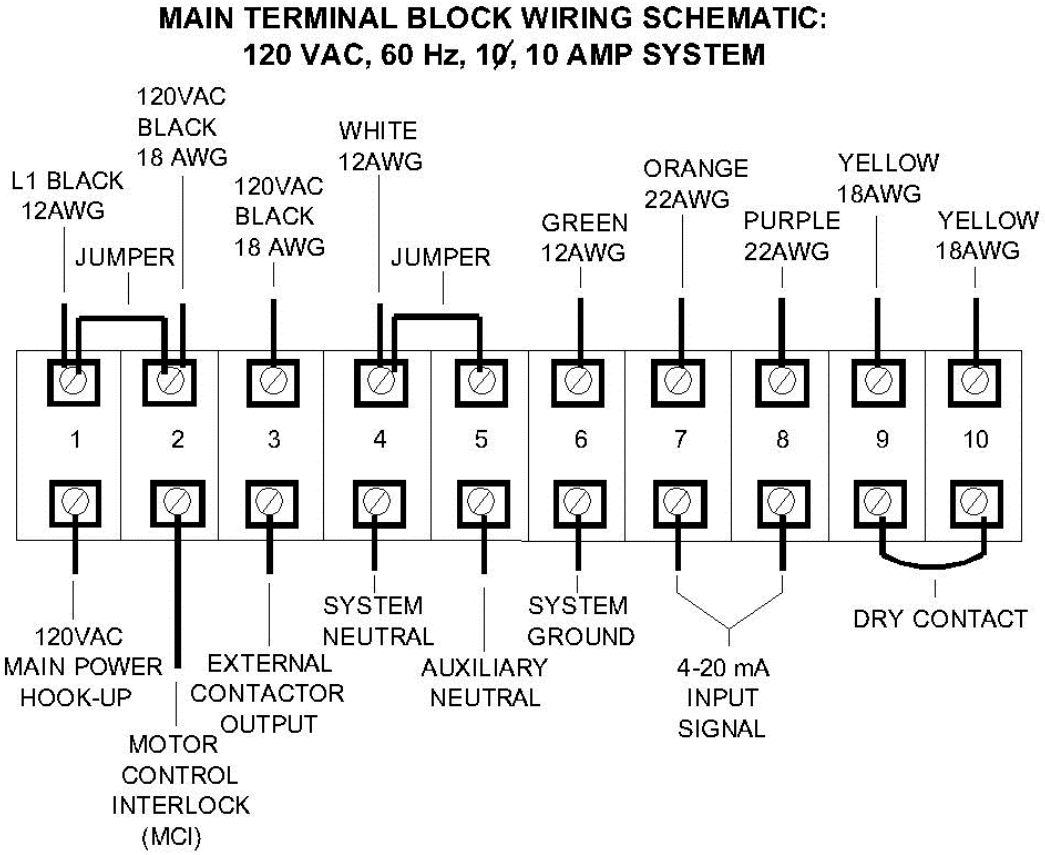
Step 6: **Ozone Output Control:** The SC27P ozone generator is equipped with two options for controlling the ozone output. The first option is a Manual 0-100% Ozone Output Control and the second is a Remote 4-20mA Control signal. See Appendix-Section A for the location of the manual ozone output control knob and remote 4-20mA control leads (orange and purple). An LED located on the systems control panel indicates the ozone

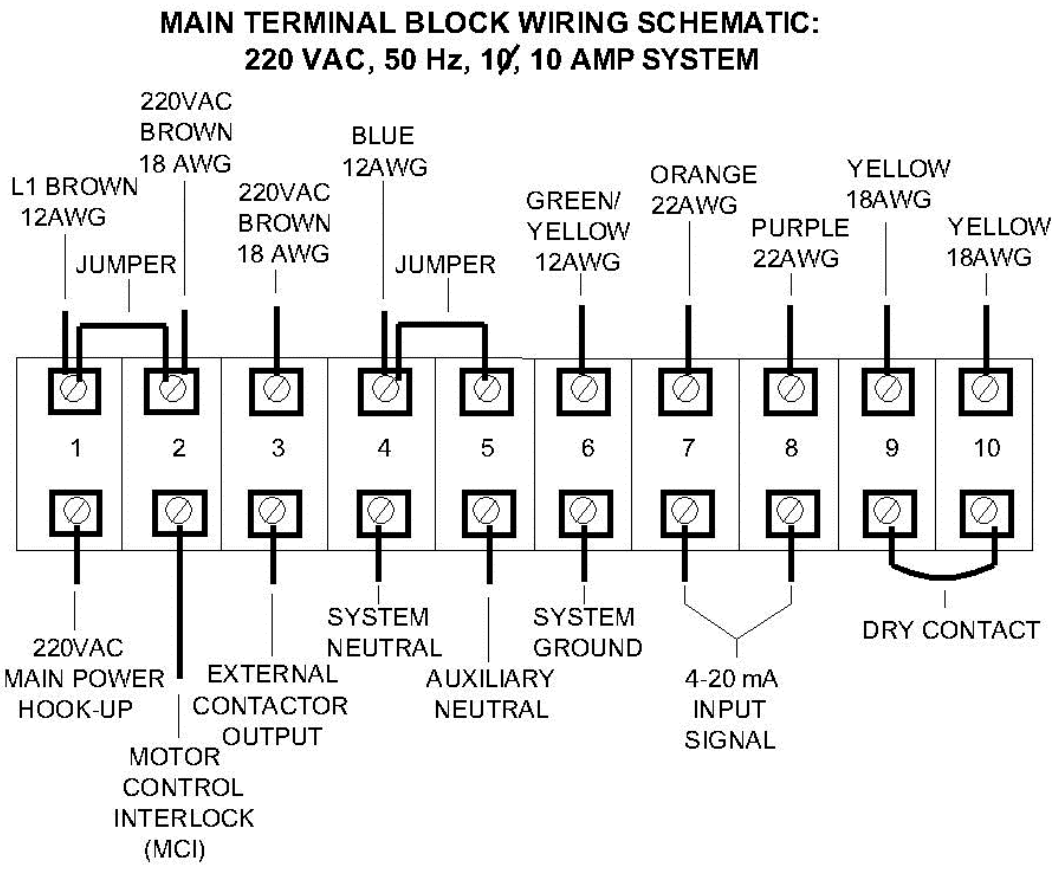
output control selected, see, Start-Up and Calibration Procedures, Figure 7-1A for LED function and Appendix-Section A for LED location.

1. **Manual Ozone Output Control:** Turning the control knob counterclockwise will decrease the ozone output down to 0% while turning the knob clockwise will increase the ozone output up to 100%. The ozone output level is indicated by the "Ozone Output" LED(s) on the control panel of the ozone generator, see Start-Up and Calibration Procedures, Figure 7-1A for LED function and Appendix-Section A for LED location.
2. **Remote 4-20mA Control:** The ozone generator will automatically sense the 4-20mA input signal and override the setting of the manual ozone output control. Based on the 4-20mA signal, ozone output will increase or decrease, 4mA = 0% ozone output, 20mA = 100% ozone output. The "Ozone Output" is indicated by the LED(s) on the control panel of the ozone generator, see Start-Up and Calibration Procedures, Figure 7-1A for LED function and Appendix-Section A for LED location. **Note: If the remote 4-20mA signal fails or is missing, the system will default to the manual ozone output setting. Check and adjust the manual ozone output control knob to avoid over-ozonation.** Following the directions in the manual of the 4-20mA control device, wire the negative (-) input signal to the Purple wire of the ozone generator and the positive (+) input signal to the Orange wire of the ozone generator.

