Ozone Systems

Installation & Operation Manual

CD4000P • CD6000P
CD8000P • CD12000P

Corona Discharge Ozone Generators

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

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Integrated Ozone Systems
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Introduction

This Installation and Operation Manual is written to assist in the installation, operation and maintenance of ozone generation systems manufactured by ClearWater Tech, LLC. The equipment has been designed to provide a safe and reliable supply of gaseous ozone using the most modern materials and technology available.

Please read this manual carefully and in its entirety before proceeding with any installation, operation or maintenance procedure associated with this equipment. Failure to follow these instructions could result in personal injury, damage to the equipment or reduced product performance.

In an ongoing effort to improve reliability and operating efficiency ClearWater Tech. may find it necessary to make changes to its products. Therefore, the information contained in this manual may not conform in every respect to earlier versions of ClearWater Tech. ozone systems found in the field. If you have any questions, please contact your ClearWater Tech. dealer or the ClearWater Tech service department.

CHAPTER

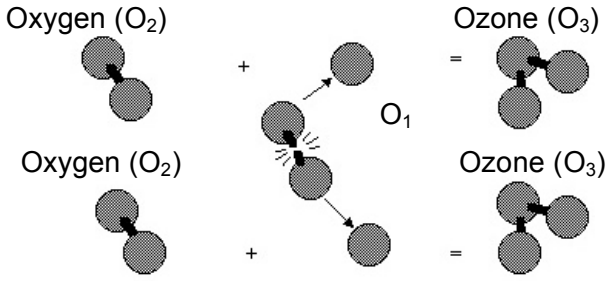
1

Overview

OVERVIEW

How Ozone is Generated

Ozone is generated by exposing oxygen molecules (O_2) in an air stream to a controlled, high-energy electrical field. As the air stream passes through the electrical field produced inside the ozone generator, some oxygen molecules are split, forming single oxygen atoms (O_1). These oxygen atoms then recombine with other O_2 molecules in the air stream, forming ozone (O_3).



Properties of Ozone

Ozone is the most powerful oxidizer available that can be safely used in water treatment.[1] It is used to treat drinking water, bottled water, swimming pool water, wastewater, food and beverage processing water, and in many other applications. Ozone is effective in performing the following water treatment functions:

- **Disinfection –** Bacterial disinfection, inactivation of viruses and cysts.
- **Oxidation of Inorganics –** Precipitates iron, manganese, sulfides, nitrites and organically-bound heavy metals.
- **Oxidation of Organics –** Including organics causing color, taste and odor problems, some detergents and pesticides, phenols, VOCs, turbidity control and micro-flocculation of soluble organics.

Molecular Weight:	48
Odor:	Readily detectable at concentrations above 0.02 ppm in air
Color:	Bluish in ozone generator cell, but ozone/air mixture exiting generator is invisible – even at high ozone concentrations
Gas Density:	2.144 grams/liter at 32ºF (approx. 150% that of oxygen)
Solubility:	Only partially soluble in water, but about 10-20 times more soluble than oxygen (at 68ºF).

Benefits of Ozone Use

- Ozone is generated on site – no transportation or storage is required.
- The most powerful oxidizer commercially available – very effective for disinfection and oxidation without handling problems.
- Ozone creates no potentially harmful by-products (such as THMs) – the only by product is oxygen.
- Ozone leaves no telltale taste or odor.

References :

1. Water Quality Association, "Ozone for POU, POE and Small Water System Water Treatment Applications," Lisle, IL, 1999.

CHAPTER

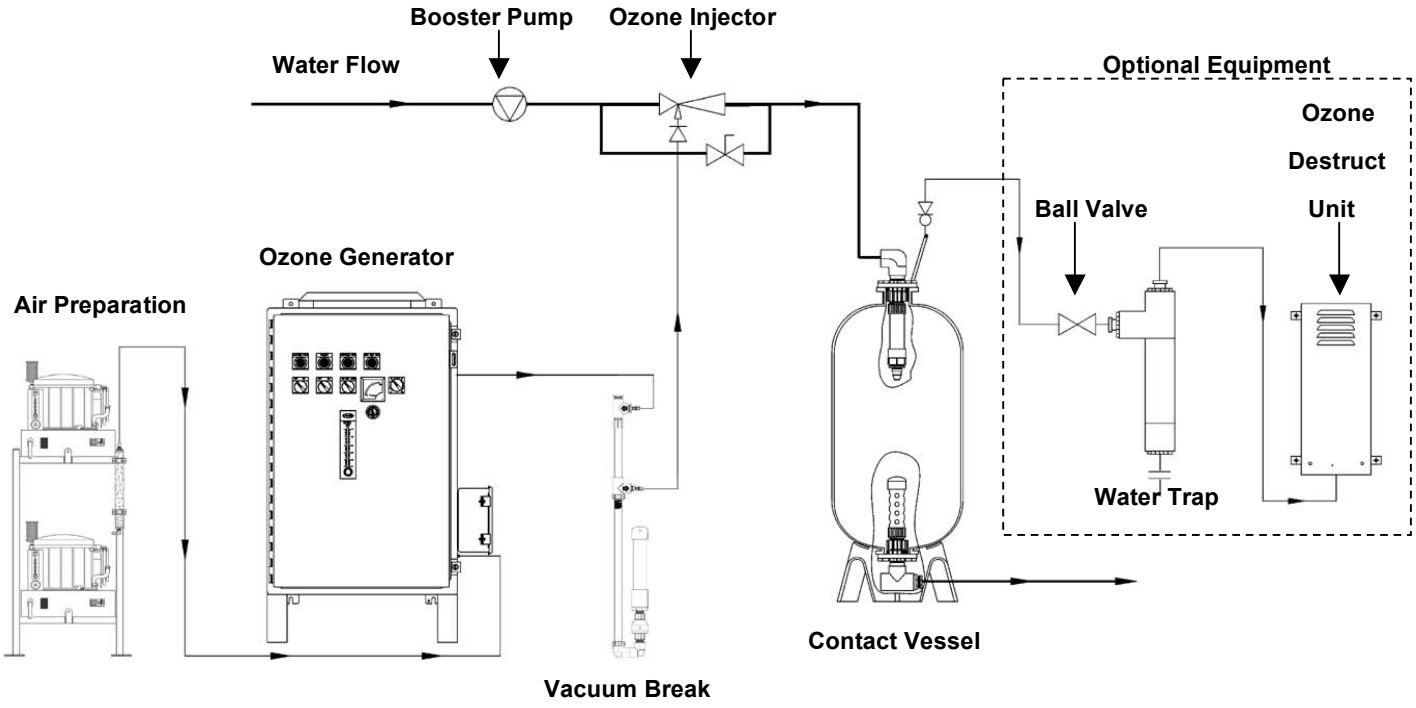
2

Theory Of Operation & Product Description

THEORY OF OPERATION/PRODUCT DESCRIPTION

ClearWater Tech ozone systems are designed for safe, effective use in a variety of water treatment applications. The CD4000P, CD6000P, CD8000P and CD12000P ozone generators 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 CD4000P Ozone System

Air Preparation System

ClearWater Tech commercial cabinet ozone generators require a source of clean, dry, oil-free, oxygen-enriched air for effective ozone production. To meet that need, the rack-mount air preparation systems built by ClearWater Tech employ pressure swing adsorption (PSA) technology with 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.

If "Plant Air" feed gas is to be used, in place of the ClearWater Tech air preparation system, the same air quality standards must be met to achieve the ozone output and longevity of the ozone generator. A pounds per square inch (PSI) regulator must be installed when using plant air feed gas. This regulator must be set to a maximum of 10 PSI.

Ozone Generator

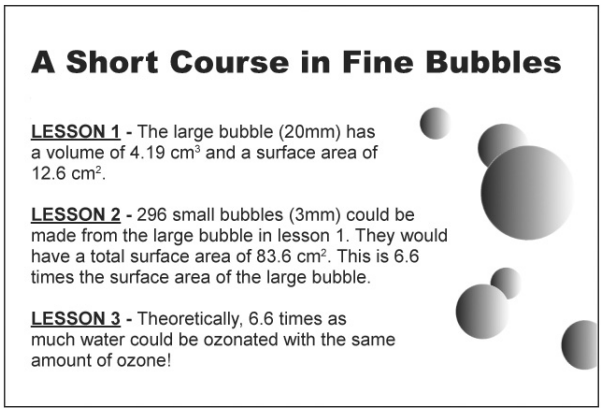
ClearWater Tech pressurized ozone generators are designed to supply high concentrations of ozone gas (up to 10%) at 10 PSI. The oxygen feed gas produced by the air preparation system is supplied to the ozone generator, which flows through built-in flow meter(s). Stainless steel needle valve(s) (preset inside the ozone generator), located on the stainless steel delivery line, are 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 pressure switch(es), 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 or more 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. The CWT pressure operated Cabinet-Ozone Generators are equipped with two three-way solenoid valves. While the valve on the right (closest to the cabinet wall) is for additional back flow prevention, the valve to the left is to depressurize and "off gas" residual ozone from the ozone reaction chambers. An internal off gas destruct (mounted inside the ozone generator) is used to destroy this residual ozone, (see Appendix - Section B). Other safety features are also built in, including a remote shut down device and thermal protection.

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.

CHAPTER

3

Safety Information

SAFETY INFORMATION

SAFETY WARNINGS

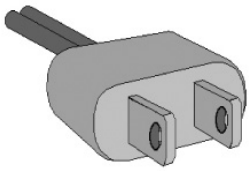
Two aspects of ClearWater Tech ozone generators represent potential dangers – ozone gas and high voltage electricity.

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 VOLTAGES. DO NOT TAMPER WITH OR DELIBERATELY BYPASS THE DOOR 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.**

CHAPTER

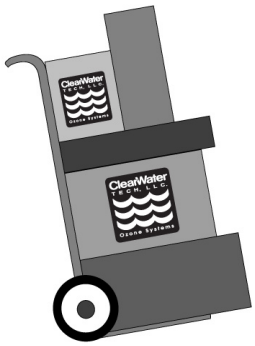
4

Installation Procedures

Getting Started

INSTALLATION PROCEDURES - Getting Started

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 air preparation system and ozone generator 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 5-1) 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 5-2) 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 each air preparation system and 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 surface should be provided for the air preparation system and ozone generator. These components should be securely fastened to the surface using the mounting holes and/or tabs provided.

- The air preparation system and ozone generator are *not* designed to withstand outdoor elements, including direct contact 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.).

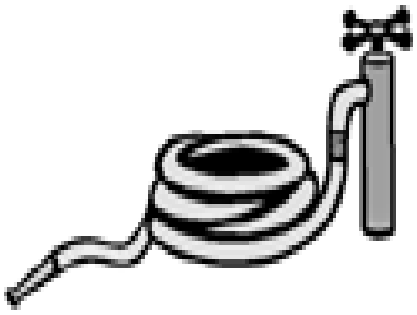
CHAPTER

5

Installation Procedures

Plumbing

INSTALLATION PROCEDURES – Plumbing



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 5-1) 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 5-2). 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(s) and contact vessel(s) 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 5-1). If such a mechanism is not present in the system (such as a heater bypass valve, etc.), it will require installation – 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(s). For serviceability of the equipment in the side stream loop, be sure to install an isolation valve between the tee or saddle and the booster pump(s).

Step 4: Plumb from the booster pump(s) to the injector manifold(s). 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(s) to the inlet side of the contact vessel. To reduce possible backpressure to the injector, minimize the number of elbows between the injector manifold(s) and contact vessel(s). The contact vessel(s) are 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(s) 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(s) and contact vessel(s) to solid mounting surfaces using appropriate hardware and according to local codes. If installing a ClearWater Tech contact column(s), use a ClearWater Tech contact column mounting kit and install according to the instructions below. If installing a contact tank(s), secure to a solid horizontal surface using mounting flange or feet.

Step 8: Install the contact vessel(s) venting system into the top of the vessel(s). If using the ClearWater Tech contact column(s), 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 5-3, 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.

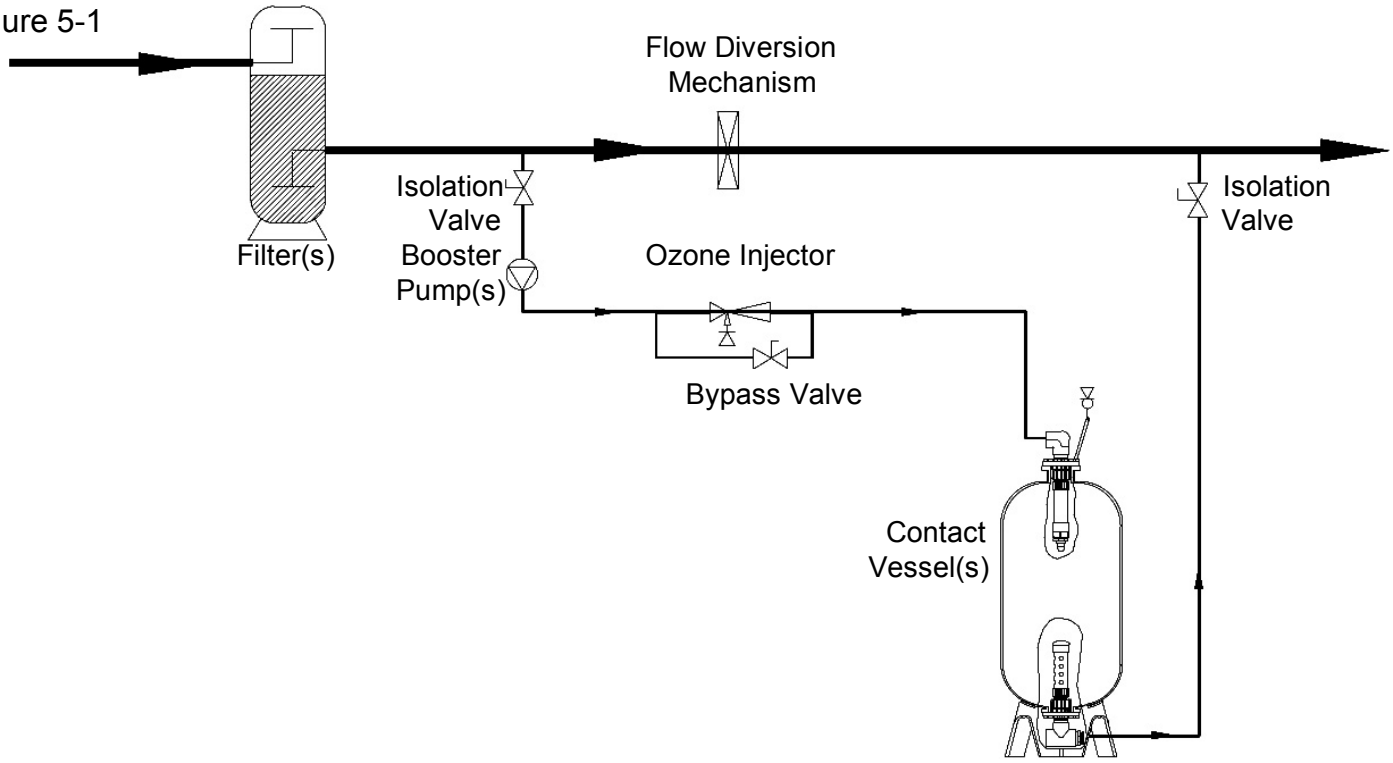
Step 3: Cut the unistrut bar to the desired length and attach it to the 'L' bracket using hardware provided.

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.

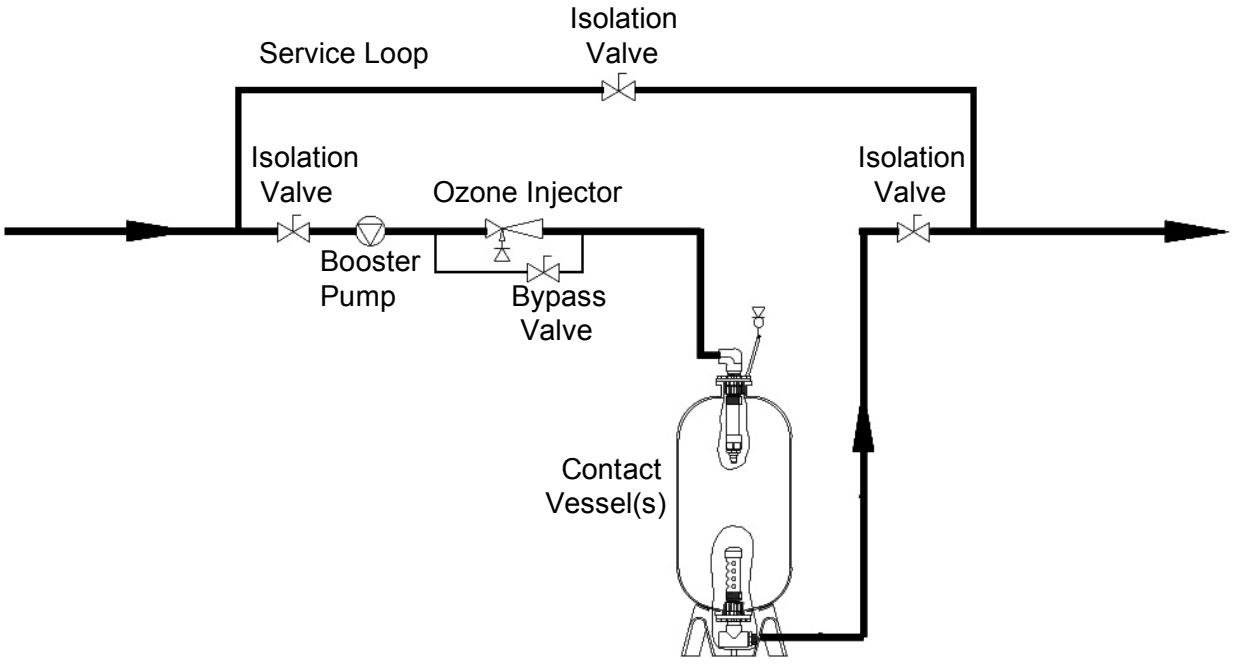
Sidestream Plumbing Installation Diagram

Figure 5-1



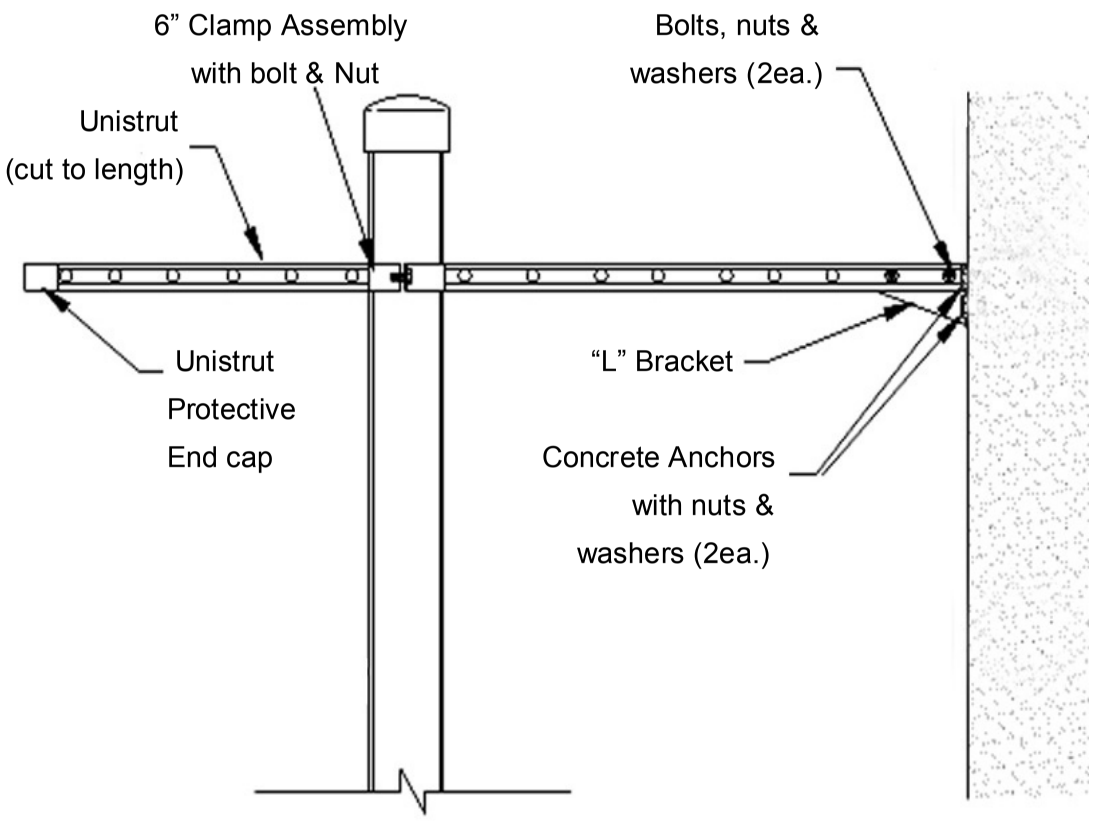
Full Flow Plumbing Installation Diagram

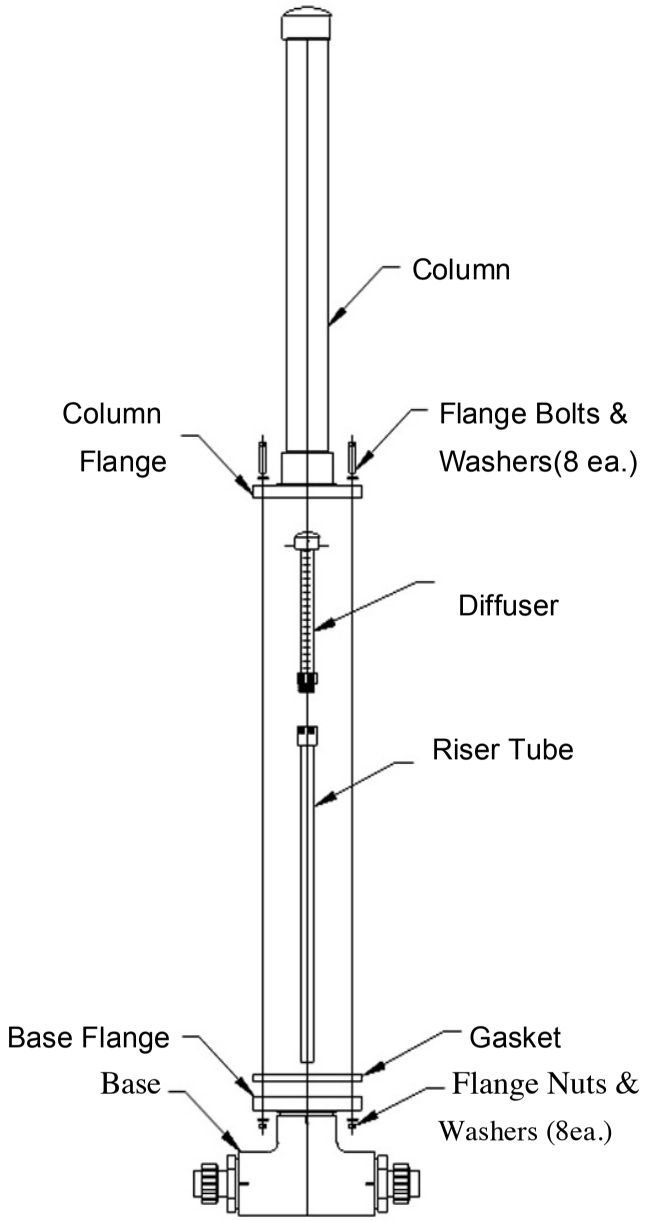
Figure 5-2



Contact Column Installation Diagram

Figure 5-3





Contact Column Exploded View

Figure 5-4

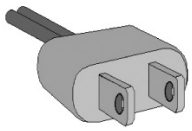
CHAPTER

6

Installation Procedures

Electrical

INSTALLATION PROCEDURES – Electrical



On the outside of the ozone generator cabinet (lower right side) is the electrical hook-up box (see Figure 6-1 A-D). The main power is wired to this box, as is most of the other ozone system equipment.

All possible pre wiring has been completed at the factory. Logic schematics have been provided in the Appendix - Section E.

- **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.**
- **All ClearWater Tech ozone generator cabinets require 240VAC, 60Hz single-phase electrical service supplied from a four-wire (L1, L2, neutral, ground) power source. Any other ozone system components (such as booster pump(s), etc.) that are three-phase *must* be wired directly to a three-phase control device (such as a mag starter).**

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 right side of the ozone generator cabinet to the grounding point.

Step 2: **Main Power –** Wire 240VAC, 30 amp, single-phase power from the main electrical service panel to *fused* terminals (L1 & L2) – the 240VAC, main power hook-ups on the terminal block in the ozone generator hook-up box. Color code: Load = black and red, ground = green, neutral = white. **Note: The ozone generator requires a true neutral.**

Step 3: **MCI (Motor Control Interlock) Power –** A *fused* interlock from the main water circulation pump to the ozone generator. Using #18 AWG, wire 120VAC power from the auxiliary terminal on the pump's three-phase motor starter to fused terminal 3 (MCI terminal) in the ozone generator hook-up box. If the MCI feature is not used, wire a jumper from L1 to the MCI terminal in the ozone generator hook-up box. **Note: The ozone generator will not function without a 120VAC signal to the MCI terminal as it is the first interlock in the hierarchy of safety controls.**

Step 4: **Booster Pump Power –** An interlock to the booster pump(s). Wire 240VAC power from the booster pump(s) to terminals 1 and 2 in the ozone generator hook-up box. The booster pump relays and internal interlocks are all pre-wired for single-phase systems. For three-phase pumps or single-phase pumps over 1 hp, use these terminals as the signal for the booster pump contactor(s) and mag starter(s). See booster pump wiring diagrams in the Appendix. **Notes: Match the coil voltage of the mag starter(s) to the signal voltage (240VAC) supplied by the ozone generator. Total pump horsepower cannot exceed 1 hp (total booster pump amperage draw cannot exceed 8 amps at 240VAC).**

Step 5: **Air Preparation System Power –** The Rack Mounted System (RMS), depending on model, consists of either two, three, four, or six individual rack mounted oxygen concentrator modules. The RMS will require controlled main power (CD4000P) or a control signal(s) (CD6000P through CD12000P) to interlock the system to the ozone generator, See Figure 6-2, A-C for air preparation system hook-up box diagrams. **Note: The prescribed air flow has been factory set to "atmospheric pressure" on each oxygen concentrator module. However, due to shipping the SCFH gauges on the modules may need to be calibrated. Follow Steps 5-8 of the 'Start-up & Calibration' section. Warning: Failure to calibrate may lead to premature failure of the oxygen concentrators.**

• CD4000P: The air preparation system consists of two individual rack mounted oxygen concentrator modules, which receive power from the ozone generator hook-up box, under normal operation. Cut off plug on power cords (plugs removed) and terminate the oxygen concentrators to terminals 3 & 4 and 5 & 6 of the ozone generator hook-up box. Terminals 3 & 5 are "hot" and terminals 4 & 6 are neutral (see Figure 6-1 A). Make sure the power switch on each of the oxygen concentrators is in the 'ON' position (if so equipped), as the ozone generator will control power to them.

• CD6000P through CD12000P: Each module on the RMS is factory pre-wired to a hook-up box located on the right side of the rack. Plug the 10-foot power cord into a 20 amp, 4-wire locking receptacle. Note: **Specifications for the mated female receptacle: Twist-Lock® 125/250VAC 3-pole/4-wire, NEMA Specification L14-20, ANSI Specification C73.83.**

• CD6000P: Using #18 AWG, wire a control signal from terminal 3 in the ozone generator hook-up box to the S1 terminal in the RMS rack hook-up box (see Figures 6-1 A & 6-2 B). Make sure the power switch on each oxygen concentrator module is in the 'ON' position (if so equipped).

• CD8000P and CD12000P: Using #18 AWG, wire a control signal from terminal 3 in the ozone generator hook-up box to the S1 terminal in the RMS rack hook-up box (see Figures 6-1 D & 6-2 C). Similarly, wire from terminal 4 in the ozone generator hook-up box to the S2 terminal in the RMS rack hook-up box. Make sure the power switch on each oxygen concentrator module is in the 'ON' position (if so equipped).

Step 6: **System Neutral –** From main power.

• CD4000P: Terminate the neutral (white) main power wire (see Step 2) to terminal 7 in the ozone generator hook-up box.
• CD6000P through CD12000P: Terminate the neutral (white) main power wire (see Step 2) to terminal 5 in the ozone generator hook-up box.

Step 7: **System Ground –** From main power. Terminate the ground (green) main power wire (see Step 2) to the ground lug located inside the ozone generator hook-up box.

Optional Equipment

Two pieces of optional equipment may require installation – an Oxidation Reduction Potential (ORP) controller and/or a remote shutdown device. Below are the steps required to wire these options to the ozone generator. Other installation procedures (equipment placement, calibration, maintenance, etc.) are included in the manual supplied by the manufacturer.

1. **ORP Controller –** Used to control the ozone generator output based on ozone demand. An unswitched 120VAC or 240VAC power source must be available for the ORP controller. See the installation manual included with the ORP controller for specific installation instructions.

CD4000P through CD12000P: The ORP controller supplies a 4-20 mA input signal to the ozone generator. With the ozone generator in the 'AUTO' position, this input signal controls the variable ozone output feature (4mA = 0% output, 20mA = 100% output). In the 'MANUAL' position, the variable ozone output is controlled by manually adjusting the potentiometer on the cabinet control panel (see Figure 8-3 A or B). The percent of ozone output (0-100%) is indicated by the meter to the left (CD4000P & CD6000P) or directly above (CD8000P & CD12000P) the potentiometer.

Step 1: Mount the ORP controller to a suitable vertical surface according to the installation manual supplied with the unit.

Step 2: Using #18 AWG, wire the 'positive' (+) lead from the ORP controller to terminal 8 (CD4000P) or terminal 6 (CD6000P through CD12000P) in the ozone generator hook-up box.

Step 3: Using #18 AWG, wire the 'negative' (-) lead from the ORP controller to terminal 9 (CD4000P) or terminal 7 (CD6000P through CD12000P) in the ozone generator hook-up box.

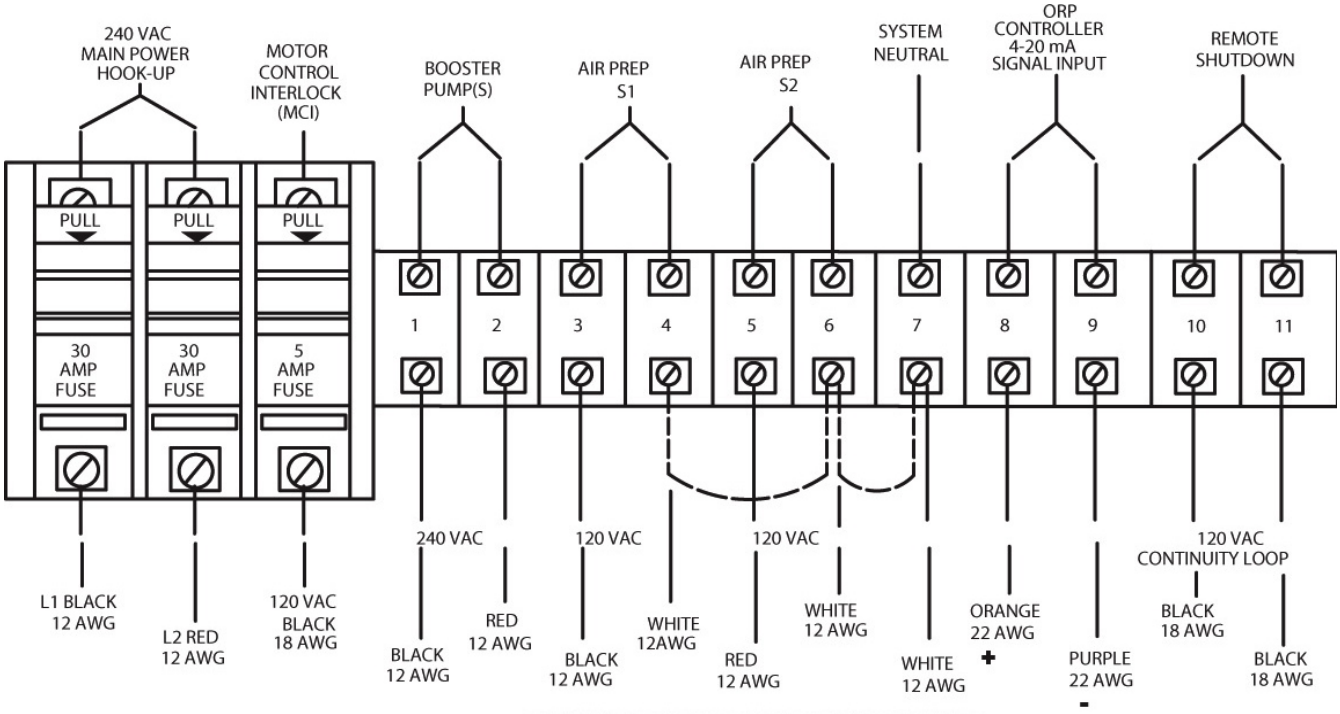
Step 4: Complete the required programming and calibration steps as outlined in the installation manual supplied with the ORP controller.

2. **Remote Shutdown Device –** An energized normally-closed control circuit used to shut down the ozone system in an emergency. In all cases, it must remain closed for the ozone system to operate. It may also be used for any continuity-type switch, such as an ozone off-gas detector. This circuit is pre-wired at the factory with a jumper installed between terminals 10 & 11 (CD4000P) or terminals 8 & 9 (CD6000P through CD12000P). The jumper must be removed if this feature is utilized, not to exceed 5 amps max.