Electrical Hook-Up Box Diagram

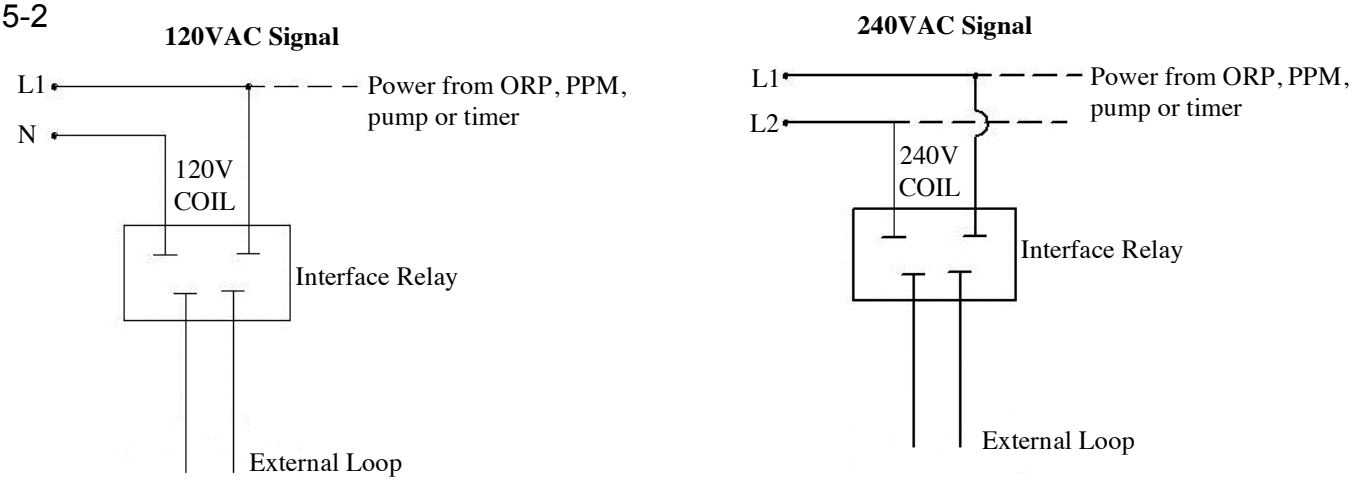
Figure 5-1





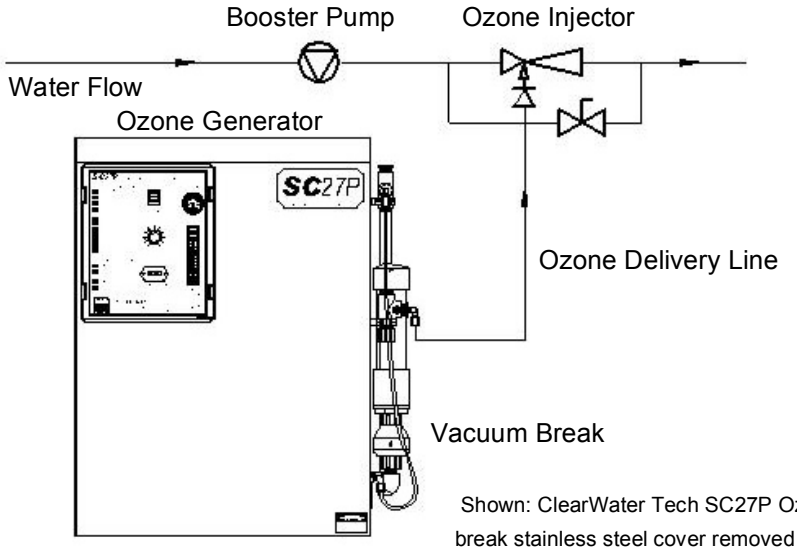
External Loop Electrical Interface

Figure 5-2



This section outlines the steps required to complete the ozone system pneumatic hook-ups. The system components include the air preparation system, ozone generator, vacuum break, and ozone injector manifold (see Figure 6-1). The air preparation system provides the ozone generator with a source of dry, oil-free oxygen-enriched air (90% +/- 3% oxygen purity at -100˚F dew point). The air is drawn from the ozone generator (where ozone is produced from the oxygen in the air stream) and through the vacuum break by the suction created at the ozone injector manifold.

Figure 6-1



Shown: ClearWater Tech SC27P Ozone System. Vacuum break stainless steel cover removed for clarity.

Vacuum break-to-injector manifold

The SC27P ozone generator incorporates a ClearWater Tech vacuum break, which provides a positive atmospheric "break" between the ozone injector manifold and the SC27P system, preventing water from flowing back into the ozone generator should the venturi check valve fail. If the check valve at the venturi begins to leak or fails completely, vacuum is interrupted and water will flow toward the ozone generator. With the incorporated vacuum break the water will flow down the riser tube (away from the ozone generator) and out to drain, protecting the SC27P from potential water damage. All pneumatic connections have been made between the ozone generation components of the SC27P and the vacuum break. The only pneumatic field connections required are between the vacuum break ozone outlet fitting and the injector manifold. Follow the steps outlined below for this procedure, see Figure 6-2.

Step 1: Remove the vacuum break's stainless steel cover located on the right hand side of the SC27P.

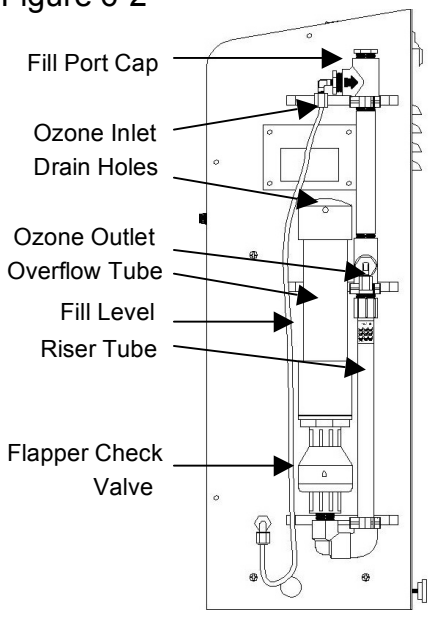
Step 2: Remove the Fill Port Cap and fill the Riser Tube with clean water (no particulate matter) to the fill level line of the overflow tube.

Step 3: Re-install the Fill Port Cap, hand tight. **Note: Do not over tighten as damage to PVC fittings may occur.**

Step 4: Connect one end of a suitable length of Teflon® delivery line to the vacuum breaks' ozone outlet. The other end of the Teflon® delivery line will be attached to the fitting threaded into the top of the check valve assembly located on the injector manifold, do not attach this line until directed in Chapter 7 of the "Start-up and Calibration Procedures".

Vacuum Break Detail

Figure 6-2



START-UP & CALIBRATION CHAPTER 7

The previous sections of this manual have involved comparatively static procedures – making electrical and pneumatic connections, fitting pipe, etc. This section involves the dynamic process of starting up and balancing the components of the ozone system, including initiating water flow, making air and water flow adjustments, etc.

Maximum performance and reliability is achieved when the prescribed air flow is maintained at the ozone generator while the system is operating under pressure. Air from the air preparation system is flowing *through* the ozone reaction chambers under pressure, and *from* the ozone generator under a slight vacuum (created by the ozone injector manifold). The change from pressure to vacuum occurs after the stainless steel ozone outlet needle valve on the ozone generator.

SC27P Ozone Generation System and Injection Manifold

Warning: ***Disconnect the External Loop dry contact from the ozone generator while performing all start-up procedures. Failure to do so may result in ozone escaping to atmosphere.***

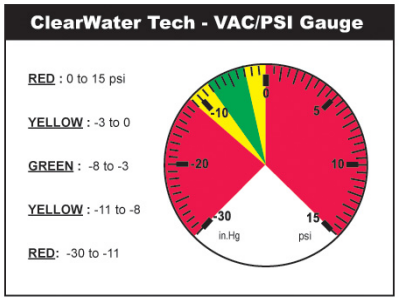
Step 1: Make sure all isolation valves in the ozone water system are open (Figures 4-1 or 4-2 show recommended isolation valve locations).

Step 2: Apply main power to the SC27P. Switch the main power switch to the "ON" position. At this time the SC27P will be powered up, the air preparation system and cooling fans should be "ON" and power should be present to the External Contactor output signal. If the External Contactor output signal is interlocked to a booster pump, the booster pump should be "ON". **Note: Ozone will *not* be produced until the "External Loop" is in place and at least 9 PSI present at the PSI gauge located on the control panel.**

Step 3: Start-up hydraulics. Allow the water in the system to reach hydraulic equilibrium (contact vessel full, off-gas vent operating, etc.) and observe for plumbing leaks. **Note: Water flow *must* be established through the main water pump and the ozone system booster pump (if so equipped).**

Step 4: Close the ball valve on the injector manifold about half way.

Step 5: Using your thumb, check for the presence of vacuum (suction) at the ozone injection manifold check valve assembly or use a ClearWater Tech vacuum test assembly to check vacuum at the injector port. If no suction is present, continue to close the ball valve on the injector manifold until vacuum is detected. If using the vacuum test assembly, check the VAC/PSI gauge for vacuum. If the needle is in the red zone on the pressure (PSI) side of the gauge, gradually close the ball valve on the injector manifold until the needle moves into the green zone. If the needle is in the red zone on the vacuum (in.Hg) side of the gauge, gradually open the ball valve on the injector manifold until the needle moves into the green zone. While vacuum is in the green zone you must be able to achieve proper SCFH (Standard Cubic Feet per Hour) of air flow (see the "Pneumatic Operating Parameters" chart for venturi SCFH required, Figure 7-2).



Step 6: The air preparation system air flow must be set to "atmospheric pressure" prior to final start-up of the SC27P.

Step 1: Check to make sure the compressor of the air preparation system is operating.

Step 2: Check the system PSI gauge for pressure, located on the control panel. If pressure is registered on the PSI gauge open the stainless steel needle valve by turn it counter clockwise so that no pressure is registered on the gauge. See Appendix-Section A for PSI gauge and stainless steel needle valve locations.

Step 3: Using the air flow gauge adjustment valve on the control panel, adjust the SCFH air flow according to the "Air prep system air flow" specifications outlined in Figure 7-2.

Step 7: Connect the Teflon® ozone delivery line from the vacuum break to the ozone inlet fitting located at the ozone injection manifold check valve assembly.

Step 8: Adjust the stainless steel needle valve located at the bottom the ozone generator (see Appendix-Section A) clock-wise, adjusting the system backpressure to 10 PSI. Check the PSI gauge on the control panel, which measures this backpressure. If there is insufficient backpressure the needle valve may be closed slightly; similarly, if there is too much backpressure the valve may be opened slightly**.** Due to the pressure switch installed, the PSI gauge must achieve 9 PSI before ozone will begin production.