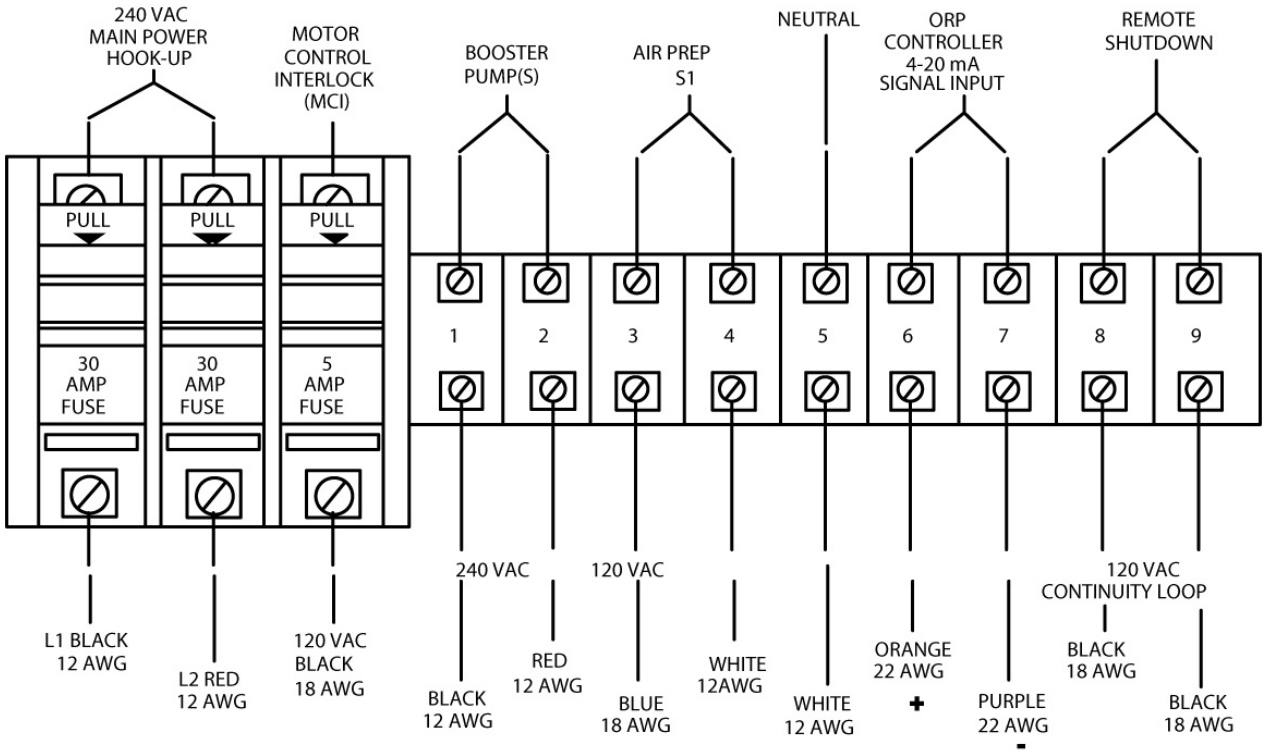
Step 1: Using #18 AWG (minimum), wire from terminal 10 (CD4000P) or terminal 8 (CD6000P through CD12000P) in the ozone generator hook-up box to the common of the device's alarm relay.

Step 2: Using #18 AWG (minimum), wire from terminal 11 (CD4000P) or terminal 9 (CD6000P through CD12000P) in the ozone generator hook-up box to the device's normally-closed alarm relay.

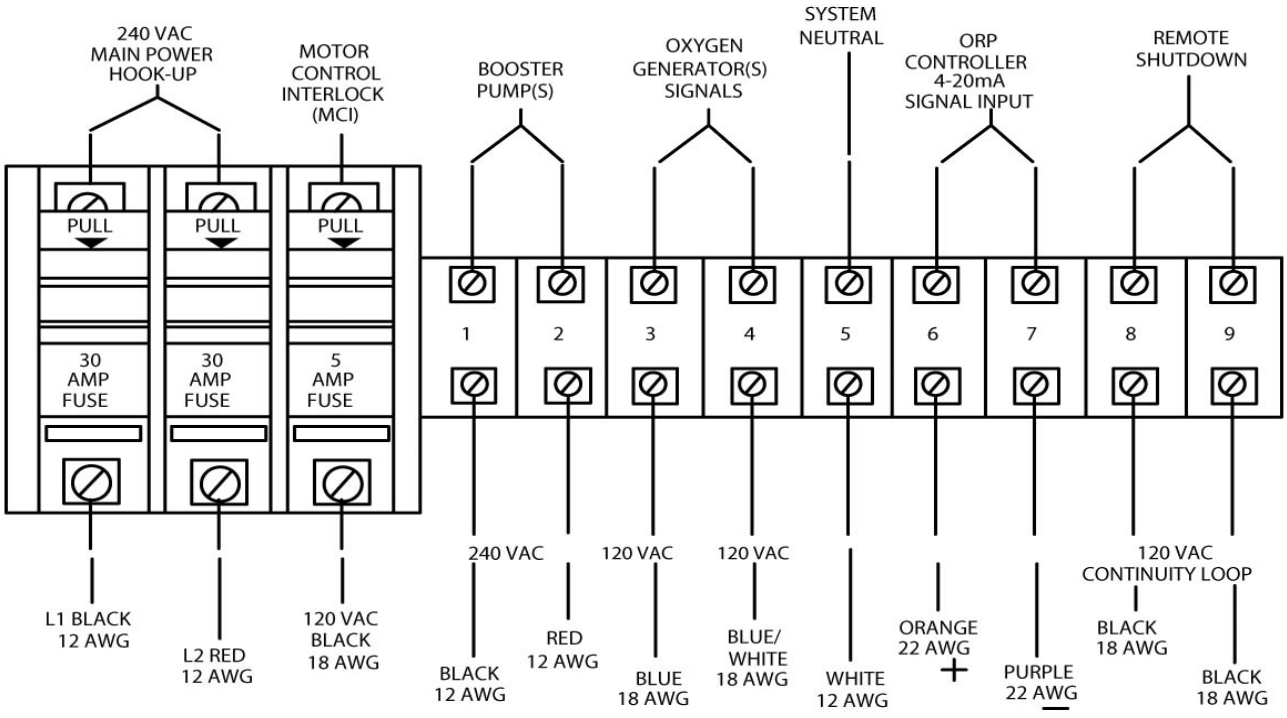
ELECTRICAL HOOK-UP BOX Diagrams
CD4000P 240 VAC, 60 Hz
1ø, 30 amp system Figure 6-1 A



ELECTRICAL HOOK-UP BOX DIAGRAM
CD6000P 240 VAC, 60 Hz
1ø, 30 amp system Figure 6-1 B



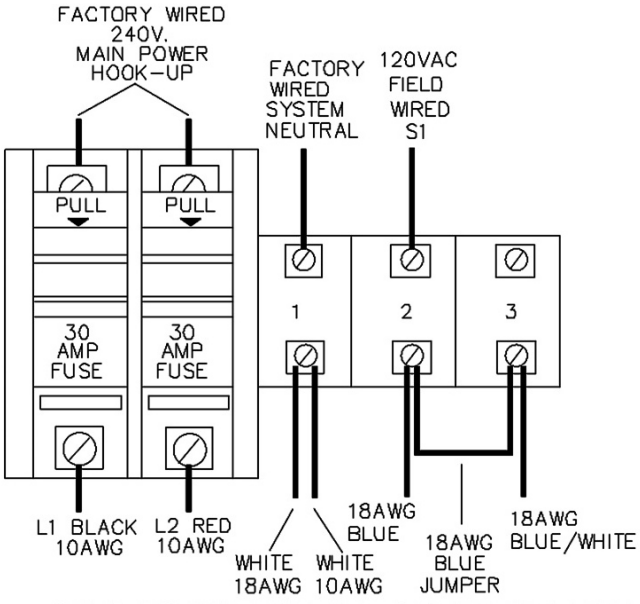
ELECTRICAL HOOK-UP BOX DIAGRAM
CD8000P - CD12000P 240 VAC, 60 Hz
1ø, 30 amp system Figure 6-1 C

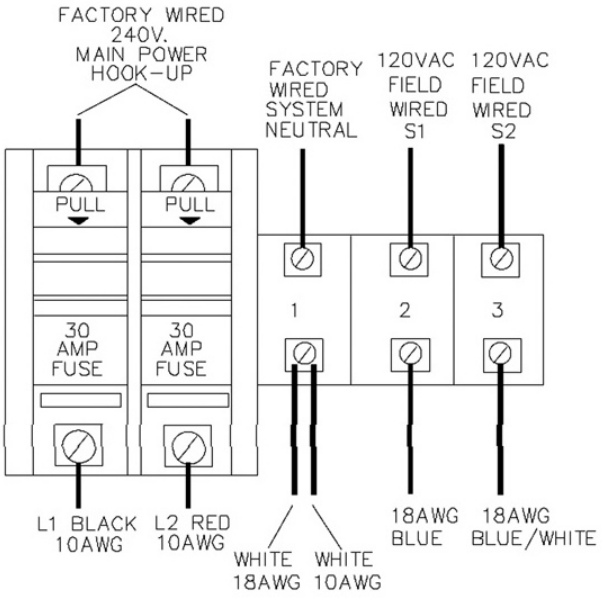


Electrical Hook-Up Box Diagrams

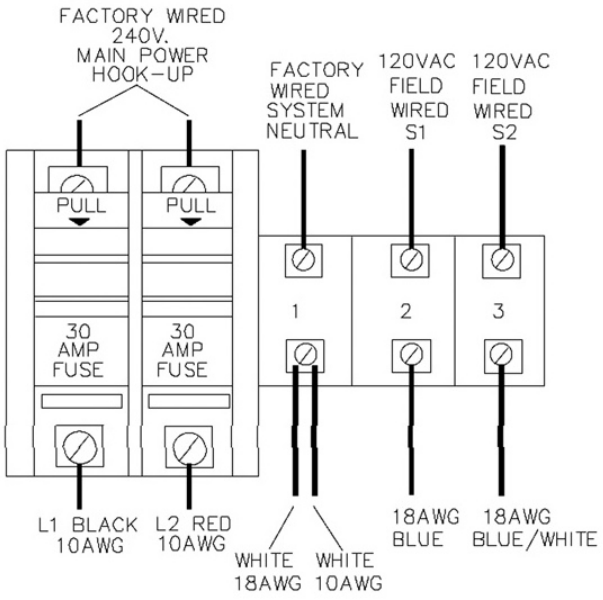
Air Preparation Systems

RMS36 240 VAC, 60 Hz
1ø, 11 amp system Figure 6-2 A
For CD6000P





RMS48 240 VAC, 60 Hz
1ø, 11 amp system Figure 6-2 B
For CD8000P



RMS72 240 VAC, 60 Hz
1ø, 17 amp system Figure 6-2 C
For CD12000P

CHAPTER

7

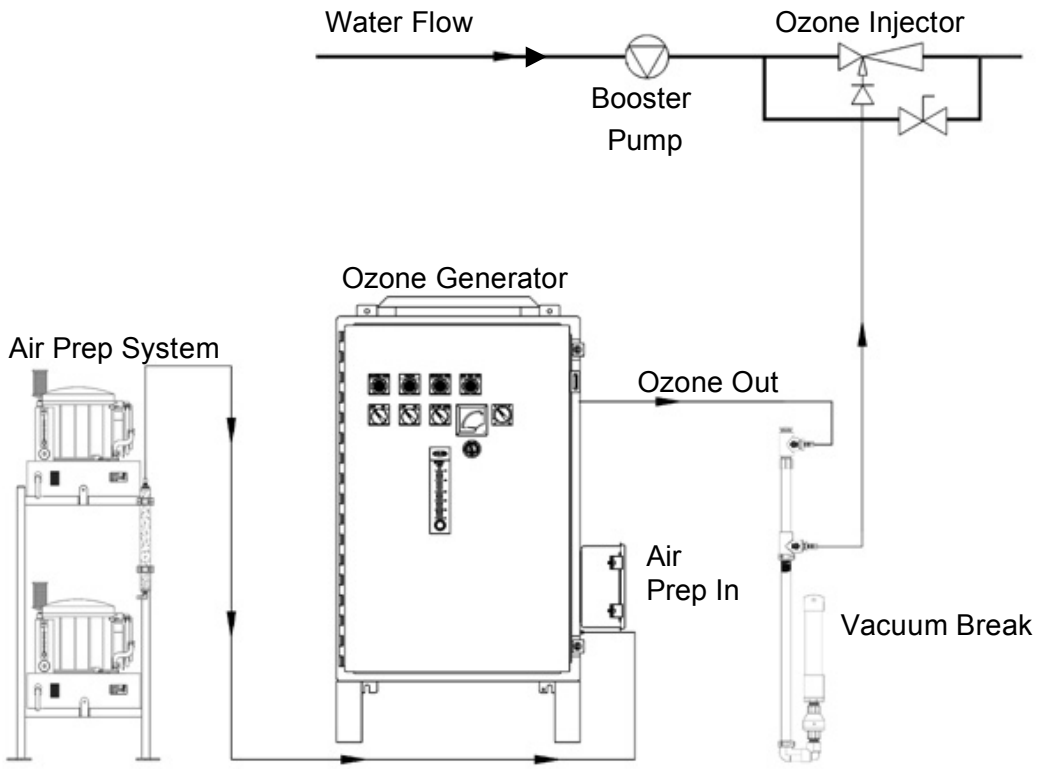
Installation Procedures

Pneumatic

INSTALLATION PROCEDURES – Pneumatic

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 7-1). 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 7-1



Hook-Up: Air preparation system-to-ozone generator

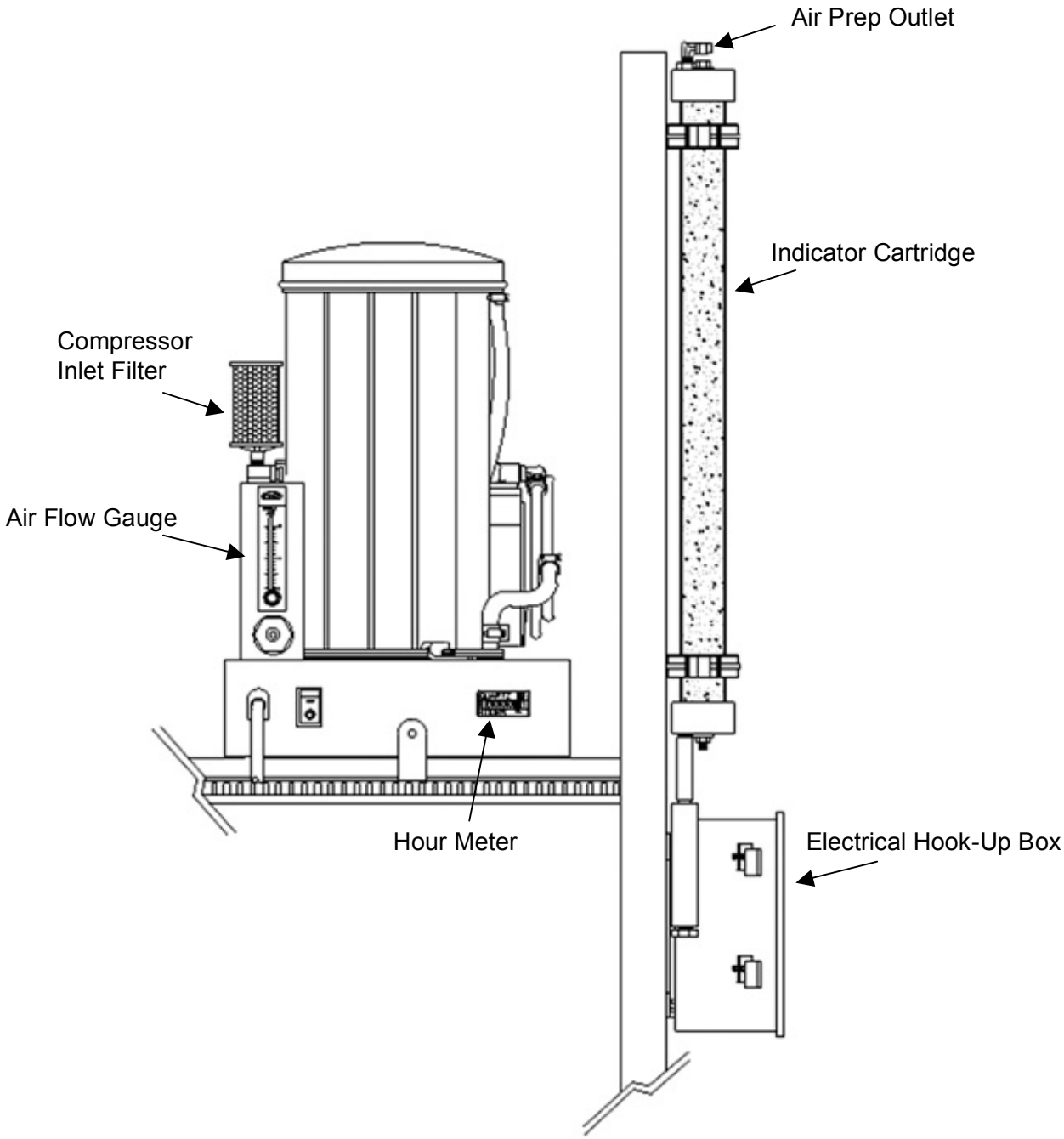
Step 1: Using a suitable length of 3/8" braided tubing (20 feet is provided), attach one end to the brass fitting on top of the clear indicator cartridge on the RMS rack (see Figure 7-2). Secure the tubing to the brass fitting with one of the hose clamps provided.

Step 2: Using Teflon® tape, install the barbed brass fitting provided into the female threads of the brass fitting labeled "Air Prep. In" located on the bottom right side of the ozone generator.

Step 3: Attach the other end of the 3/8" braided tubing onto the barbed brass "Air Prep. In" fitting installed in Step 2 above. Secure the tubing to the fitting with one of the hose clamps provided.

RMS Rack Detail

Figure 7-2



Hook-Ups: Ozone generator-to-vacuum break & vacuum break-to-injector manifold

The ClearWater Tech vacuum break provides a positive atmospheric "break" between the ozone injector manifold and the ozone generator, preventing water from flowing back into the ozone generator should the venturi check valve fail. Under normal operating conditions, the vacuum break's flapper valve (see Figure 7-3) is closed, allowing the vacuum created by the venturi to draw the output gas from the ozone generator. 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 vacuum break properly installed between the venturi and the ozone generator, the water will flow down the riser tube (away from the ozone generator) and out to drain, protecting the ozone generator from potential water damage.

Step 1: Select a suitable vertical surface that is accessible and in close proximity to both the ozone generator and the ozone injector manifold.

Step 2: Install the two Clic® mounting clamps provided onto the vertical surface so that the vacuum break is in a vertical position and the drain holes are *below* the level of the ozone generators ozone outlet fitting(s). One clamp should be located so it fits around the Riser Tube Elbow, and the other so it fits around the bottom of the Lower Tee (see Figure 7-3).

Step 3: Remove the Fill Port Cap located on top of the Riser Tube and fill the Riser Tube with clean water (no particulate matter) until "Fill Level" line indicated in Figure 7-3.

Step 4: Re-install the Fill Port Cap, using pliers or a wrench to tighten. **Note: Do not over- tighten as damage to PVC fittings may occur.**

Step 5: Install the thread-by-compression fitting(s) (provided in the ozone delivery line kit) into the stainless steel ozone outlet(s) located on the right side of the ozone generator. CD4000P & CD6000P models have a single outlet labeled "Ozone Out". CDP8000 & CD12000P models have dual ozone outlets, labeled "Ozone Out A" and "Ozone Out B".

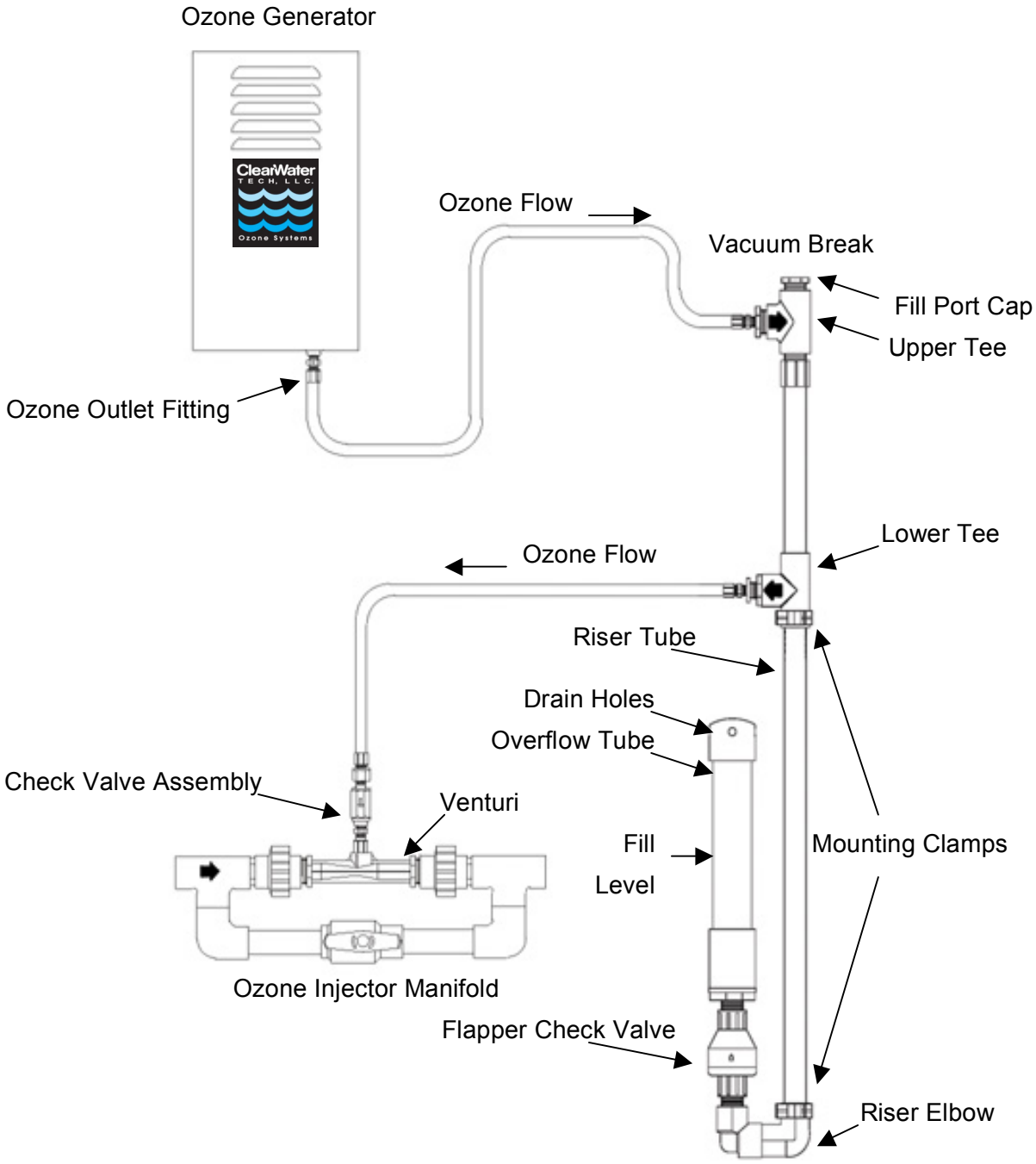
Step 6: Connect one end of a suitable length of Teflon® ozone delivery line to the fittings installed into the ozone outlets (see Step 5 above). Attach the other end of the Teflon® delivery line to the fitting threaded into the Upper Tee. As an additional backflow prevention measure, loop this length of tubing as high as is practical between the two connection points. **Note: Models CD8000P & CD12000P have dual ozone outlets.** If the ozone system is designed to have two ozone injection points, this step must be repeated for the other ozone outlet using a second vacuum break. If the system has one ozone injection point, tee or "Y" the Teflon® tubing from each ozone outlet into a single line before the vacuum break.

Step 7: Connect one end of a second length of Teflon® delivery line to the fitting threaded into the Lower Tee. Attach the other end of the delivery line to the fitting located on top of the check valve assembly.

Step 8: Adjustments to the valve on the ozone injector manifold will be necessary. These steps are covered in Chapter 8 - "Start-up and Calibration Procedures".

Vacuum Break Detail

Figure 7-3



Hook-Up: Contact vessel-to-ozone destruct system **(if so equipped)**

The ClearWater Tech ozone off-gas destruct system 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 the ClearWater Tech off-gas vent, this two-stage ozone destruct system is an efficient way to properly vent the ozone system contact vessel (see Figure 7-4).

NOTES:

- **The ozone destruct unit must have constant power to function correctly. Make sure it is plugged into an unswitched 120VAC outlet or wired to unswitched 240VAC power. Once up to temperature, the unit will remain warm to the touch.**
- **It is normal for small amounts of water to drain from the water trap, so it must be plumbed to waste appropriately.**

Step 1: Select a suitable vertical surface adjacent to the ozone system contact vessel. Using the clamps provided, mount the water trap to the surface.

Step 2: Using the mounting tabs, mount the ozone destruct unit adjacent to the water trap.

Step 3: Using Teflon® tape, install the small ball valve into the opening (at the tee or inlet) of the water trap. Using Teflon® tape, install the thread-by-compression fitting provided into the small ball valve.

Step 4: Using the thread-by-compression fitting, attach one end of a suitable length of the Teflon® tubing to the fitting on top of the contact vessel (the fitting is threaded directly into the cap of the contact *column* and is threaded into the off-gas vent on the top of a contact *tank*). Attach the other end of the tubing to the inlet of the small ball valve (see Step 3 above) in the water trap.

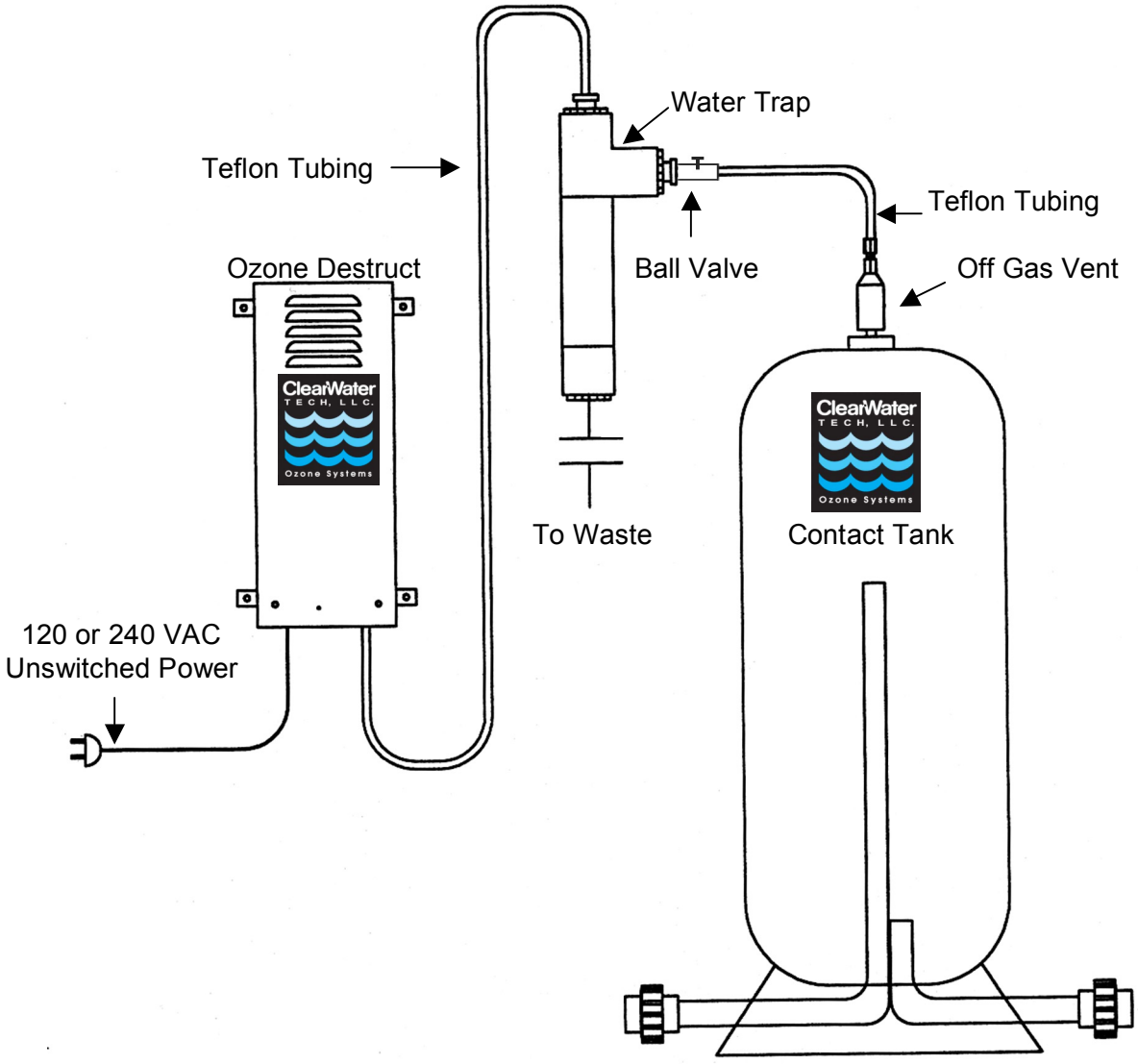
Step 5: Using the thread-by-compression fitting provided, attach another suitable length of Teflon® tubing to the fitting on top of the water trap. Attach the other end of the tubing to the inlet fitting on the bottom of the ozone destruct unit.

Step 6: Attach a suitable length of braided tubing to the fitting on the bottom of the water trap. Terminate the other end to appropriate waste or drain.

Step 7: Plug the ozone destruct unit into an unswitched 120VAC outlet or wire to unswitched 240VAC power and allow it to warm up. **Warning: The destruct unit will be warm to the touch, when in operation.**

Ozone Destruct System Detail

Figure 7-4



CHAPTER

8

Start-Up & Calibration

START-UP & CALIBRATION

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 generator 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 needle valve inside the ozone generator.

Air Preparation System, Ozone Generator & Ozone Injector(s)

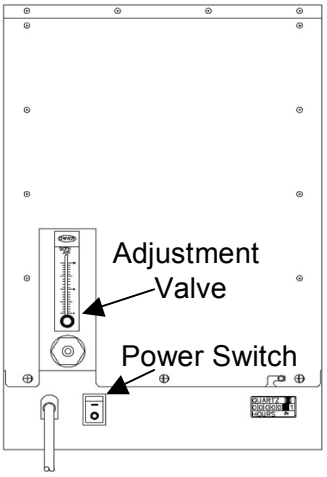
Step 1: Make sure all isolation valves in the ozone water system are open (Figures 5-1 or 5-2 show recommended isolation valve locations).

Step 2: Make sure electrical power is on to all ozone system electrical components. The main power switch on each of the oxygen concentrator module of the air preparation system must be in the 'ON' position (if so equipped), see Figure 8-1.

Step 3: Turn the 'Booster Pump' switch on the ozone generator cabinet door to the 'ON' position. The light directly above the 'Booster Pump' switch should come on (see "Cabinet Control Panel" diagrams - Figure 8-3 A and B). Allow the water system to reach hydraulic equilibrium (contact vessel(s) full, off-gas vent(s) operating, etc.) and observe for plumbing leaks. **Notes: 1) Water flow *must* be established through the main water pump and the ozone system booster pump (if so equipped). Make sure all isolation valves are *open*. 2) The ozone generator cabinet door *must* be closed and the door safety interlock engaged for the system to operate.**

Step 4: Turn the 'Cooling' switch on the ozone generator cabinet door to the 'ON' position. The light directly above the Cooling' switch should come on. **Note: The two cooling fans mounted in the bottom of the cabinet will *not* operate unless the 'Booster Pump' switch is in the 'ON' position (see Step 3 above). Check to make sure cooling air is flowing through the ozone generator by placing a hand near the vent on the top of the cabinet or over the vent on either side of the cabinet.**

Figure 8-1



Step 5: Each oxygen concentrator must be set to "atmospheric pressure" prior to full start up of the system. Disconnect the oxygen delivery line from each oxygen concentrator, located at the front of each unit. **Note: This should have been completed on step 'Installation procedures' - Electrical Section.**

Step 6: Check to make sure the compressor on each oxygen concentrator module of the air preparation system is operating.

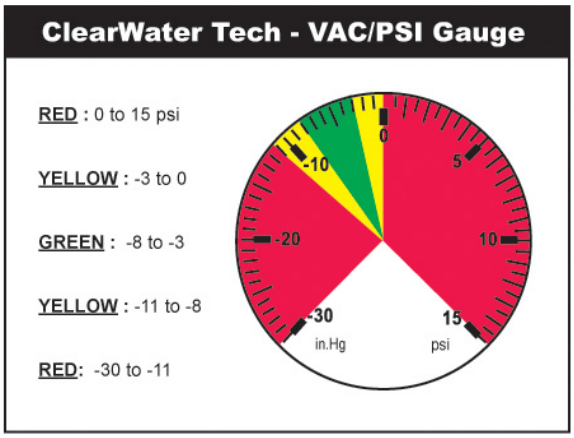
Step 7: Using the air flow gauge adjustment valve on each module (see Figure 8-1), adjust the air flow according to the "Air prep. System air flow" specifications outlined in Figure 8-2. **Note: All modules should be producing identical air flows. When the system is under normal operation the air flow of each module will drop from the initial setting, due to the system being under pressure. DO *NOT* READJUST THE AIR FLOW GAUGE ADJUSTMENT VALVE(S).**

Step 8: Connect the oxygen delivery lines to each oxygen concentrator.

Step 9: Disconnect the Teflon® ozone delivery line(s) from the ozone outlet fitting(s) located on the right side of the ozone generator.

Step 10: Close the ball valve on the injector manifold(s) about half way.

Step 11: Using your thumb, check for the presence of vacuum (suction) at the end of the Teflon® ozone delivery line 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(s) equally 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(s) 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(s) 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 8-2).



Step 12: Connect the Teflon® ozone delivery line(s) to the ozone outlet fitting(s) located on the right side of the ozone generator.

Step 13: Turn the 'Ozone/Air Prep' switch on the ozone generator cabinet back to the 'ON' position. The light directly above the 'Ozone/Air Prep' switch should come on.

Step 14: Using the air flow gauge adjustment valve on the ozone generator cabinet door, adjust the air flow to the ozone generator according to the "Ozone generator air flow" specifications outlined in Figure 8-2. The stainless steel needle valve(s), located inside the ozone generator on the stainless steel ozone delivery line(s), is preset to 10 PSI of backpressure to the ozone reaction chambers. The PSI gauge on the front panel of the ozone generator measures this back pressure. If there is insufficient backpressure the needle valve may be closed slightly, similarly, if there is too much back pressure the valve may be opened slightly**. Note: The lock nut on the needle valve must be loosened prior to adjustment and tightened after adjustment.** Due to the pressure switch(es) installed, the PSI gauge must achieve 9 PSI before the ozone outlet solenoid valves open, allowing the ozone to flow through the ozone generator and out to the injector manifold(s). **Note: In order to make adjustments inside the cabinet, the door interlock override switch must be engaged. Located inside the ozone generator electrical hook-up box (see Figure 9-2), this switch *must* be returned to the 'OFF' position for normal operation.**

Step 15: Using the ball valve on the ozone injector manifold(s) and the air flow adjustment valve on the ozone generator, make final adjustments to pressure and air flow levels.