Step 9: By setting the air preparation SCFH (step 6) and system backpressure PSI (step 8), the air flow gauge on the control panel will read in CFH rather than SCFH. At this point the air flow meter becomes passive and should

read in the range indicated on the "Ozone Generator Air Flow" line of the "Pneumatic Operating Parameters" chart, Figure 7-2. **Note: When the system is under normal operation, the "Air Prep System Air Flow" set point will drop from the initial setting due to the system being under backpressure. DO *NOT* RE-ADJUST THE AIR FLOW GAUGE ADJUSTMENT VALVE.**

Step 10: Perform a final check of all air connections from the SC27P to the ozone injector manifold. Repair leaks as required. Check all system water connections, including the ozone injector manifold, vacuum break and contact vessel. Repair leaks as required. **Note: The check valve at the ozone injector manifold may make a humming noise. This is normal.**

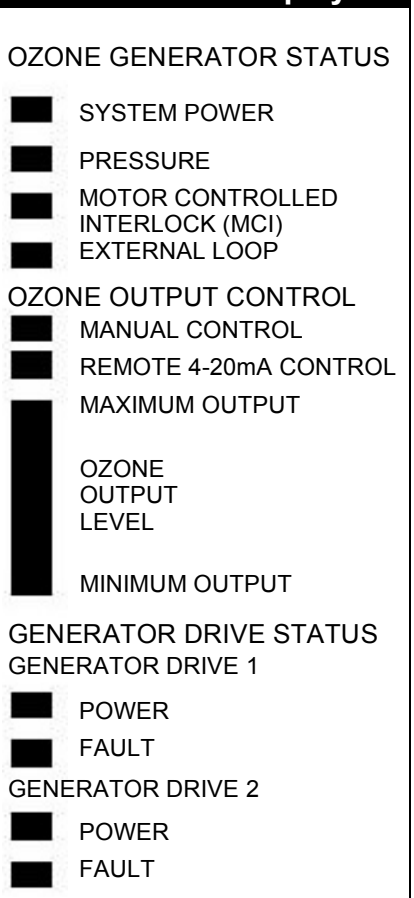
Step 11: Reconnect the External Loop connector to the ozone generator. **Note: The Ozone LED(s) will not illuminate and ozone will not be produced until the External Loop has been replaced.**

Step 12: Observe indicating LED(s), on the control panel of the SC27P and adjust the manual ozone output control knob to desired level setting. See Figure 7-1 A-C for proper LED function and Appendix-Section A for location of the LED's.

SC27P – Control Panel LED Function

Figure 7-1A

LED	Function	SC27P LED Display
System Power	Main Power is "ON" to the SC27P, when LED is Illuminated	
Pressure	The SC27P has sufficient pressure, when LED is Illuminated	
Motor Control Interlock (MCI)	The MCI is energized, when LED is illuminated	
External Loop	The External Loop has continuity through it when the LED is *not* illuminated, which indicates ozone is being produced. The External Loop *does not* have continuity, when the LED is illuminated, which indicates no ozone production.	
Manual Control	Ozone output is being controlled by the Manual Ozone Output Control, when LED is illuminated	
Remote 4-20mA Control	Ozone output is being controlled by an External 4-20mA Control signal, when LED is illuminated	
Ozone Output Level	The ten LED's represent 0-100%, minimum to maximum ozone output. Each LED is equal to 10% output. These LED's can be adjusted with the manual ozone output control knob located on the control panel of the SC27P or automatically with a remote 4-20mA control signal.	
Drive 1 and Drive 2 - Power	Power is being sent to the high voltage Drive board, when the LED is illuminated	
Drive 1 and Drive 2 - Fault	When illuminated, this LED indicates that there is a fault with the drive module or the Ozone Reaction Chamber. If this LED is illuminated, refer to the Troubleshooting Guide. **Notes: Upon startup, the fault LED will remain illuminated for 30 seconds before ozone is produced and the ozone output LED's will not be illuminated. If the drive module goes to a fault condition, the drive board will restart every 30 seconds. If the fault is not remedied the drive module will continue to go into a fault mode. When the drive module is in fault mode ozone will not be generated.**	



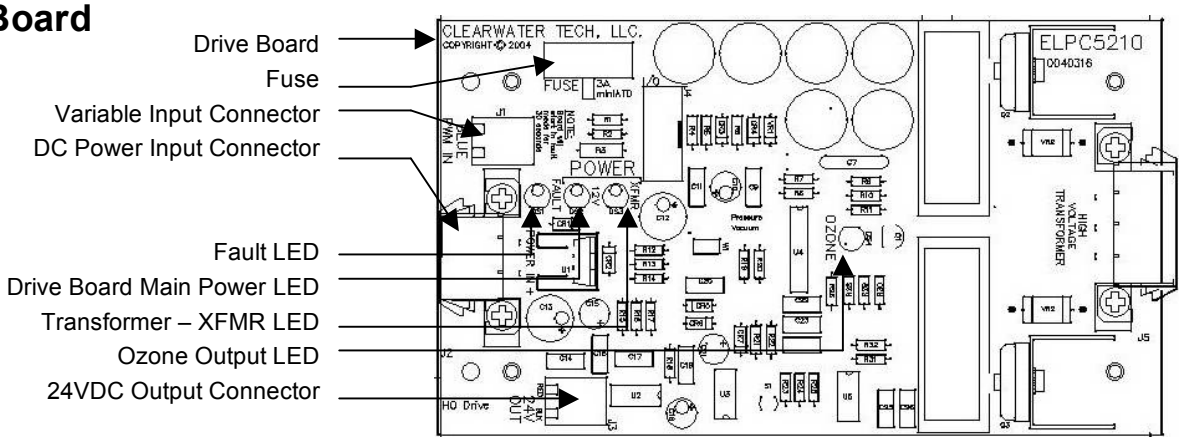
SC27P - Ozone Generator Drive Board LED Function

Figure 7-1B

LED	Function
12V MAIN POWER	When illuminated, this "Green" LED indicates that main power is supplied to the drive module up to the "on board" fuse of the drive board.
XFMR POWER	When illuminated, this "Green" LED indicates that 48V Buss power is available to the drive module transformer (XFMR) from the "on board" fuse to the drive transformer.
OZONE OUTPUT	The "Amber" ozone output LED will illuminate when ozone is being generated. The LED will also pulse as the output increases or decreases with either the Manual Ozone Output Control or from a Remote 4-20mA signal.
FAULT	When illuminated, this "Red" LED indicates that there is a fault with the drive module or the Ozone Reaction Chamber. If this LED is illuminated, refer to the Troubleshooting Guide. **Notes: Upon startup, the fault LED will remain illuminated for 30 seconds before ozone is produced. If the drive module goes to a fault condition, the drive board will restart every 30 seconds. If the fault is not remedied the drive module will continue to go into a fault mode. When the drive module is in fault mode ozone will not be generated.**

SC27P Drive Board

Figure 7-1C



Vacuum Break

Check the water level in the vacuum break, making sure it is *above* the flapper valve (see Figure 6-2). If water is not pressing downward on the flapper valve it will open, causing a loss of vacuum. A loss of vacuum means ozone cannot flow from the vacuum break, which in turn can cause an ozone leak. **Note: If the vacuum break must be refilled with water disconnect the External Loop from the SC27P and shut down the system and follow the steps outline in Chapter 6 "Installation Procedures – Pneumatic." Then re-start the system by following the steps outlined in Chapter 7 "Start-up and Calibration Procedures."**

Pneumatic Operating Parameters

Figure 7-2

SC27P	Operating Range	Optimum
Air prep System air flow *	8 to 10 scfh	10 scfh
Ozone generator air flow (gauge – front control panel)	4 to 6 cfh	6 cfh
PSI gauge (gauge – front control panel)	9 to 12 psi	10 psi
Injector manifold air flow	8 to 12 scfh	10 scfh
Injector manifold injector	-3 to -8 in. Hg.	-5 in. Hg.

*** Be sure that the SCFH flow rate is regulated to no more than 10 SCFH with the air flow gauge adjustment valve.**

MAINTENANCE CHAPTER 8

Maintenance of the ozone system is critical to its longevity and operating efficiency. While all system components are built to provide years of reliable service with minimum maintenance, following the procedures outlined below is strongly recommended.

All maintenance procedures have been segmented by interval: daily, monthly, semi-annual and annual. Daily procedures involve quick, visual checks for changes in normal operating conditions. Monthly, semi-annual and annual procedures include cleaning and/or replacement of certain critical parts.

NOTES:

- **The ozone generator warranty states that it "does not extend to any product or part which has been damaged or rendered defective as a result of use of parts not sold by ClearWater Tech, or service or unit modification not authorized by ClearWater Tech" Please contact your ClearWater Tech dealer if you have any questions about any maintenance procedure *before* you begin that procedure.**

- **CAUTION: Observe all common safety practices and review the "Safety Warnings and Instructions" in Chapter 2 before attempting any maintenance procedure that requires the use of tools and/or shutting down the ozone system.**

Daily Procedures

Ozone Generator

- Indicator Lights: Check all indicating LED's on the control panel of the SC27P. See Appendix-Section A for location and See Figure 7-1A for Control Panel LED function. See Troubleshooting Guide as required.
- Air Flow: Check the air flow meter on the SC27P control panel. Make sure air flow is within the CFH (cubic feet per hour) range shown on the "Ozone generator air flow" line of the "Pneumatic Operating Parameters" (see Figure 7-2). Adjust if necessary by following steps outlined in the "Start-Up & Calibration" section.
- Pressure: Check the PSI gauge located on the ozone generator cabinet door. Make sure pressure is within the range shown on the "PSI Gauge" line of the "Pneumatic Operating Parameters" chart (see Figure 7-2). Adjust if necessary by following steps outlined in the "Start-Up & Calibration" section.

Vacuum Break

- Water Level: Check the water level in the vacuum break. Make sure it is *above* the flapper valve in the overflow tube. If the vacuum break must be refilled with water disconnect the External Loop from the SC27P and shut down the system and follow the steps outline in Chapter 6 " Installation Procedures – Pneumatic." Then re-start the system by following the steps outlined in Chapter 7 "Start-up and Calibration Procedures."

Injection Manifold

- Check Valve: Inspect the Teflon® ozone delivery line that runs between the vacuum break and the check valve assembly on the suction port of the ozone injector manifold. If water is observed in the delivery line near the check valve assembly, the check valve has failed. See Troubleshooting Guide.