Step 16: Perform a final check of all air connections from the air preparation system to the ozone injector manifold(s). Repair leaks as required. Check all water system connections, including the ozone injector manifold(s), vacuum break and contact vessel. Repair leaks as required. **Note: The check valve(s) at the ozone injector manifold(s) may make a humming noise. This is normal.**

Step 17: Perform a final check of the ozone system safety interlocks. If an interlock is not in the proper operating mode, it may cause the system to shut down prematurely or function incorrectly. The safety interlocks are summarized below:

- **The ozone generator cabinet door must be closed or the override switch must be in the 'OFF' position.**
- **The main circulation pump must be ON (MCI interlock).**
- **The booster pump must be activated.**
- **The ozone generator cooling fans must be ON.**
- **The ozone generator cabinet must have a minimum 9 PSI of pressure.**
- **The ORP level (if the system is equipped with an ORP controller) must be low enough when the system is in the 'AUTO' position.**

Vacuum Break

Check the water level in the vacuum break, making sure it is *above* the flapper valve (see Figure 7-3). 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.

Ozone Destruct System

Adjust the small ball valve at the tee of the water trap (see Figure 7-4) so that only a small amount of water is "spitting" into the trap. This will indicate that the contact vessel is full and only a very small amount of water is allowed to escape.

Pneumatic Operating Parameters

Figure 8-2

CD4000P (2 Modules)	Operating Range	Optimum
Air prep. system air flow (each module at atmospheric pressure)	10 to 12 scfh	12 scfh
Ozone generator total air flow (gauge - outside of cabinet door)	10 to 13 cfh	12 cfh
PSI gauge – outside of cabinet door	9 to 12 psi	10 psi
Injector manifold air flow	20 to 24 scfh	24 scfh
Injector manifold injector	-3 to -8 in. hg.	-5 inches

CD6000P (3 Modules)	Operating Range	Optimum
Air prep. system air flow (each module at atmospheric pressure)	10 to 12 scfh	12 scfh
Ozone generator total air flow (gauge - outside of cabinet door)	15 to 19 cfh	18 cfh
PSI gauge – outside of cabinet door	9 to 12 psi	10 psi
Injector manifold air flow	30 to 36 scfh	36 scfh
Injector manifold injector	-3 to -8 in. hg.	-5 inches

CD8000P (4 Modules)	Operating Range	Optimum
Air prep. system air flow (each module at atmospheric pressure)	10 to 12 scfh	12 scfh
Ozone generator total air flow (gauges - outside of cabinet door)	20 to 26 cfh	24 cfh
PSI gauge – outside of cabinet door	9 to 12 psi	10 psi
Injector manifold air flow	40 to 48 scfh	48 scfh
Injector manifold injector	-3 to -8 in. hg.	-5 inches

CD12000P (6 Modules)	Operating Range	Optimum
Air prep. system air flow (each module at atmospheric pressure)	10 to 12 scfh	12 scfh
Ozone generator total air flow (gauges - outside of cabinet door)	30 to 39 cfh	36 cfh
PSI gauge – outside of cabinet door	9 to 12 psi	10 psi
Injector manifold air flow	50 to 72 scfh	72 scfh
Injector manifold injector	-3 to -8 in. hg.	-5 inches

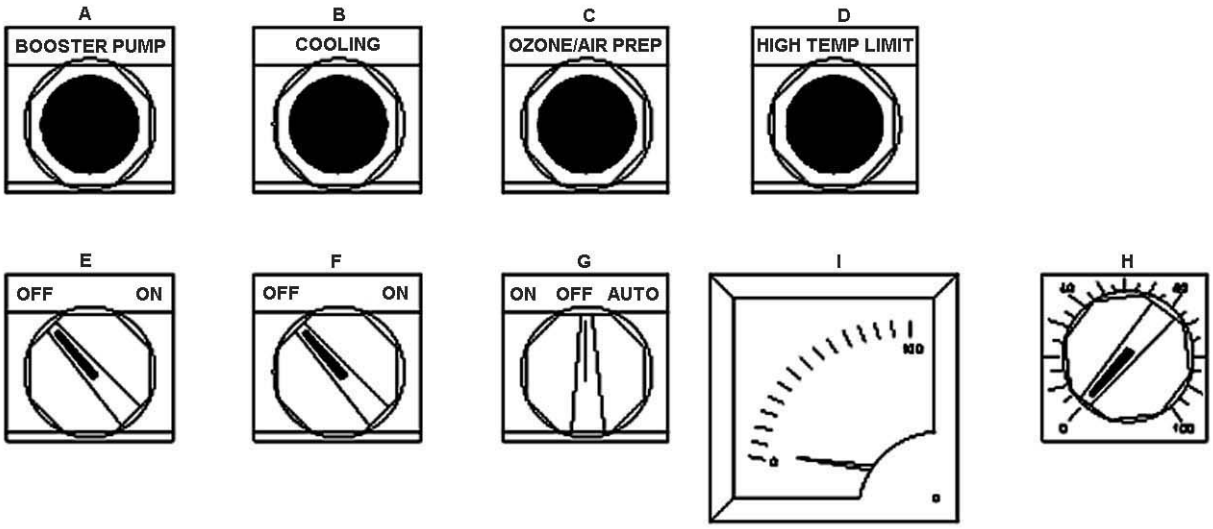
CABINET CONTROL PANEL DIAGRAM

Figure 8-3 A

CD4000P & CD6000P

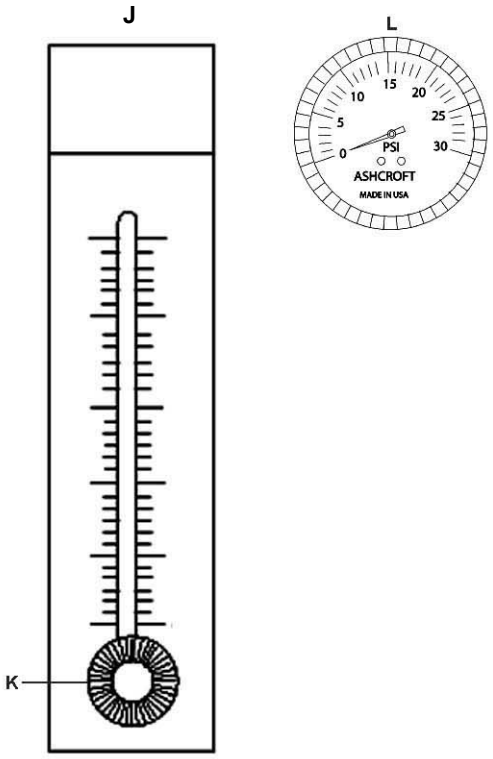
INDICATOR LIGHTS:

A. Booster pump ON = booster pump terminals energized.
B. Cooling ON = ozone generator cooling fans operating.
C. Ozone/Air Prep ON = ozone cells and air prep. terminals energized.
D. High Temp Limit ON = ozone generator has reached temperature limit (150º F).



CONTROL SWITCHES:

E. Booster pump ON/OFF
F. Cooling system ON/OFF
G. Ozone/Air Prep ON/OFF/AUTO
On = Overrides external signal (if so equipped). Output controlled manually by 0-100% potentiometer (H).
Off = No ozone output.
Auto = Output controlled by 4-20 mA control signal from external source.
H. Potentiometer - Adjusts ozone output.



GAUGES:

I. Ozone output gauge (0-100%)
J. Air flow gauge
K. Air flow adjustment valve
L. Pressure gauge

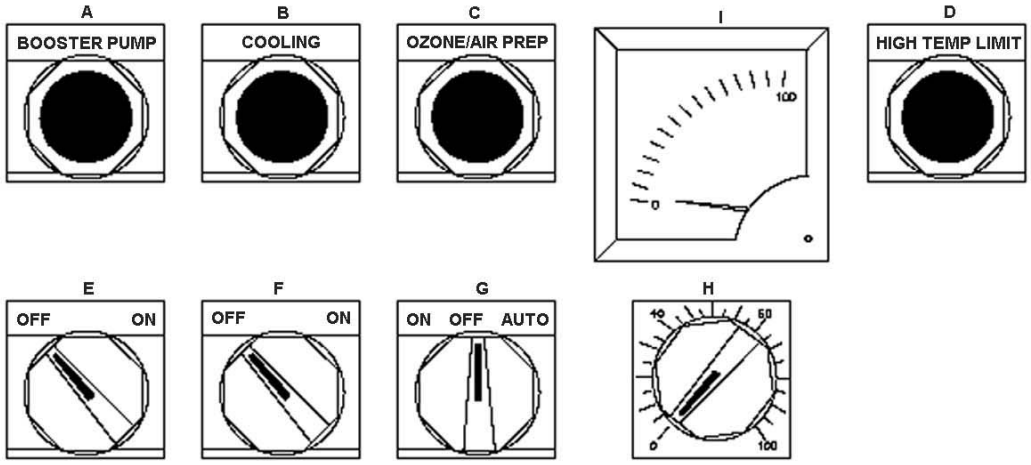
CABINET CONTROL PANEL DIAGRAM

Figure 8-3 B

CD8000P & CD12000P

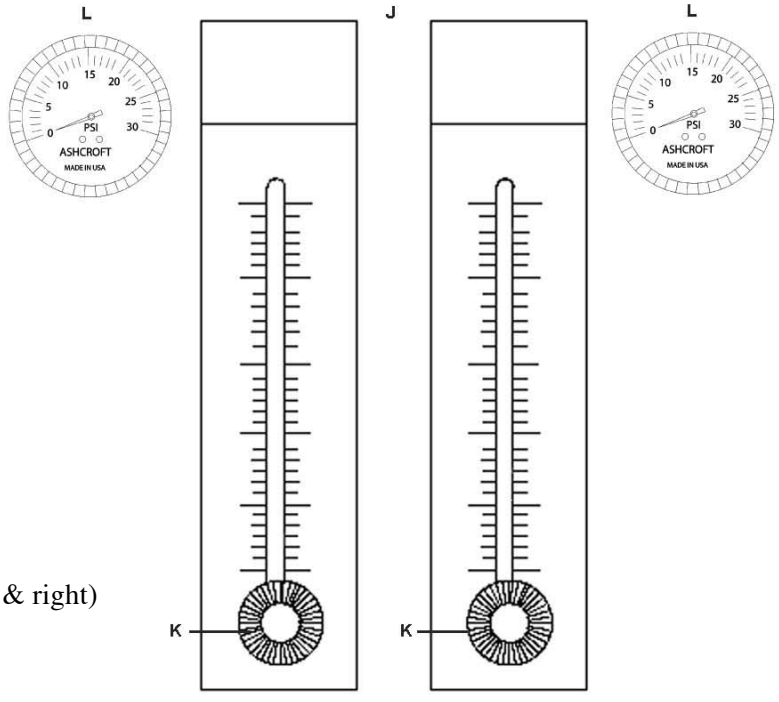
INDICATOR LIGHTS:

A. Booster pump ON = booster pump terminals energized.
B. Cooling ON = ozone generator cooling fans operating.
C. Ozone/Air Prep ON = ozone cells and air prep. terminals energized.
D. High Temp Limit ON = ozone generator has reached temperature limit (150º F).



CONTROL SWITCHES:

E. Booster pump ON/OFF
F. Cooling system ON/OFF
G. Ozone/Air Prep ON/OFF/AUTO
<u>On</u> = Overrides external signal (if so equipped). Output controlled manually by 0-100% potentiometer (H).
<u>Off</u> = No Ozone output
<u>Auto</u> = Output controlled by 4-20mA control signal from external source.
H. Potentiometer – Adjust ozone output



GAUGES:

I. Ozone output gauge (0-100%)
J. Air flow meters (left & right)
K. Air flow adjustment needle valve (left & right)
L. Pressure gauges (left & right)

CHAPTER

9

Maintenance Procedures

MAINTENANCE

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" (Chapter 3) before attempting any maintenance procedure that requires the use of tools and/or shutting down the ozone system.**

Daily Procedures

Air Preparation System:

- Power Switch - Check the power switch on each air preparation system module (see Figure 8-1). **Note: Since the air preparation system power is interlocked to the ozone generator, the power switches should always be in the 'ON' position (if so equipped).**

- Indicator Cartridge - Inspect the air preparation system indicator cartridge (see Figure 7-2). A change in the blue crystals to a light pink or white in color indicates the presence of moisture in the feed gas coming from the air preparation system. If such a change is observed, refer to the Troubleshooting Guide.

- Air Flow - Check the air flow gauge on each air preparation system module (see Figure 8-1). Make sure the air flow is within the SCFH range shown on the "Air prep. System Air Flow" line of the "Pneumatic Operating Parameters" chart (Figure 8-2). Adjust if necessary by following Step 5-8 of the "Start-Up & Calibration" section.

Ozone Generator:

- Indicator Lights - Check the indicator lights on the ozone generator cabinet door (see Figure 8-3 A and B). The white "Booster Pump", "Cooling" and "Ozone/Air Prep" lights should be illuminated. The red "High Temp Limit" light should *not* be illuminated under normal operating conditions.

- Air Flow – Check the air flow gauge on the ozone generator cabinet door. 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 8-2). Adjust if necessary by following Step 14 of the "Start-Up & Calibration" section.

- Pressure - Check the PSI gauge located on the ozone generator cabinet door. Make sure pressure is within then range shown on the "Pressure" line of the "Pneumatic Operating Parameters" chart (see Figure 8-2). Adjust if necessary by following Step 14 of 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. Fill as required by removing the threaded fitting on top of the riser tube until water is up to the 'Fill Level' in the overflow tube (see Figure 7-3).

Injection Manifold:

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

Ozone Destruct System:

- Water Trap – Check water trap for excessive water – it should be no more than half full. If excessive water is observed, see Troubleshooting Guide.

- Ozone Destruct Unit – Check to make sure the power indicator light (located on the right side of the unit) is illuminated**. Note: Unit must be plugged into an unswitched outlet. Cover of unit will be warm to the touch.**

Monthly Procedures

Ozone Generator:

Before checking drive module power and cooling fan operation, move the door interlock override switch - located in the ozone generator electrical hook-up box - to the right (see Figure 9-2). **CAUTION: This overrides the door interlock switch, so the inside of the unit remains energized with the door open. Do not touch anything inside the cabinet while this switch is activated!**

- Drive Module Operation – The Drive Module is made up of two components, the drive board and the drive transformer. With the ozone generator cabinet door open, check for illumination of the drive module "Ozone Output" LED's (for LED location, see Figure 9-1), if not see Troubleshooting Guide.
  - Main Power LED – 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.
  - Transformer Power LED – When illuminated, this "Green" LED indicates that 48V Buss power is available to the drive module transformer (XFMR), from the "on board" fuse of the to the drive transformer.
  - Ozone Output LED – The "Amber" ozone output LED will illuminate when ozone drive is being generated. The LED will also pulse as the output increases or decreases with either the "Potentiometer" located on the front cabinet door (see "Cabinet Control Panel Diagram" - Figure 8-3 A and B) or with a signal from 4-20mA controller (see 'Installation Procedures' – Electrical, Optional Equipment).
  - Fault LED – When illuminated, this "Red" LED indicates that there is a fault with the drive module or the Ozone Reaction Chamber. If this LED is on refer to the Troubleshooting Guide. **Note: Upon start-up the fault light will remain on 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.**

- Cooling Fan Operation – With the ozone generator cabinet door open, check to make sure the two cooling fans (mounted on the bottom panel of the ozone generator cabinet) are operating. If not, refer to the Troubleshooting Guide. **Note: Before proceeding further, close the ozone generator cabinet door and move the door interlock override switch back to the left. This is the correct position for the switch during normal operation.**

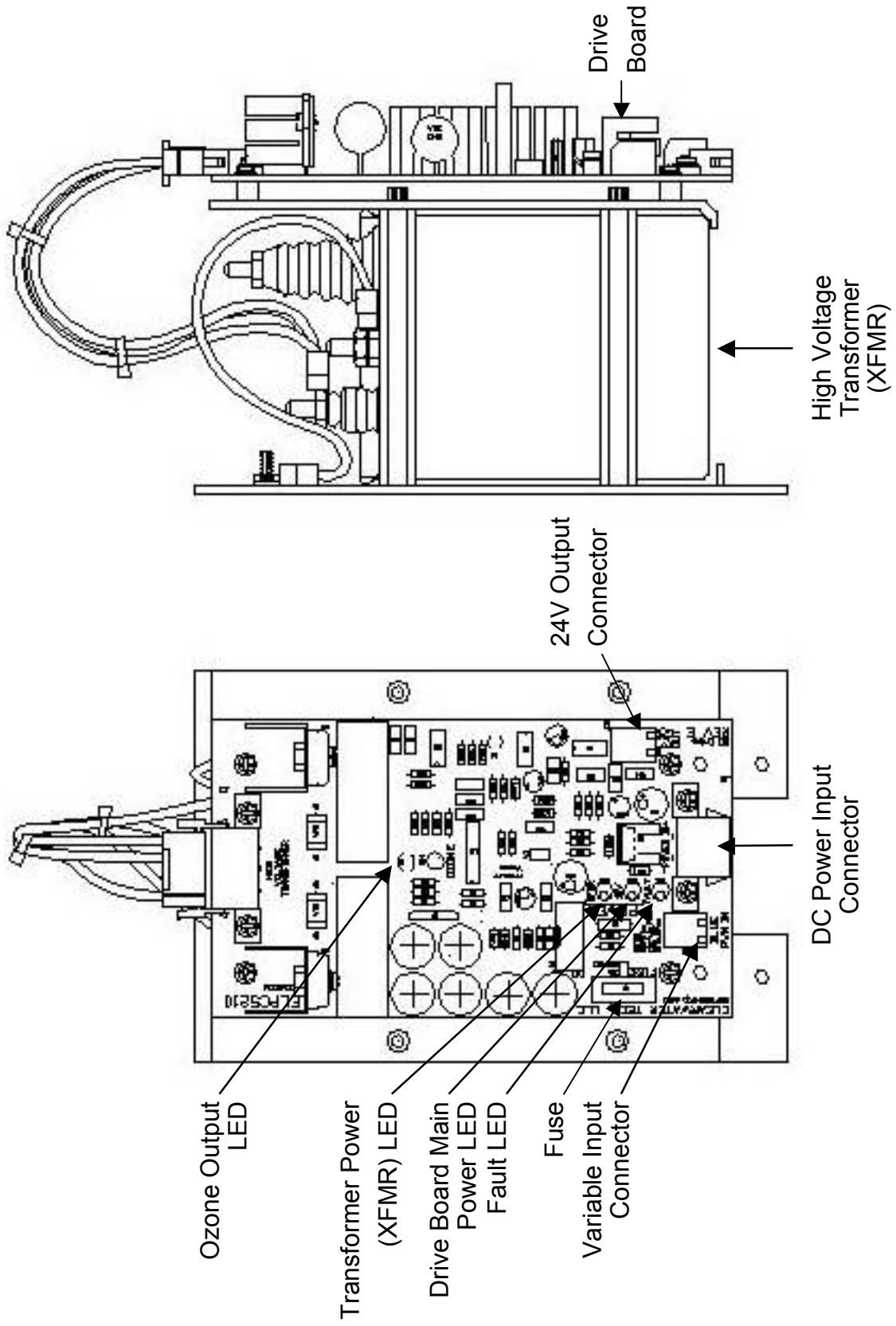
- Cooling Fan Filters – Check the cooling fan filter elements (mounted on the *underneath* side of the ozone generator bottom panel) and clean as required. Operating conditions in the equipment area will dictate the frequency required for this procedure. To check filters remove the thumbnuts and the protective grills (see Figure 9-3). Remove the filter elements and clean with soap and water, drying them completely before re-installing. **Note: A slot-head screwdriver or similar tool may be required to loosen the filter element from the fan.**

Booster Pump(s):

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

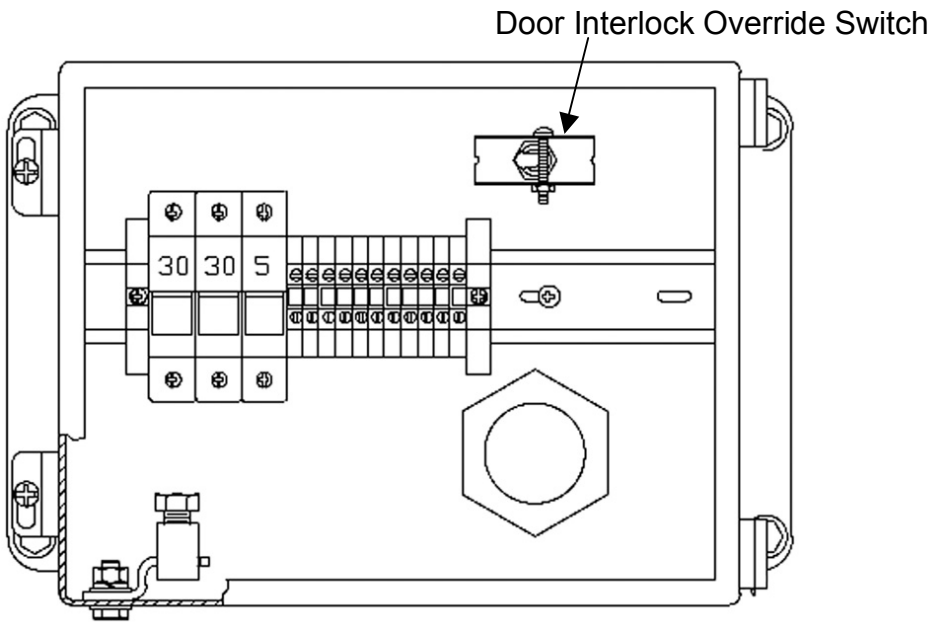
Drive Module High Output (H.O.)

Figure 9-1



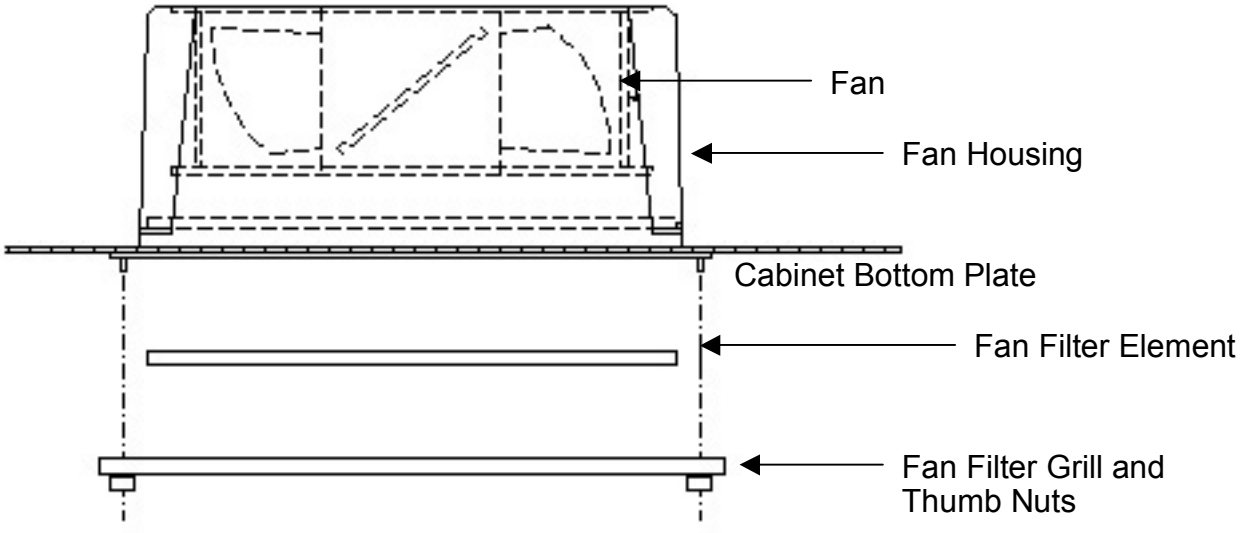
Electrical Hook-Up Box

Figure 9-2



Ozone Generator Cooling Fan Assembly

Figure 9-3



System Shutdown Procedures

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

Step 1: Turn the 'Ozone/Air Prep' switch on the ozone generator cabinet door to the 'OFF' position. The light(s) directly above the switch should go out. The air preparation system, reaction chambers and optional equipment (ORP controller and/or remote shutdown device) will be disabled.

Step 2: Allow 5 minutes after completing Step 1 for internal components to cool. Then turn the 'Cooling' switch on the ozone generator cabinet door to the 'OFF' position. The light directly above the switch should go out. The ozone generator cooling fans will be disabled.

Step 3: Turn the 'Booster Pump' switch on the ozone generator cabinet door to the 'OFF' position. The light directly above the switch should go out.

Step 4: Disconnect the power to the ozone generator cabinet, either at the service disconnect box (if so equipped) or main circuit breaker.

Step 5: Using a multimeter, check to make sure power to the ozone generator cabinet has been disconnected. Check for power at the electrical hook-up box (outside of cabinet, lower right side).

Semi-Annual Procedures

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

Air Preparation System:

- Air Inlet Filter(s) - Replace the air compressor inlet filter on each air preparation system module (see Figure 7-2). **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:

- Compressors - Following the procedures outlined in the compressor rebuild kit; rebuild the two compressor heads on each air preparation system module**. 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 Generators:

- Cooling Filters – Clean or replace the cooling fan filter elements as required.

- Inline Filter – Replace the filter and O-ring inside the filter bowl. Follow instructions included in filte replacement kit.

- Solenoid Valve - The ozone generators is equipped with two solenoid valves, located on the stainless steel ozone output delivery line. Rebuild the solenoid valves according to the directions included with the solenoid rebuild kit. For location see “Internal View – Ozone Generator” (Appendix - Section B).

- Reaction Chambers – Remove and disassemble one reaction chamber according to the steps outlined below (see Figure 9-4). The chamber in the lower right corner of the ozone generator is most likely to become fouled, so it is recommended that this chamber be removed for inspection. Check the chamber interior and dielectric tube for oil, dirt or moisture. If all parts are clean, dry and free of debris, the chamber may be re-assembled and no further maintenance is required. If the chamber is fouled or the dielectric is cracked, inspect all other chambers in the cabinet and rebuild or replace as required.

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 (mounted onto the reaction chamber).

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 nut brush adapter, 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 9-4 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 5 to Step 2. Follow steps outlined in Chapter 8 - "Start-Up and Calibration" to re-start the ozone system.

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 7-3).

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 5-4).

Step 1: Make sure the isolation valves before and after the contact column(s) are closed.

Step 2: Disconnect the vent line from the top of the contact column(s).

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.

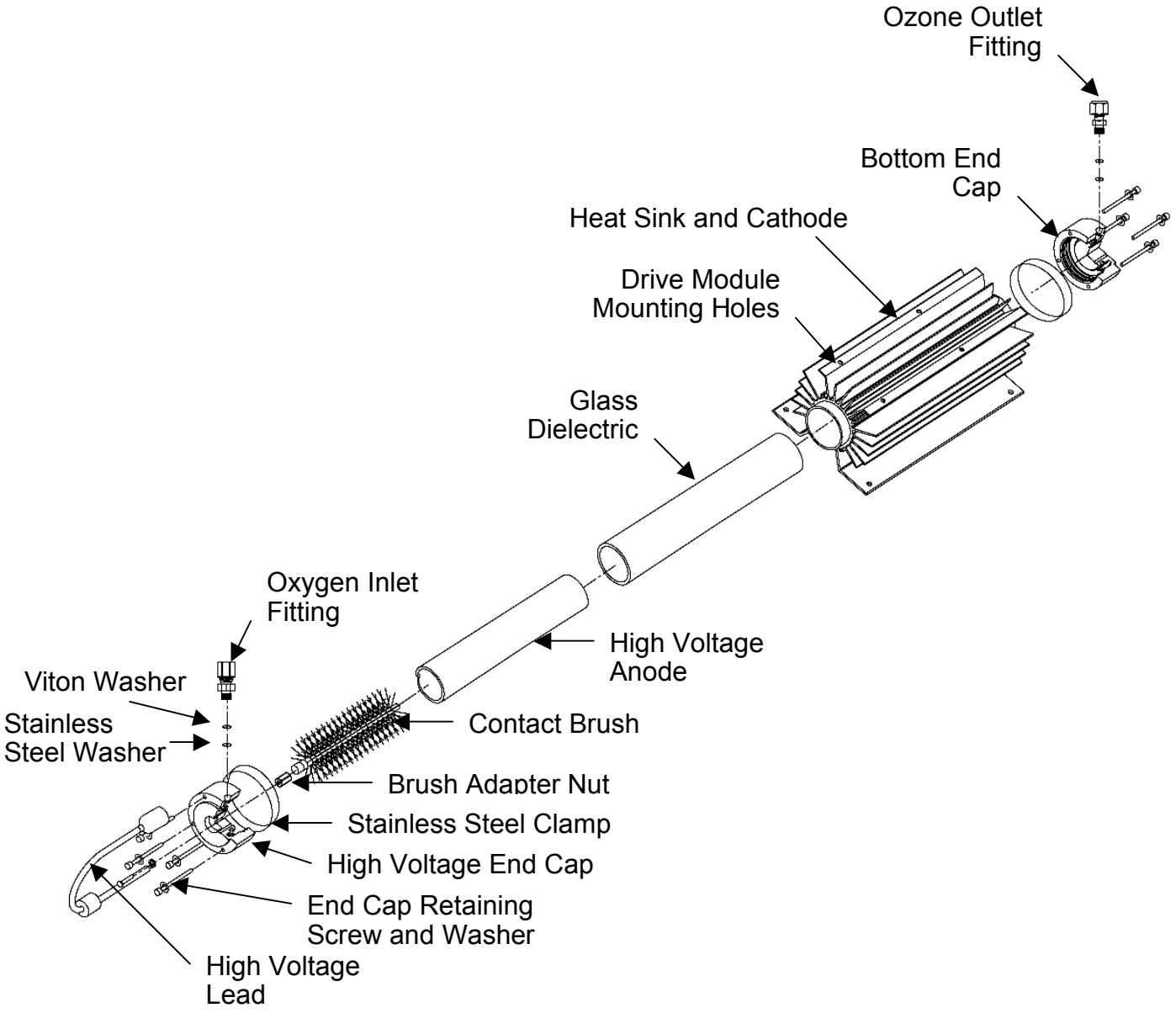
Ozone Destruct System:

- Off-Gas Vent – Disconnect tubing from top of off-gas vent and remove vent from contact vessel. Disassemble vent and clean inside thoroughly. The float assembly maybe disassembled cleaned, making sure all ports and orifices are clean and free of debris. Clean O-rings or replace as required. Re-assemble and mount vent onto the contact vessel.

- Ozone Destruct Unit – Under normal operating conditions, this unit may require no annual maintenance. However, if a strong odor of ozone can be detected in the air immediately surrounding the unit, the catalyst may require replacement. Follow the directions included with the ozone destruct rebuild kit.

2” Pressurized Reaction Chamber - Exploded View

Figure 9-4



CHAPTER

10

Troubleshooting Guide

TROUBLE SHOOTING

AIR PREPARATION

PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
Unit not operating	- No power to system	- Check main power to unit
	- Power switch(es) in 'OFF' position	- Turn switch(es) to 'ON' position
	- Insufficient pressure in ozone generator	- Adjust stainless steel needle valve
	- Incorrect wiring	- See 'Installation Procedures' - Electrical
	- Fuse blown in ozone generator	- Replace fuse
Low air flow or no air flow	- Flow meter out of adjustment	- Adjust flow meter See 'Start-Up & Calibration'-Steps 5-8
	- Fouled compressor inlet filter	- Replace inlet filter
	- Compressor not functioning	- Rebuild or replace as required
	- Excessive back pressure in system	- Check solenoid(s) and check valves for proper operation & replace as required
Compressor pressure relief valve making noise	- Excessive backpressure in system	- Check solenoid(s) and check valves for proper operation & replace as required.
	- Pinched tubing	- Replace tubing
	- Compressor not functioning	- Rebuild or replace as required
Indicator cartridge desiccant has changed from blue & white to all pink or white	- Moisture has entered air prep. system	- Check & tighten fittings
		- Rebuild/replace all compressor(s) or ATF module(s) as required
		- Replace indicating desiccant
Unit is making excessive noise	- Unit not properly secured to floor or wall	- Secure firmly in place
	- Shipping damage	- Locate damage and repair/replace parts
	- Fan blocked (if so equipped)	- Clear obstructions
	- Packaging material not removed	- Remove packaging material

OZONE GENERATOR

PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
'Booster Pump' indicating light is not on or System is not on	- Lamp burned out	- Replace lamp
	- No power to unit	- Check circuit breakers
	- Switch is in the 'OFF' position	- Turn switch to the 'ON' position
	- Blown fuse	- Replace fuse
	- Incorrect wiring	- See 'Installation Procedures' - Electrical
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
Unit does not stay on	- Unit overheating	- Check fan for proper operation and clean fan filter as required
	- Insufficient pressure	- Adjust stainless steel needle valve See 'Start-Up & Calibration'-Step 14
	- Defective check valve	- Replace check valve
'Cooling' indicating light is not on	- Lamp burned out	- Replace lamp
	- 'Cooling' switch is in the 'OFF' position	- Turn switch to the 'ON' position
	- 'Booster Pump' switch is in the 'OFF' position	- Turn switch to the 'ON' position
'Ozone/Air Prep' indicating light is not on	- Lamp burned out	- Replace lamp
	- 'Ozone/Air Prep' switch is in the 'OFF' position	- Turn switch to the 'ON' position
	- Blown fuse	- Replace fuse
	- Insufficient pressure	- Adjust stainless steel needle valve See 'Start-Up & Calibration'-Step 1
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
'High Temp Limit' indicator light on	- Unit is overheating clean fan filter(s)	- Check fan(s) for proper operation and
		- Check operating temperature
		- See 'Installation Procedures' - Getting Started...Equipment Placement'

OZONE GENERATOR – continued

PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
Drive Module Main Power, "Green" LED not illuminated	- No power to drive module from power supply	- Check main power to unit - 'ON/OFF/AUTO' switch is in the "OFF" position (see 'Installation Procedures' – Electrical, Optional Equipment) - Check fan for proper operation/clean fan filter - Test voltage from power supply to drive module (see 'Appendix' – Drive Module Input Voltages) - Check for loose wires or connectors
Transformer (XFMR) Power, "Green" LED not illuminated	- If the drive module 'Main Power' LED is not illuminated, the 'XFMR Power' LED will not turn illuminate - Blown drive module "on board" fuse - Loose wire harness connection from - Drive board is in 'Fault' mode	- Test voltage from power supply to drive module (see 'Appendix' – Drive Module Input Voltages) - Replace "on board" fuse - Check all wires and connectors the drive board to the drive transformer - See Troubleshooting, 'Fault' LED
Ozone Output, "Amber" LED not illuminated	- If the Transformer (XFMR) Power LED is not illuminated, the 'Ozone Output' LED will not illuminate - The output potentiometer is turned down to 0%, with the 'ON/OFF/AUTO' switch in the "ON" position - Drive board is in 'Fault' mode	- Check all wires and connectors - Turning the Potentiometer clock wise will increase ozone output percentage and the 'Ozone Output' LED will begin to illuminate (see 'Installation Procedures' Electrical, Optional Equipment) - There is not a 4-20mA input signal from a dedicated control source, with the 'ON/OFF/AUTO' switch in the "AUTO" position - Check all wires and connectors. Be sure all switches are in the correct position (see 'Installation Procedures' - Electrical, Optional Equipment) - See Troubleshooting, 'Fault' LED
Fault, "Red" LED illuminated	- Upon start-up the 'Fault' LED will be 'ON' for 30 seconds, this is normal - Loose wire harness connection from the drive board to the drive transformer - Failed drive board - Failed drive transformer - Broken dielectric - Water in ozone reaction chamber - Excessive dirt or debris in the ozone reaction chamber - Loose or disconnected High Voltage lead to transformer - High Temp Limit	- Wait for the start-up to commence - Check all wires and connectors - Replace drive board - Replace drive transformer - Replace dielectric - Clean dielectric and replace O-rings reaction chamber - Clean dielectric and replace O-rings - Attach High Voltage lead to transformer - See 'High Temp Limit' section above