Monthly Procedures

Ozone Generator

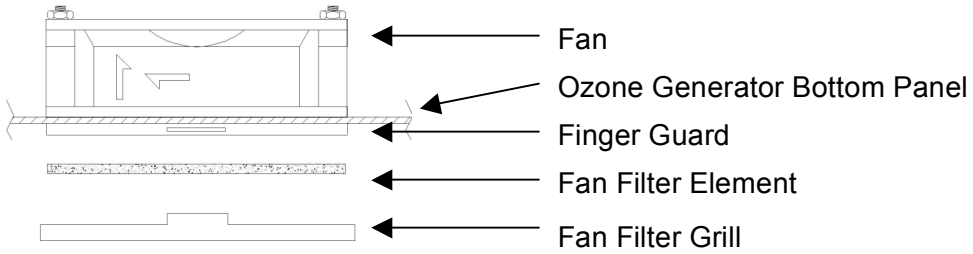
- Cooling Fan Operation: Check to make sure the two cooling fans (mounted on the bottom panel of the SC27P.) and the two exhaust fans (located behind the air preparation compressor) are operating. If not, refer to the Troubleshooting Guide.
- Cooling Fan Filters: Check the cooling fan filter elements (mounted on the bottom of the SC27P) and clean as required. Operating conditions in the equipment area will dictate the frequency required for this procedure. Remove the filter element and clean with soap and water, drying them completely before re-installing (see Figure 8-1). **Note: Fan filter stainless steel cover must be removed to access fan filters.**

Booster Pump(s)

- Strainer Baskets: Check and clean the strainer basket in the booster pump(s) as required (if so equipped).

Ozone Generator Cooling Fan Assembly

Figure 8-1



System Shutdown Procedures

CAUTION: The ozone generator operates at high voltage. Follow these steps carefully before performing any semi-annual or annual maintenance procedures.

Step 1: Turn off power to any peripheral system hydraulic components.

Step 2: Turn the Main Power switch on the SC27P to the "OFF" position. The Main Power LED's on the control panel should not be illuminated.

Step 3: Disconnect the power to the ozone system either at the service disconnect box (if so equipped) or main circuit breaker.

Semi-Annual Procedures

CAUTION: Follow system shutdown procedures (outlined above) before performing any of the following steps.

Air Preparation System

- Air Inlet Filter: Replace the air compressor inlet filter. See Appendix-Section A for location. **Note: Manufacturers' recommended replacement interval is 4,000 hours of operation. Operating conditions in the equipment area will dictate the required frequency of this procedure**.

Annual Procedures

CAUTION: Follow system shutdown procedures before performing any of the following steps.

Air Preparation System

- Compressor: Following the procedures outlined in the compressor rebuild kit, rebuild the two compressor heads. See Appendix-Section A for location. **Note: Manufacturers' recommended interval is 5,000 to 12,000 hours of operation. Compressor performance and/or operating conditions in the equipment area will dictate the required frequency of this procedure.**

Ozone Generator

- Cooling Fan Filters: Clean or replace the cooling fan filter elements as required. **Note: Fan filter stainless steel cover must be removed to access fan filters.**
- Depressurization Valve: Rebuild the depressurization valve, see Appendix-Section A for location.
- Check Valve: Replace check valve located behind the system control panel, see Appendix-Section A for location.
- Reaction Chambers: Remove and disassemble one reaction chamber according to the steps outlined below (see Figure 8-2). Check the chamber interior and dielectric tube for oil, dirt or moisture. **Note: CWT pressurized reaction chambers are anodized blue.**

Removal and Disassembly

Note: Disassembly and service of the reaction chamber is a technical, delicate and critical procedure. Please consult your ClearWater Tech dealer before attempting this procedure.

Step 1: Make sure all power to the ozone generator has been disconnected according to the "System Shutdown Procedures" outlined above.

Step 2: Unplug the electrical connections from the drive module.

Step 3: Disconnect tubing connections from the fittings on both ends of the reaction chamber.

Step 4: Remove reaction chamber from ozone generator.

Step 5: Disconnect the high voltage lead from the drive module.

Step 6: Remove retaining screws from the two end caps (4 each).

Step 7: Using a gentle back-and-forth twisting motion, remove the non-high voltage end cap (the one *without* the white power lead attached) from the heat sink/cathode assembly. **Note: The stainless steel clamp must not be removed.**

Step 8: Remove the high voltage end cap and dielectric from the heat sink/cathode assembly. **Note: The stainless steel clamp must not be removed.**

Step 9: With contact brush attached, remove the brush adapter nut from the high voltage end cap.

Step 10: Inspect the dielectric, end caps and cathode for breakage, corrosion or debris. Clean and/or replace parts as necessary. If cleaning and/or parts replacement is not required, re-assemble the reaction chamber per the instructions below.

Assembly and Re-installation

Step 1: Make sure the glass dielectric is clean (free of dust, dirt, grease, oils, etc.).

Step 2: Prepare the end caps for re-assembly by replacing the O-rings. Thread the hex brush adapter nut, with contact brush attached, onto the end of the high voltage end cap (cap with the white power lead attached) center screw.

Step 3: Using a gentle twisting motion, press the *non*-high voltage end cap onto the heat sink/cathode assembly until flush with the heat sink cooling fins. **Note: See Figure 8-2 for correct orientation of end cap.**

Step 4: Slide the four end cap retaining screws through the holes in the non-high voltage end cap, aligning them with the heat sink screw bosses. Thread screws into screw bosses until heads are snug against the end cap.

Step 5: Roll the high voltage anode (foil-like material) lengthwise, preserving the *longer* dimension. Insert the rolled anode into the dielectric. Center the anode in the dielectric (approximately 1/2" from either end of the glass), making sure it is rolled squarely.

Step 6: Slide the dielectric into the heat sink/cathode assembly. Seat the dielectric into the O-rings of the non-high voltage end cap by applying pressure with a gentle twisting motion. (There must not be any dirt, debris, oils or fingerprints on the dielectric upon re-installation).

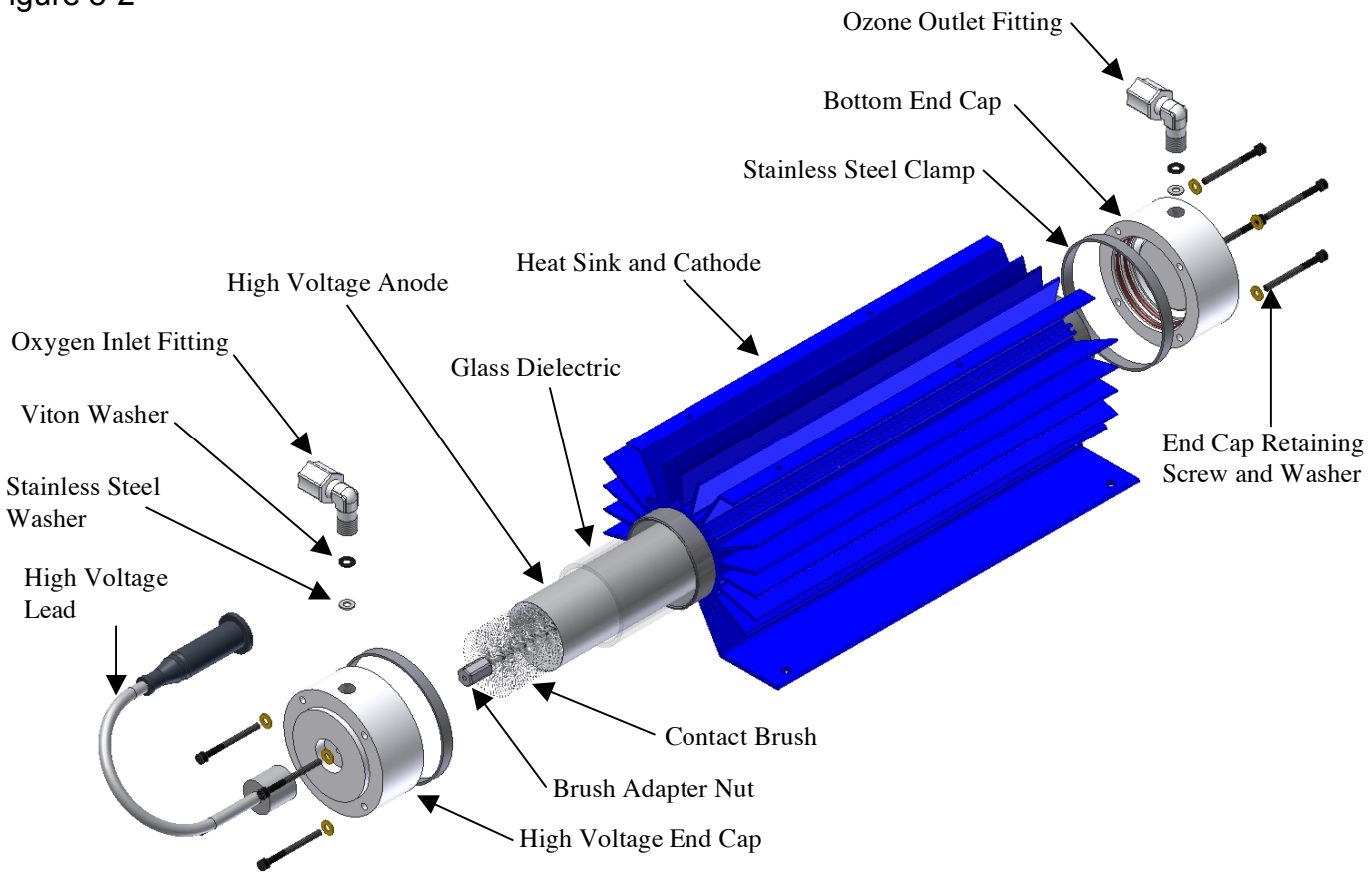
Step 7: *Slowly* insert the high voltage end cap assembly into the dielectric. **Note: Do not bend center wire of the brush during this procedure.** It is normal for the *bristles* to bend. Using a gentle twisting motion, press the high voltage end cap onto the heat sink/cathode assembly until flush with the heat sink cooling fins.