OZONE GENERATOR – continued

PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
Fan not operating	- 'Cooling' switch off	- Turn 'Cooling' switch on
	- Fan inoperable	- Replace fan
Unit flooded with water Ozone smell detected in or near ozone generator	- Defective check valve(s)	- Replace check valve(s) - Assess damage, repair as required
	- Insufficient vacuum at venturi	- Adjust injector See 'Start-Up & Calibration'- Step 9-12
	- Loose internal fittings	- Check all fittings, tighten as needed
	- Defective O-ring seals in reaction chamber(s)	- Check & replace as required
	- Defective dielectrics	- Check & replace as required

OZONE INJECTION/CONTACTING

PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
Water backflow past injector check valve(s)	- Defective check valve(s)	- Replace check valve(s)
Water bubbling in vacuum break	- No vacuum	- See 'Start-Up & Calibration'
	- Debris on seat of vacuum break flapper valve	- Clean seat of flapper See ' Maintenance Procedures' - Annual
Low air flow or no air flow	- Air prep. system not operating properly	- See 'Start Up & Calibration'- Step 14
	- Fouled inline filter	- Change inline filter and O-ring
	- Air leak	- Check all fittings, tighten as needed
	- Incorrect wiring to air prep. system	- See'Installation Procedures - Electrical
Low vacuum	- Hydraulics/Pneumatics out of adjustment	- See 'Start-Up & Calibration'- Step 9-12
	- Defective check valve	- Replace check valve
	- Hydraulic back pressure	- Back wash filter (if so equipped), look for obstruction in venturi
	- Defective solenoid valve	- Rebuild or replace as required
	- No water in vacuum break	- Fill vacuum break with water – See 'Start-Up and Calibration' – Vacuum Break
	- Booster pump not functioning properly	- Check booster pump (contact dealer)

OZONE INJECTION/CONTACTING

PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
High Vacuum	- Hydraulics/Pneumatics out of adjustment	- See 'Start-Up & Calibration' – Step 1-4
	- Change in hydraulics - excessive water flow through ozone injector	- See 'Start-Up & Calibration' – Step 1-4
Ozone smell detected around vacuum break or ozone injector	- No vacuum	- See 'Start-Up & Calibration'
	- Loose fittings	- Tighten all fittings
	- Broken fittings	- Replace fittings

OZONE DESTRUCT

PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
Excessive water in water trap	- Failed off gas vent	- Clean vent or replace as required
	- Failed spring check valve in water trap	- Replace water trap
	- Back pressure on drain line	- Remove back pressure
Ozone destruct unit not operating	- No power to unit	- Check main power to unit
	- Switch not ‘ON’	- Turn switch to ‘ON’ position
	- Fuse blown	- Replace fuse
	- Incorrect wiring connections	- See 'Installation Procedures'- Electrical
Ozone destruct unit trips Electrical circuit breaker	- Incorrect wiring	- See 'Installation Procedures' -
	- Incorrect circuit breaker	- Replace with correct circuit breaker
	- Water back flow into unit	- Assess damage and rebuild as needed
Ozone destruct indicator light not illuminated	- Lamp burned out	- Replace lamp
	- Switch not’ON’	- Turn switch to ‘ON’ position
	- Blown fuse	- Replace fuse
	- Incorrect wiring	- See 'Installation Procedures'- Electrical
Receive an electrical shock from ozone destruct	- 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

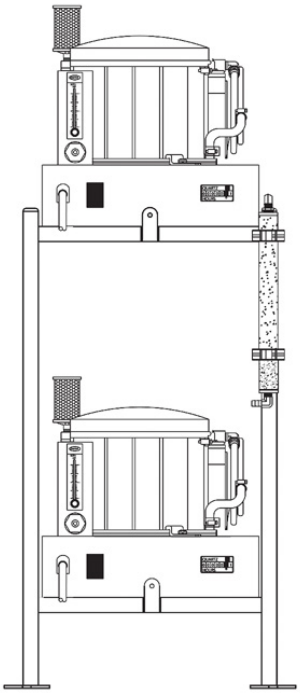
CHAPTER

11

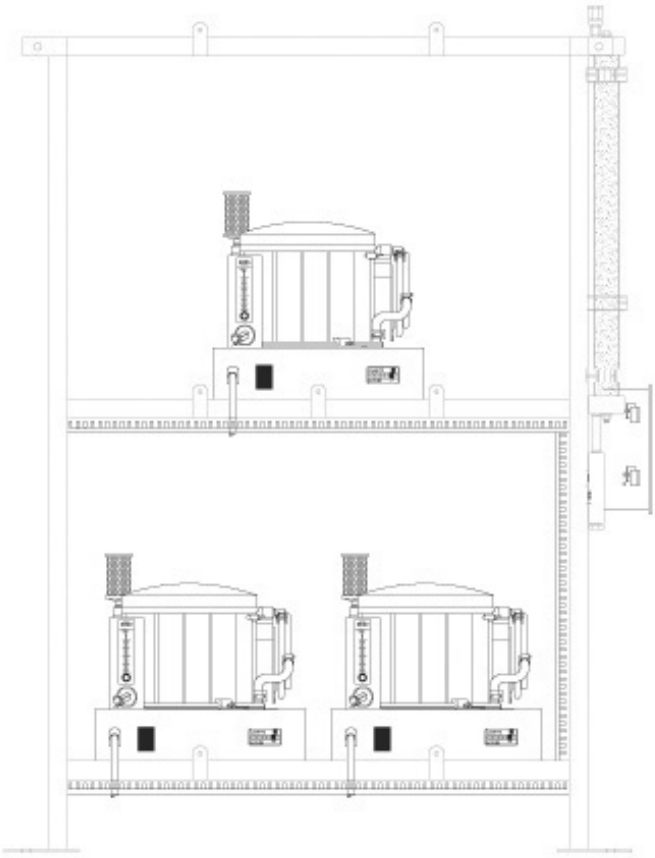
Appendix

APPENDIX - Section A

Specifications



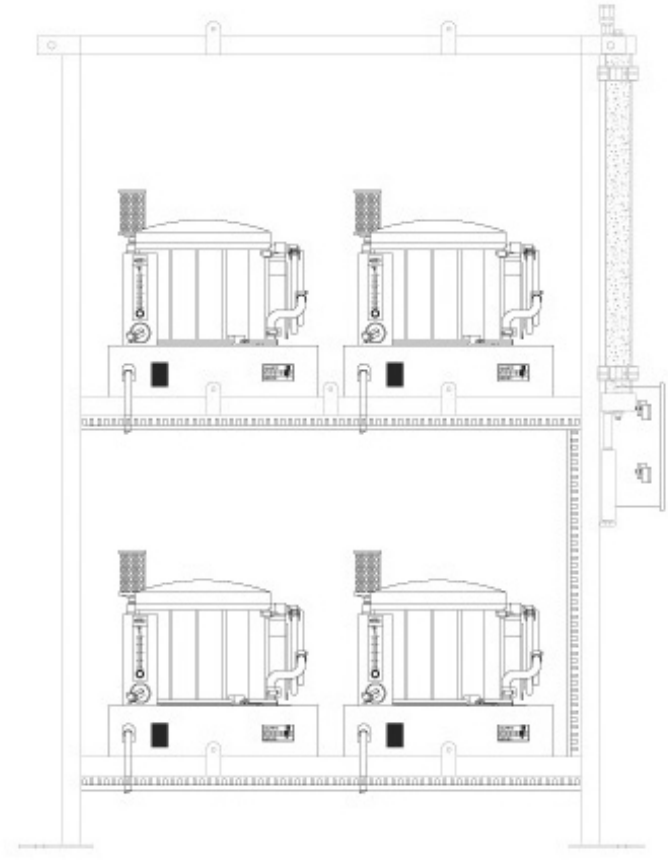
Shown: ClearWater Tech RMS24 Air Prep. System



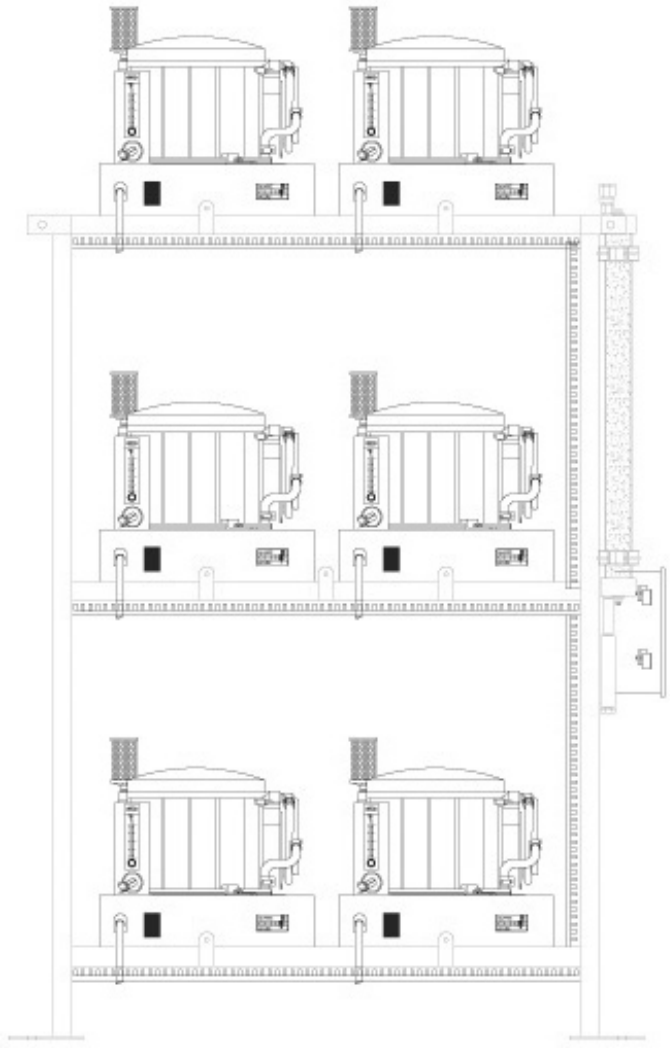
Shown: ClearWater Tech RMS36 Air Prep. System

AIR PREP SYSTEM	SPECIFICATIONS	OXYGEN OUTPUT/SCFH
RMS 24 (2 air prep. modules)	46” h x 19” w x 23” d, 130 lbs	90% (+/-3%) @ 24 scfh
RMS 36 (3 air prep. modules)	60” h x 42” w x 19” d, 195 lbs	90% (+/-3%) @ 36 scfh

Section A – Specifications



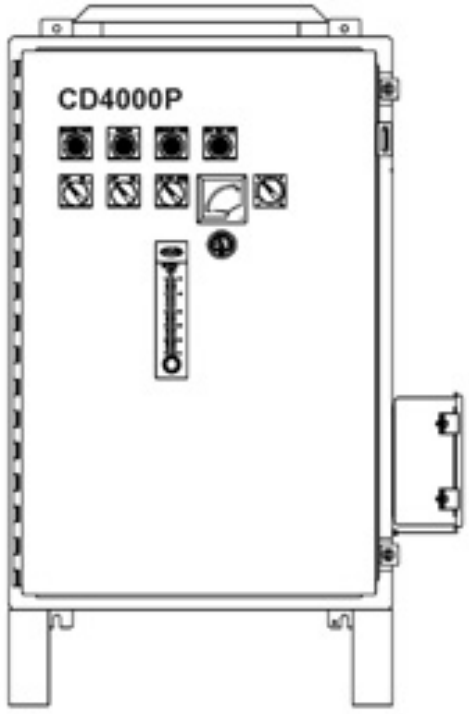
Shown: ClearWater Tech RMS48 Air Prep. System



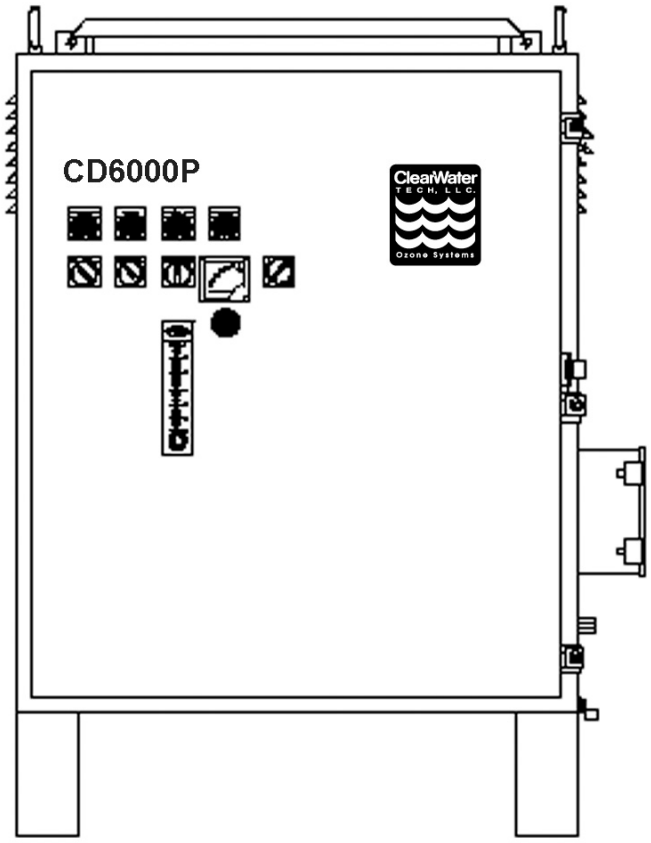
Shown: ClearWater Tech RMS72 Air Prep. System

AIR PREP SYSTEM	SPECIFICATIONS	OXYGEN OUTPUT/SCFH
RMS 48 (4 air prep. modules)	60” h x 42” w x 19” d, 250 lbs	90% (+/-3%) @ 48 scfh
RMS 72 (6 air prep. modules)	75.5” h x 42” w x 19” d, 360 lbs	90% (+/-3%) @ 72 scfh

Section A – Specifications



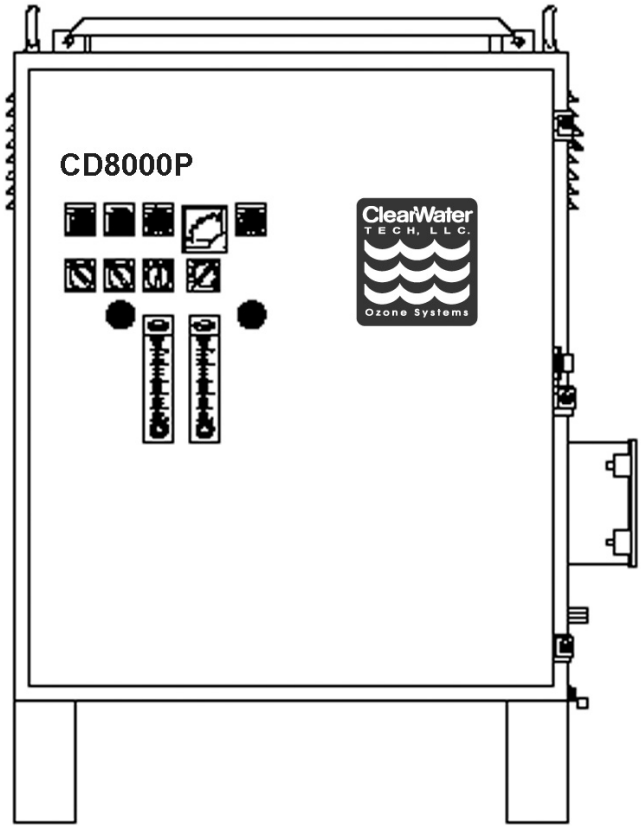
Shown: ClearWater Tech CD4000P Ozone Generator