Step 8: Slide the four end cap retaining screws through the holes in the end cap, aligning them with the heat sink screw bosses. Thread screws into screw bosses until heads are snug against the end cap.

Step 9: Re-install complete reaction chamber assembly into the ozone generator by following the "Removal and Disassembly" instructions in reverse order, from Step 6 to Step 2. Follow steps outlined in Chapter 7, "Start-Up and Calibration," to re-start the ozone system.

2" Pressurized Reaction Chamber - Exploded View

Figure 8-2



Vacuum Break

- Cleaning: Disconnect ozone delivery lines. Remove the vacuum break from mounting clamps. Disconnect the overflow tube from flapper valve, open flapper and clean the seat with a soft clothe. Remove riser tube threaded fitting and flush riser tube with water. Re-assemble and re-install vacuum break, making sure to add water to correct level (see Figure 6-2).

Injector Manifold

- Check Valve: Replace the check valve located at the ozone injection manifold. **Note: Because the system is in the shutdown mode, no vacuum is present at the injector. Therefore, it is normal for some water to be flowing from the injector during this procedure.**

Contact Vessel

- Cleaning: Contact Column only. Inspect the diffuser slots at the top of the contact column riser tube. If they are clear, no further maintenance is required. If the slots are fouled, disassemble the column and clean as required, following the steps outlined below (see Figure 4-4).

Step 1: Make sure the isolation valves before and after the contact column are closed.
Step 2: Disconnect the vent line from the top of the contact column.
Step 3: Remove the bolts in the 6" base flange.
Step 4: Remove the column, lifting it over the interior riser tube.
Step 5: Remove and clean the diffuser.
Step 6: Inspect the flange gasket and replace if necessary.
Step 7: Reassemble the contact column and attach vent lines.

TROUBLE SHOOTING CHAPTER 9

AIR PREPARATION

PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
Compressor not operating	- No power to SC27P System	- Check main power to system - MCI terminal does not have a voltage signal "Installation Procedure - Electrical"
	- Incorrect wiring	- See "Installation Procedures - Electrical"
	- Compressor not functioning	- Rebuild or replace as required
Low air flow or no air flow / Low Pressure or no pressure	- Flow meter out of adjustment	- Adjust air flow See "Start-Up & Calibration"
	- Fouled compressor inlet filter	- Replace inlet filter
	- Compressor not functioning	- Rebuild or replace as required
	- Air leak	- Check & tighten fittings
	- Depressurization Valve failed	- Rebuild or replace as required
Compressor pressure relief valve making noise	- Excessive backpressure between compressor and sieve bed (ATF)	- Inspect check valves for proper operation and replace as required.
	- Pinched tubing	- Replace tubing
	- Compressor not functioning	- Rebuild or replace as required
	- Sieve bed (ATF) not functioning	- Replace as required

OZONE GENERATOR

PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
"System Power" LED is not illuminated or System is not "ON"	- No power to unit	- Check circuit breakers
	- Switch is in the "OFF" position	- Turn switch to the "ON" position
	- Incorrect wiring	- See "Installation Procedures - Electrical"
	- Blown fuse	- Replace fuse
Circuit breaker trips	- Incorrect wiring	- See "Installation Procedures - Electrical"
	- Circuit breaker amperage does not match draw	- Replace with correct circuit breaker
	- Unit flooded with water	- Assess damage, correct cause and rebuild as required
Receive an electrical shock upon touching the unit	- Incorrect wiring	- See "Installation Procedures - Electrical"
	- Unit not grounded	- Ground unit according to local codes
	- Unit flooded with water	- Assess damage, correct cause and rebuild as required
Motor Controlled Interlock (MCI) LED is not illuminated	- MCI terminal does not have voltage	- Apply voltage to MCI terminal, see "Installation Procedures – Electrical"
"Pressure" LED is not illuminated	- Insufficient pressure in the SC27P	- Adjust air flow and pressure, see "Start-Up & Calibration" procedures - See Troubleshooting, Low Pressure or no pressure
"External Loop" LED is illuminated	- The external loop does not have continuity	- See Figure 7-1A for function
"Manual Control" LED is not illuminated	- The system is being controlled by the a Remote 4-20mA Control signal	- No action taken
"Remote 4-20mA Control" LED is not illuminated	- The system is being controlled by the a Manual Ozone Output Control setting	- No action taken
'Ozone Output' LED(s) are not illuminated	- The manual ozone output adjustment is set to 0% output	- See "Installation Procedures - Electrical"
	- Remote 4-20mA controller is sending a 4mA signal, which limits output 0%	- No solution required, controller will adjust LED's automatically

OZONE GENERATOR – continued

PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
Ozone Output LED's are not responding to the remote 4-20mA control signal	- The remote 4-20mA control signal is not sensed by the 4-20mA control circuit	- Check for loose wires or connections - See "Installation Procedures – Electrical" - Check 4-20mA controller operation
Ozone Generator "Drive 1" and/or "Drive 2" LED(s) are not illuminated	- No power to drive module from power supply	- Check main power to unit - Test voltage from power supply to drive module (see "Appendix – Drive Module Input Voltages") - Check for loose wires or connectors
	- If drive module "Main Power" LED(s) not illuminated, the "XFMR Power" LED will not illuminate	- Test voltage from power supply to drive module (see "Appendix – Drive Module Input Voltages")
	- Blown drive module "on board" fuse	- Replace "on board" fuse
	- Drive board is in "Fault" mode	- See Troubleshooting, "Fault" LED
Ozone Generator "Fault 1" and/or "Fault 2" LED(s) illuminated and Drive Module - "Fault" LED(s) illuminated	- Upon start-up the "Fault" LED will be "ON" for 30 seconds, this is normal	- Wait for the start-up to finish
	- Loose wire harness connection from the drive board to the drive transformer	- Check all wires and connectors
	- Failed drive board	- Replace drive board
	- Failed drive transformer	- Replace drive transformer
	- Broken dielectric	- Replace dielectric
	- Water in ozone reaction chamber	- Clean dielectric and replace O-rings
	- Excessive dirt or debris in the ozone reaction chamber	- Clean dielectric and replace O-rings
	- Loose or disconnected High Voltage lead to transformer	- Attach High Voltage lead to transformer
	- High temp limit	- If the temperature with in the SC27P system is greater than 150˚ F; the drive modules will go to Fault mode.
Drive Module - Main Power "Green" LED(s) not illuminated	- No power to drive module from power supply	- Check main power to unit - Test voltage from power supply to drive module (see 'Appendix' – Drive Module Input Voltages) - Check for loose wires or connectors
Drive Module - Transformer (XFMR) Power, "Green" LED(s) not illuminated	- If drive module "Main Power" LED(s) not illuminated, the "XFMR Power" LED will not illuminate	- Test voltage from power supply to drive module (see "Appendix–Drive Module Input Voltages")
	- Blown drive module "on board" fuse	- Replace "on board" fuse
	- Drive board is in "Fault" mode	- See Troubleshooting, "Fault" LED
Drive Module - Ozone Output, "Amber" LED(s) not illuminated	- If the Transformer (XFMR) Power LED is not illuminated, the "Ozone Output" LED will not illuminate	- Check all wires and connectors
	- The Manual Ozone Output is turned down to 0%	- Turning the Manual Ozone Output knob clockwise will increase ozone output percentage and the "Ozone Output" LED will begin to illuminate (see "Installation Procedures – Electrical")
	- Drive board is in "Fault" mode	- See Troubleshooting, "Fault" LED
Drive Module - "Ozone Output" LED(s) not responding to the remote 4-20mA control signal	- The remote 4-20mA control signal is not sensed by the 4-20mA control board	- Check for loose wires or connections - Check electrical installation procedures of the remote 4-20mA controller

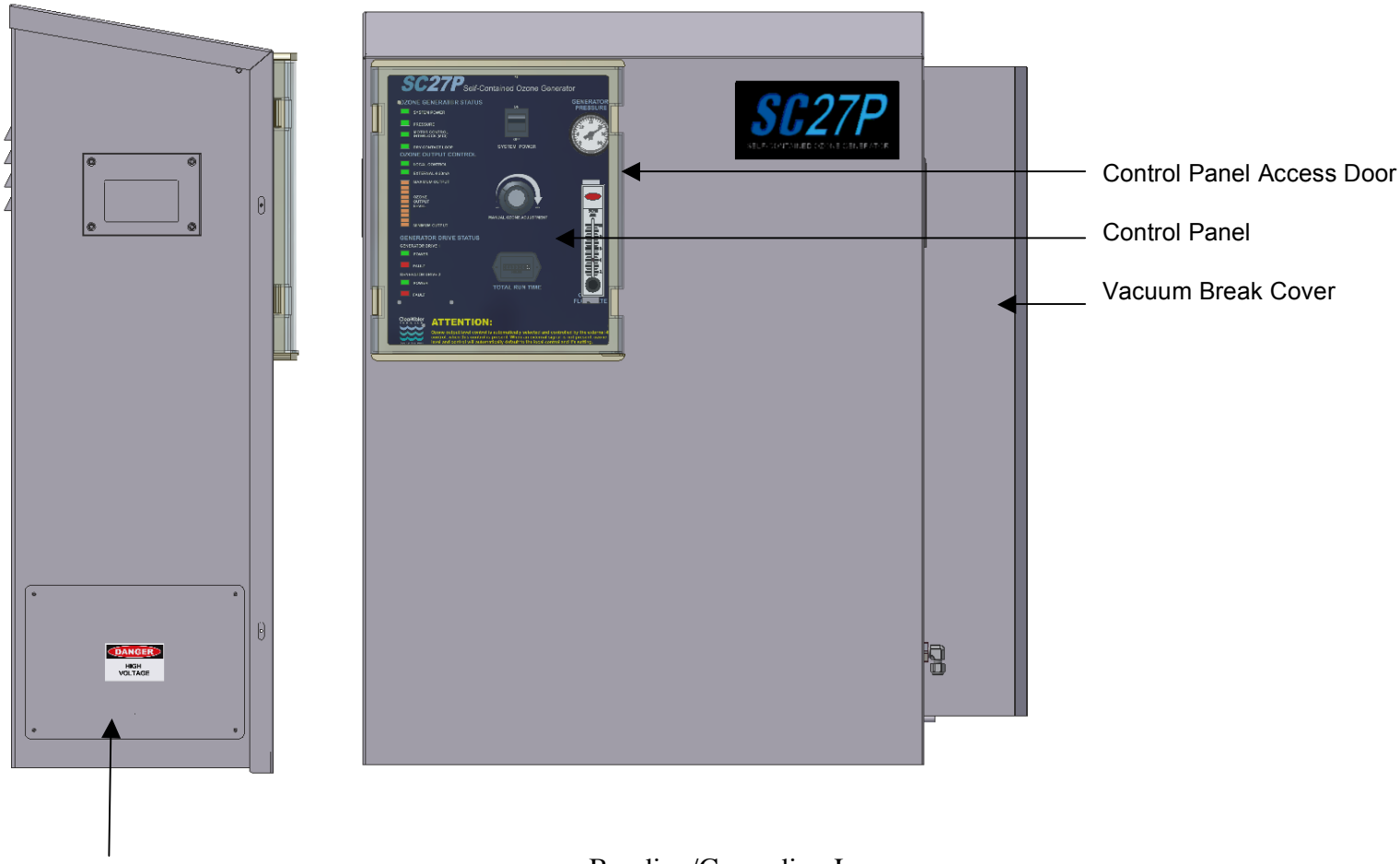
OZONE GENERATOR – continued

PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
Cooling Fan(s) or exhaust fan(s) not operating	- Fan obstructed - Fan inoperable	- Remove obstruction - Replace fan
Unit flooded with water	- Vacuum break check valve failed	- Clean or replace check valve - Assess damage, repair as required
Ozone smell detected near or around ozone generator	- Insufficient vacuum at venturi - Loose internal fittings - Defective O-ring seals in reaction chamber(s) - Defective dielectrics	- Adjust injector See "Start- Up & Calibration" - Check all fittings, tighten as needed - Check & replace as required - Check & replace as required

OZONE INJECTION/CONTACTING

PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
Water backflow past injector check valve	- Defective check valve	- Replace check valve
Water bubbling in vacuum break	- No vacuum - Debris on seat of vacuum break flapper valve	- See "Start-Up & Calibration" - Clean seat of flapper See "Maintenance Procedures-Annual"
Low vacuum at injector	- Hydraulics/Pneumatics out of adjustment - Defective check valve - Hydraulic back pressure - Defective solenoid valve - No water in vacuum break - Booster pump not functioning properly	- See "Start-Up & Calibration" - Replace check valve - Back wash filter (if so equipped) - Check for obstruction in venturi - Rebuild or replace as required - Fill vacuum break with water See "Start-Up and Calibration" - Check booster pump (contact dealer)
High Vacuum at injector	- Hydraulics/Pneumatics out of adjustment - Change in hydraulics - excessive water flow through ozone injector	- See "Start-Up & Calibration" - See "Start-Up & Calibration"
Ozone smell detected around vacuum break or ozone injector	- No vacuum - Loose fittings - Broken fittings	- See "Start-Up & Calibration" - Tighten all fittings - Replace fittings

Specifications

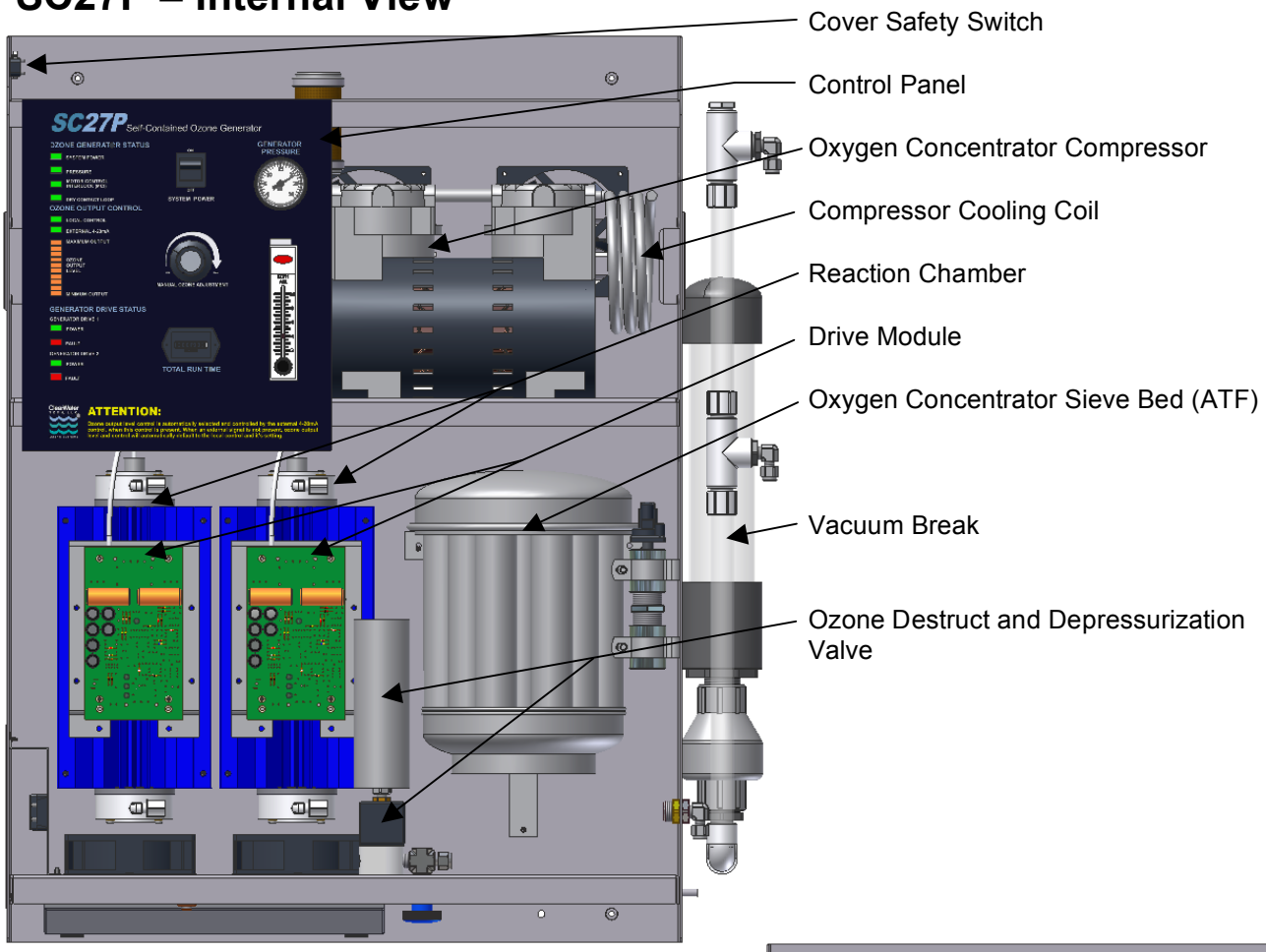


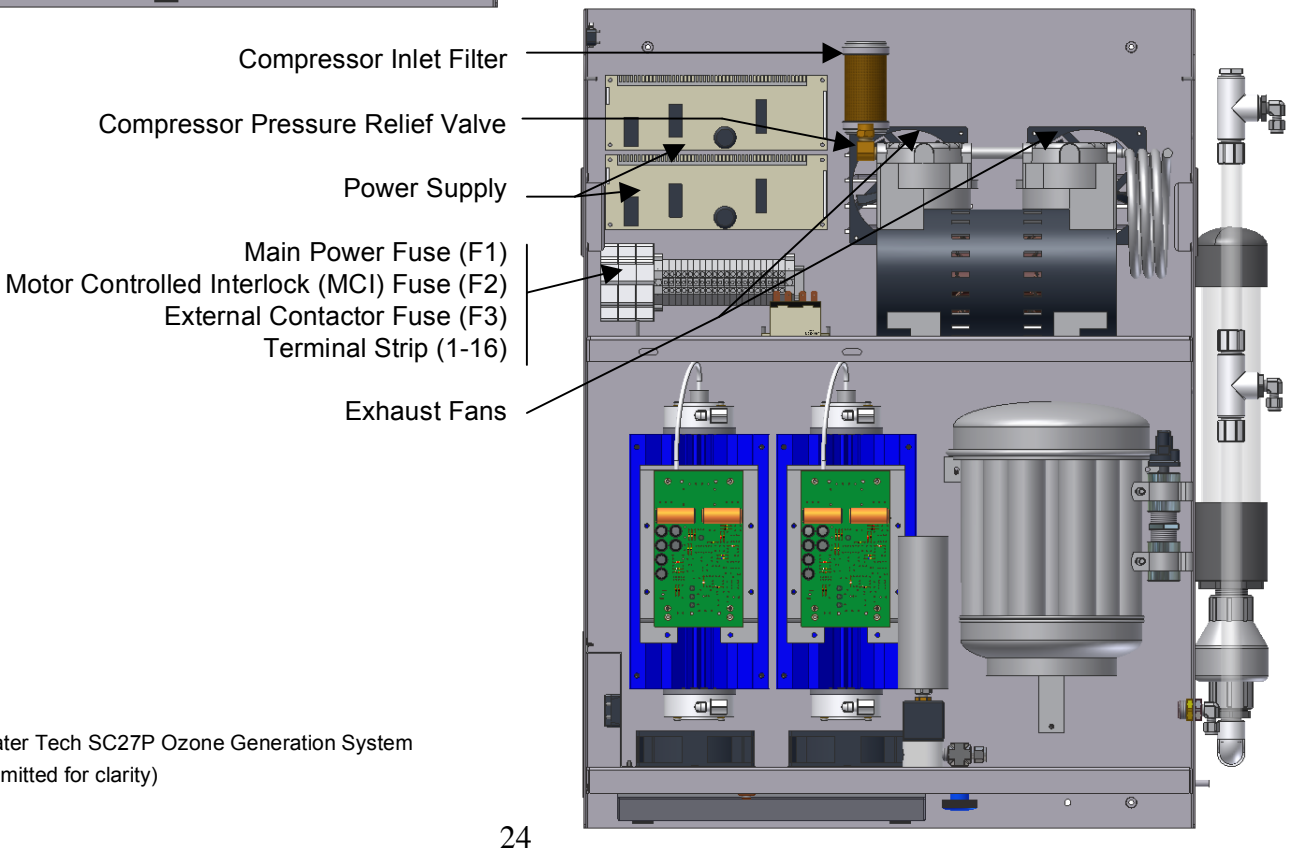
Shown: SC27P Bottom Panel with out cooling fan cover

OZONE GENERATOR	SPECIFICATIONS	OZONE OUTPUT/SCFH
SC27P	34” h x 29” w x 13” d, 139 lbs	27g/h, 6% @ 12 scfh, 10PSI
Mounting Bracket Hole Measurement	16” w On-Center	

Section A – Specifications

SC27P – Internal View

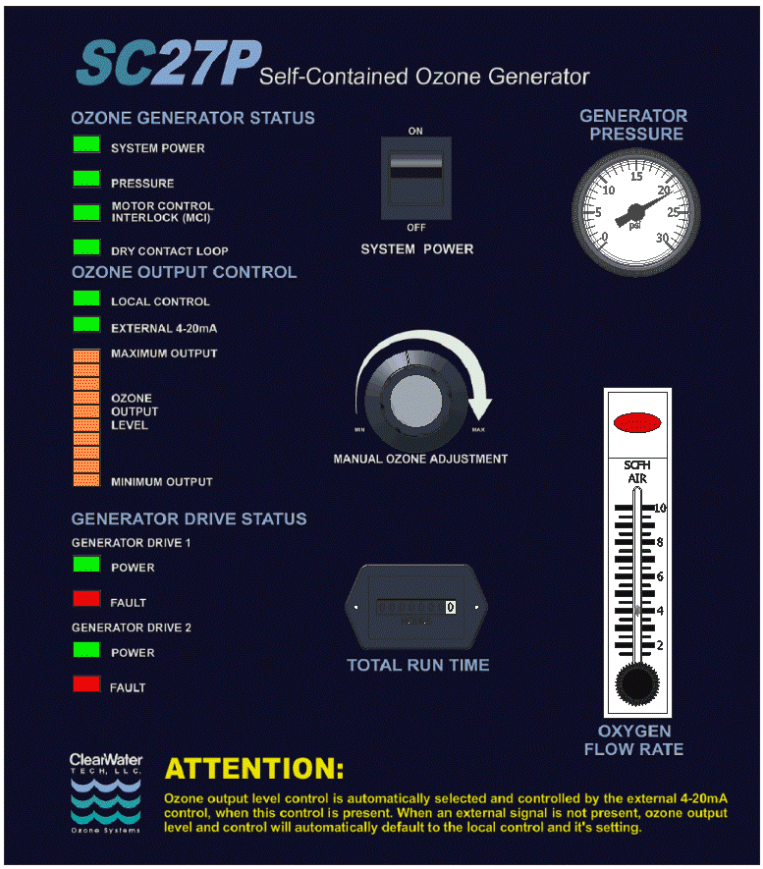




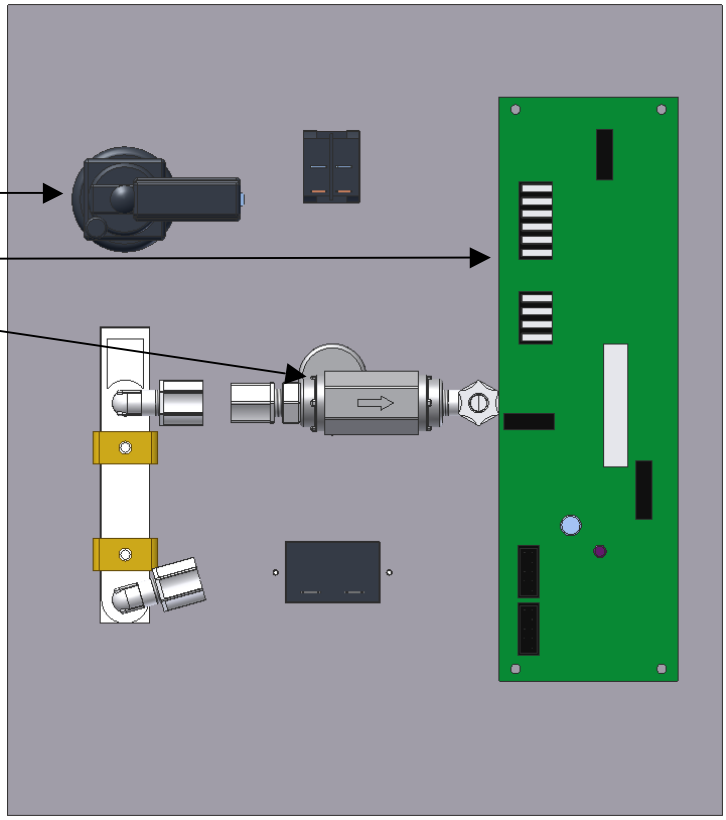
Shown: ClearWater Tech SC27P Ozone Generation System
(Wire harness omitted for clarity)

Section A – Specifications

SC27P – Control Panel



Shown: ClearWater Tech SC27P Control Panel Front View



Shown: ClearWater Tech SC27P Control Panel Back View

APPENDIX - Section B

Parts List

Ozone Generator

Description	PART #
Compressor Inlet Filter	OXS350
Compressor Rebuild Kit	OXS356
Pressure Relief Valve	OXS361
Non-High Voltage End Cap	Contact Dealer
High Voltage End Cap	Contact Dealer
O-ring Set	ORS40
Drive Module – Complete	DRM13
Drive Module Transformer	HVT200
Drive Module Board	ELPC5210
Power Supply – 24VDC 150w	PSR820
Cooling Fan and Exhaust Fan – 120VAC 60Hz	FA41
Cooling Fan and Exhaust Fan - 240VAC 50/60Hz	FA42
Cooling Fan Filter	FA40
Display Board	CCA1064
Pressure Switch	PS20
Check Valve – ¼" fpt X ¼" fpt	CKV21
Depressurization Valve rebuild kit	SV1500
Fuse, Bussmann FNM-10 – 10 amp, 250VAC Midget Time Delay, Main Power	FUSE110
Fuse, Bussmann FNM-1 – 1 amp, 250VAC Midget Time Delay, MCI	FUSE101
Fuse, Bussmann FNM-2 – 2 amp, 250VAC Midget Time Delay, External Contactor	FUSE102
Fuse, Littelfuse Minifuse 297003 - 3 amp, 32VAC, Drive Board	FUS66

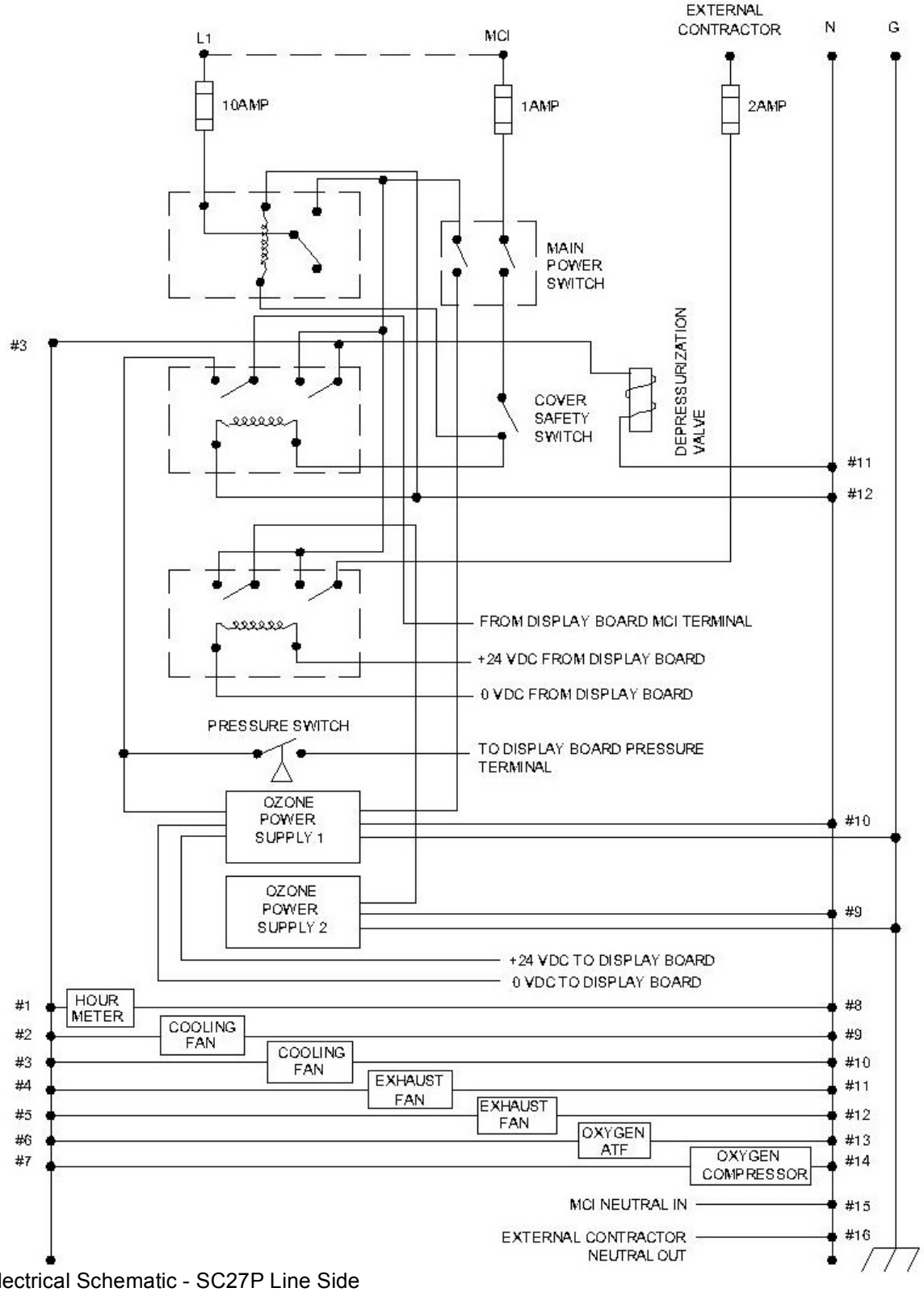
Maintenance Kit

ASP500A

Part #	QTY	Description
OXS350	1	Oxygen Concentrator – Replacement Compressor Inlet Filter
OXS356	1	Oxygen Concentrator – Compressor Rebuild Kit
OXS361	1	Oxygen Concentrator – Compressor Pressure Relief Valve
FA40	2	Filter – Fan filter, element only
ORG110	8	O-ring – 2" CD reaction chamber, pressurized end cap, large
ORG120	8	O-ring – 2" CD reaction chamber, pressurized end cap, small
HSW100	4	Sealing washer - Viton
HWW9004	4	Hardware washer - #6, flat, S.S.
CKV21	1	Check Valve – ¼" fpt X ¼" fpt
SV1500	1	Depressurization valve – rebuild kit
FUSE110	1	Fuse, Bussmann FNM-10 – 10 amp, 250VAC Midget Time Delay, Main Power
FUSE101	1	Fuse, Bussmann FNM-1 – 1 amp, 250VAC Midget Time Delay, MCI
FUSE102	1	Fuse, Bussmann FNM-2 – 2 amp, 250VAC Midget Time Delay, External Contactor
FUS66	2	Fuse, Littelfuse Minifuse 297003 -3 amp, 32VAC, Drive Board

APPENDIX - Section C

Logic Schematic

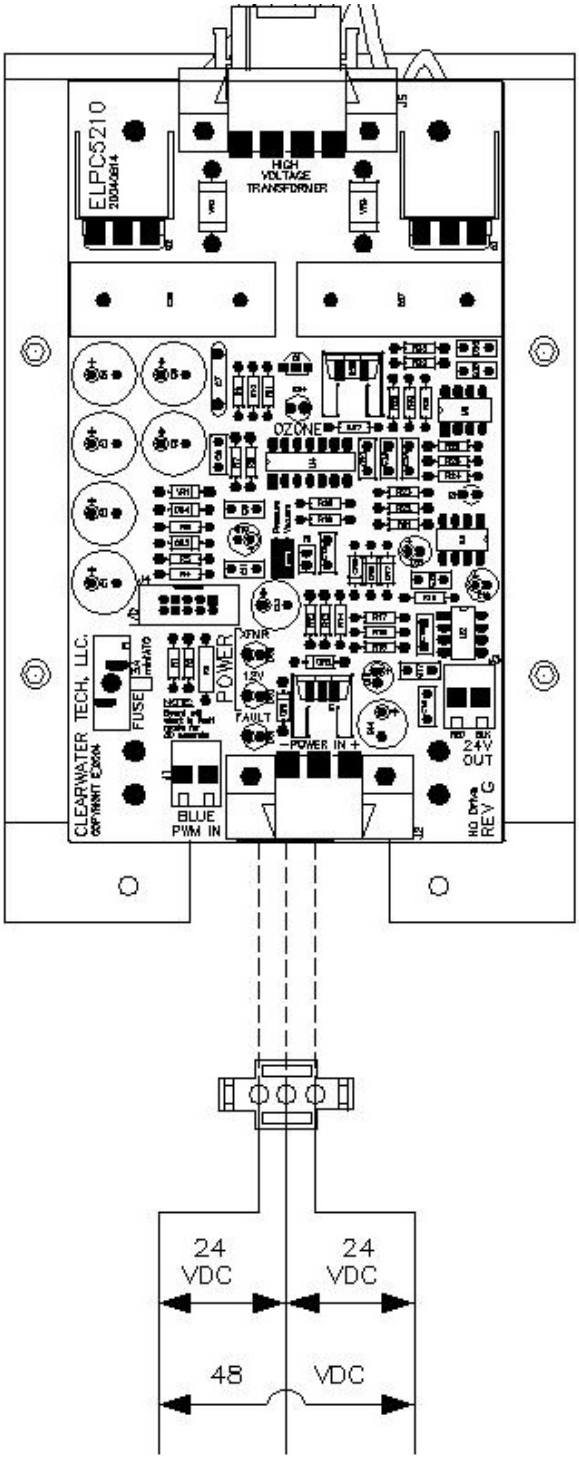


Shown: Electrical Schematic - SC27P Line Side

Note: This system is not dual voltage rated. System voltage is 120VAC 60Hz or 220VAC 50Hz.

APPENDIX - Section D

Drive Module Input Voltages



Shown: HO Drive Module

APPENDIX - Section E

ClearWater Tech, LLC. Limited One-Year Warranty

Summary of the Warranty

ClearWater Tech, LLC ("CWT") makes every effort to assure that its products meet high quality and durability standards and warrants the products it manufactures against defects in materials and workmanship for a period of one (1) year, commencing on the date of original shipment from CWT, with the following exceptions: 1) The warranty period shall begin on the installation date if the installation is performed within 90 days of the original shipment from CWT; 2) The warranty period shall begin on the date of the bill of sale to the end user if the installation date is more 90 days after the original shipment date. To validate the warranty, a warranty card, accompanied by a copy of the bill of sale, must be returned to CWT and must include the following information:

- End user name
- Complete address, including telephone number
- Date installed
- Complete model and serial number information
- Name of company from which the unit was purchased

Repairs and replacement parts provided under this warranty shall carry only the unexpired portion of this warranty or 90 days, whichever is longer.

Items Excluded from the Warranty

This warranty does not extend to any product and/or part from which the factory assigned serial number has been removed or which has been damaged or rendered defective as a result of:

- An accident, misuse, alteration or abuse
- An act of God such as flood, earthquake, hurricane, lightning or other disaster resulting only from the forces of nature
- Normal wear and tear
- Operation outside the usage parameters stated in the product user's manual
- Use of parts not sold by CWT
- Service or unit modification not authorized by CWT
- Check valve/solenoid valve failure
- Damage which may occur during shipping
- Failure to meet service requirements as outlined in the I & O manual

Obtaining Service Under the Warranty

Any product and/or part not performing satisfactorily may be returned to CWT for evaluation. A Return Goods Authorization (RGA) number must first be obtained by either calling or writing your local authorized dealer, distributor or CWT direct, prior to shipping the product. The problem experienced with the product and/or part must be clearly described. The RGA number must appear prominently on the exterior of the shipped box(es). The product and/or part must be packaged either in its original packing material or in comparable and suitable packing material, if the original is not available. You are responsible for paying shipping charges to CWT and for any damages to the product and/or part that may occur during shipment. It is recommended that you insure the shipment for the amount you originally paid for the product and/or part.

If, after the product and/or part is returned prepaid and evaluated by CWT, it proves to be defective while under warranty, CWT will, at its election, either repair or replace the defective product and/or part and will return ship at lowest cost transportation prepaid to you **except for shipments going outside the 50 states of the United States of America.** If upon inspection, it is determined that there is no defect or that the damage to the product and/or part resulted from causes not within the scope of this limited warranty, then you must bear the cost of repair or replacement of damaged product and/or part and all return freight charges. Any unauthorized attempt by the end user to repair CWT manufactured products without prior permission shall void any and all warranties. For service, contact your authorized dealer or distributor or CWT direct at (805) 549-9724.

Exclusive Warranty

There is no other expressed warranty on CWT products and/or parts. Neither this warranty, nor any other warranty, expressed or implied,including any implied warranties or merchantability of fitness, shall extend beyond the warranty period. Some states do not allow limitation on how long an implied warranty lasts, so that the above limitation or exclusion may not apply to you.

Disclaimer of Incidental and Consequential Damages

No responsibility is assumed for any incidental or consequential damages; this includes any damage to another product or products resulting from such a defect. Some states do not allow the exclusion or limitation of incidental or consequential damages, so that above limitation or exclusion may not apply to you.

Legal Remedies of Purchaser

This warranty gives you specific legal rights and you may also have other rights, which vary from state to state.

THIS STATEMENT OF WARRANTY SUPERSEDES ALL OTHERS PROVIDED TO YOU AT ANY PRIOR TIME.