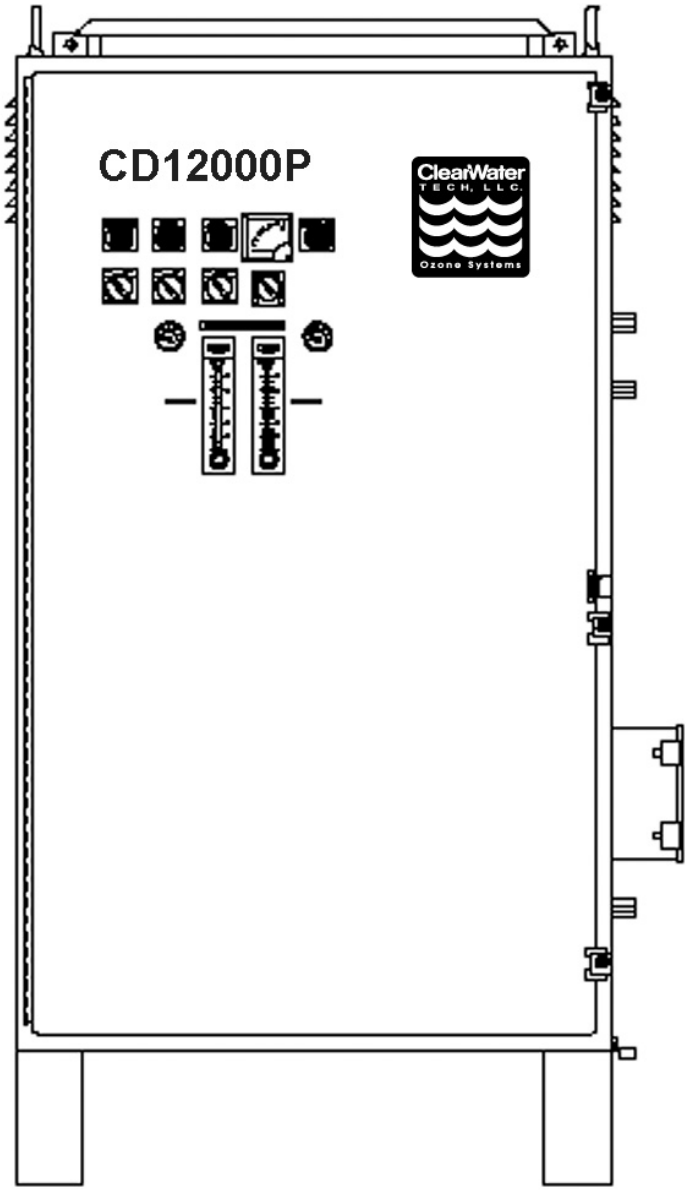
Shown: ClearWater Tech CD6000P Ozone Generator

OZONE GENERATOR	SPECIFICATIONS	OZONE OUTPUT/SCFH
CD4000P	42” h x 28.5” w x 14” d, 149 lbs	56 g/h, 6% @ 24 scfh
CD6000P	52” h x 40.5” w x 18” d, 264 lbs	87 g/h, 6% @ 36 scfh

Section A – Specifications



Shown: ClearWater Tech CD8000P Ozone Generator

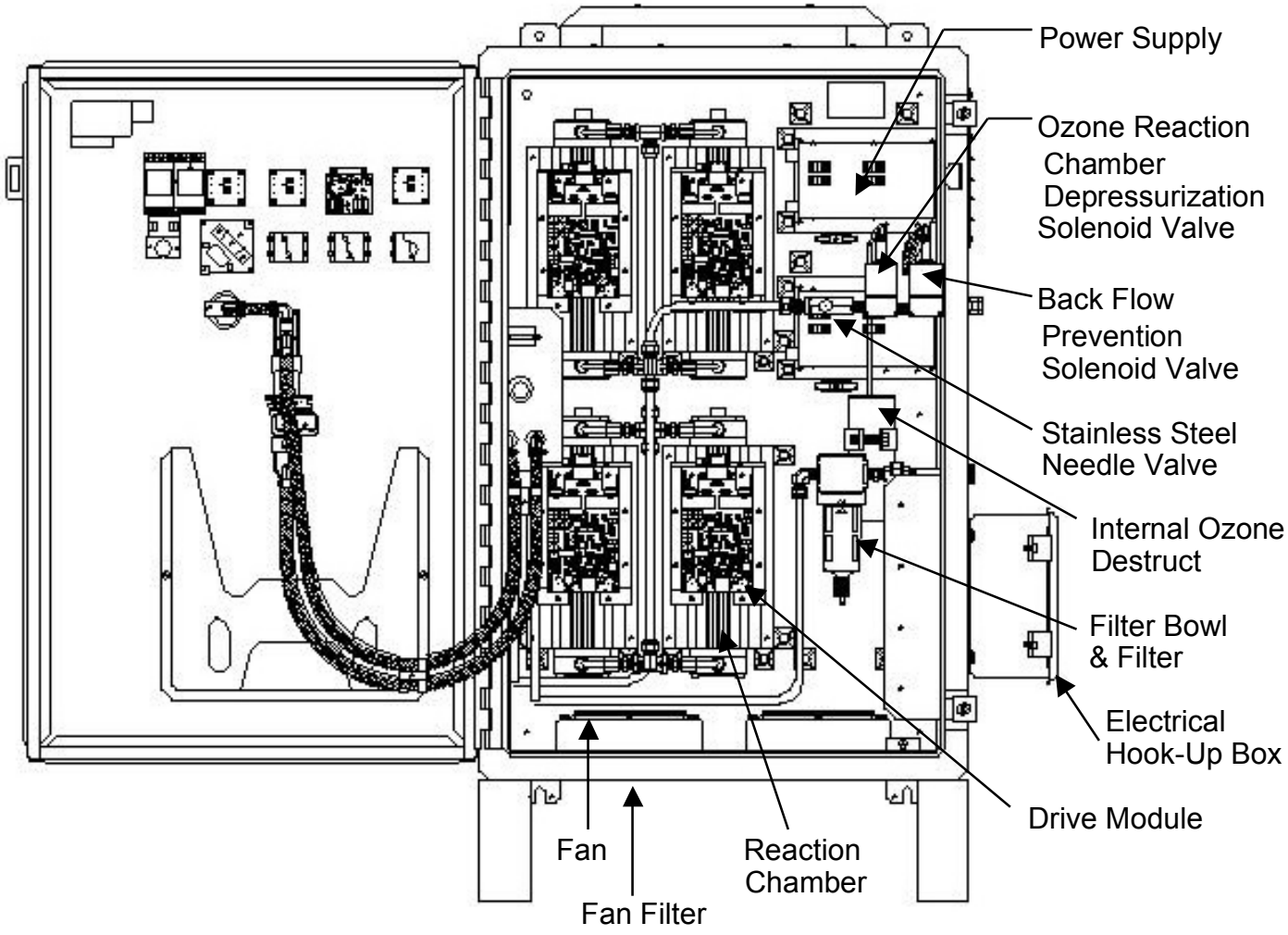


Shown: ClearWater Tech CD12000P Ozone Generator

OZONE GENERATOR	SPECIFICATIONS	OZONE OUTPUT/SCFH
CD8000P	52” h x 40.5” w x 18” d, 314 lbs	116 g/h, 6% @ 48 scfh
CD12000P	70” h x 40.5” w x 18” d, 421 lbs	174 g/h, 6% @ 72 scfh

APPENDIX - Section B

Ozone Generator – Main Components



Shown: ClearWater Tech CD4000P Ozone Generator

(Wire harness omitted for clarity)

APPENDIX - Section C

Parts List

Air Preparation

Description	RMS24 - RMS72
Compressor Inlet Filter	OXS350
Compressor Rebuild Kit	OXS355
Pressure Relief Valve	OXS361
Compressor Vibration Mount	OXS365
Indicating Desiccant Refill – RMS24	DES16
Indicating Desiccant Refill – RMS36, RMS48, RMS72	DES35
Fuse - 30 amp, 240VAC	FUS32

Ozone Generator

Description	CD4000P - CD12000P
Reaction Chamber - Complete	RCC11
Dielectric Anode 2”	RCC71
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	PSR910
Cooling Fan - CD4000P	FA62
Cooling Fan - CD6000P - CD12000P	FA91
Cooling Fan Filter - CD4000P	FA60
Cooling Fan Filter - CD6000P - CD12000P	FA90
4-20mA Control Board	ELPC5430
Solenoid Valve Rebuild Kit	SV1500
Inline Filter	FLT42
Thermostat	ECC160
Replacement Light	INL11
Fuse – Bussmann FNW30 - 30 amp, 240VAC, Main	FUS32
Fuse – Bussmann FNW5 - 5 amp, 240VAC, MCI	FUS22
Fuse, Bussmann MDL-5 – 5 amp, 250VAC Slow Blow, Power Supply	FUS20
Fuse, Littelfuse Minifuse 297003 - 3 amp, 32VAC, Drive Board	FUS66

APPENDIX - Section D

Maintenance Kit

Air Preparation System

ASP285 - Maintenance Kit – RMS24 air preparation system

Part #	QTY	Description
OXS350	2	Oxygen Concentrator – Replacement Compressor Inlet Filter
OXS356	2	Oxygen Concentrator – Compressor Rebuild Kit
OXS361	2	Oxygen Concentrator – Compressor Pressure Relief Valve
DES16	1	Indicating desiccant Refill

ASP290B - Maintenance Kit – RMS36 air preparation system

Part #	QTY	Description
OXS350	3	Oxygen Concentrator – Replacement Compressor Inlet Filter
OXS356	3	Oxygen Concentrator – Compressor Rebuild Kit
OXS361	3	Oxygen Concentrator – Compressor Pressure Relief Valve
DES35	1	Indicating desiccant Refill
FUS32	2	Fuse – Bussmann FNW30 - 30 amp, 240VAC, Main

ASP291B - Maintenance Kit – RMS48 air preparation system

Part #	QTY	Description
OXS350	4	Oxygen Concentrator – Replacement Compressor Inlet Filter
OXS356	4	Oxygen Concentrator – Compressor Rebuild Kit
OXS361	4	Oxygen Concentrator – Compressor Pressure Relief Valve
DES35	1	Indicating desiccant Refill
FUS32	2	Fuse – Bussmann FNW30 - 30 amp, 240VAC, Main

ASP292B - Maintenance Kit – RMS72 air preparation system

Part #	QTY	Description
OXS350	6	Oxygen Concentrator – Replacement Compressor Inlet Filter
OXS356	6	Oxygen Concentrator – Compressor Rebuild Kit
OXS361	6	Oxygen Concentrator – Compressor Pressure Relief Valve
DES35	1	Indicating desiccant Refill
FUS32	2	Fuse – Bussmann FNW30 - 30 amp, 240VAC, Main

Section D - Maintenance Kit

Ozone Generators

ASP165 - Maintenance Kit – CD4000P ozone generator

Part #	QTY	Description
FA60	2	Filter – Fan filter, element only
FLT42	1	Filter – Filter bowl, element only
FUS66	4	Fuse, Littelfuse Minifuse 297003 - 3 amp, 32VAC, Drive Board
FUS20	2	Fuse, Bussmann MDL-5 – 5 amp, 250VAC Slow Blow, Power Supply
FUS22	2	Fuse – Bussmann FNW5 - 5 amp, 240VAC, MCI
FUS32	2	Fuse – Bussmann FNW30 - 30 amp, 240VAC, L1 and L2
INL11	4	Indicator Light – Replacement lamp, 120VAC
ORG110	16	O-ring – 2” CD reaction chamber, pressurized end cap, large
ORG120	16	O-ring – 2” CD reaction chamber, pressurized end cap, small
SV1500	2	Solenoid Valve – 3 way rebuild kit
HSW100	8	Sealing washer - Viton
HWW9004	8	Hardware washer - #6, flat, S.S.

ASP178 - Maintenance Kit – CD6000P ozone generator

Part #	QTY	Description
FA90	2	Filter – Fan filter, element only
FLT42	1	Filter – Filter bowl, element only
FUS66	6	Fuse, Littelfuse Minifuse 297003 - 3 amp, 32VAC, Drive Board
FUS20	2	Fuse, Bussmann MDL-5 – 5 amp, 250VAC Slow Blow, Power Supply
FUS22	2	Fuse – Bussmann FNW5 - 5 amp, 240VAC, MCI
FUS32	2	Fuse – Bussmann FNW30 - 30 amp, 240VAC, L1 and L2
INL11	4	Indicator Light – Replacement lamp, 120VAC
ORG110	24	O-ring – 2” CD reaction chamber, pressurized end cap, large
ORG120	24	O-ring – 2” CD reaction chamber, pressurized end cap, small
SV1500	2	Solenoid Valve – 3 way rebuild kit
HSW100	12	Sealing washer - Viton
HWW9004	12	Hardware washer - #6, flat, S.S.

Section D - Maintenance Kit

Ozone Generators – continued

ASP185 – Maintenance Kit – CD8000P ozone generator

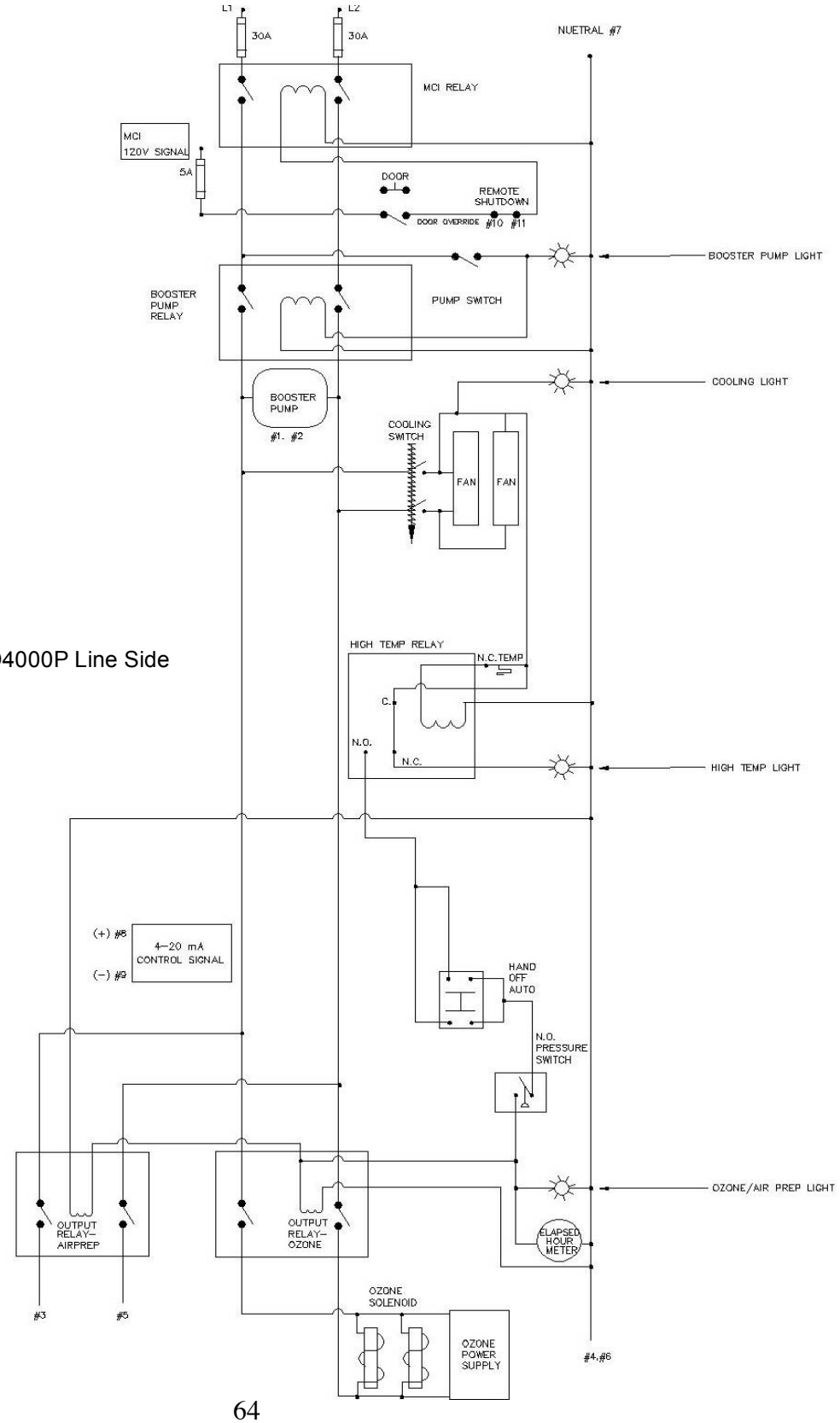
Part #	QTY	Description
FA90	2	Filter – Fan filter, element only
FLT42	1	Filter – Filter bowl, element only
FUS66	8	Fuse, Littelfuse Minifuse 297003 - 3 amp, 32VAC, Drive Board
FUS20	4	Fuse, Bussmann MDL-5 – 5 amp, 250VAC Slow Blow, Power Supply
FUS22	2	Fuse – Bussmann FNW5 - 5 amp, 240VAC, MCI
FUS32	2	Fuse – Bussmann FNW30 - 30 amp, 240VAC, L1 and L2
INL11	4	Indicator Light – Replacement lamp, 120VAC
ORG110	32	O-ring – 2” CD reaction chamber, pressurized end cap, large
ORG120	32	O-ring – 2” CD reaction chamber, pressurized end cap, small
SV1500	4	Solenoid Valve – 3 way rebuild kit
HSW100	16	Sealing washer - Viton
HWW9004	16	Hardware washer - #6, flat, S.S.

ASP242 - Maintenance Kit – CD12000P ozone generator

Part #	QTY	Description
FA90	2	Filter – Fan filter, element only
FLT42	1	Filter – Filter bowl, element only
FUS66	12	Fuse, Littelfuse Minifuse 297003 - 3 amp, 32VAC, Drive Board
FUS20	4	Fuse, Bussmann MDL-5 – 5 amp, 250VAC Slow Blow, Power Supply
FUS22	2	Fuse – Bussmann FNW5 - 5 amp, 240VAC, MCI
FUS32	2	Fuse – Bussmann FNW30 - 30 amp, 240VAC, L1 and L2
INL11	4	Indicator Light – Replacement lamp, 120VAC
ORG110	48	O-ring – 2” CD reaction chamber, pressurized end cap, large
ORG120	48	O-ring – 2” CD reaction chamber, pressurized end cap, small
SV1500	4	Solenoid Valve – 3 way rebuild kit
HSW100	24	Sealing washer - Viton
HWW9004	24	Hardware washer - #6, flat, S.S.

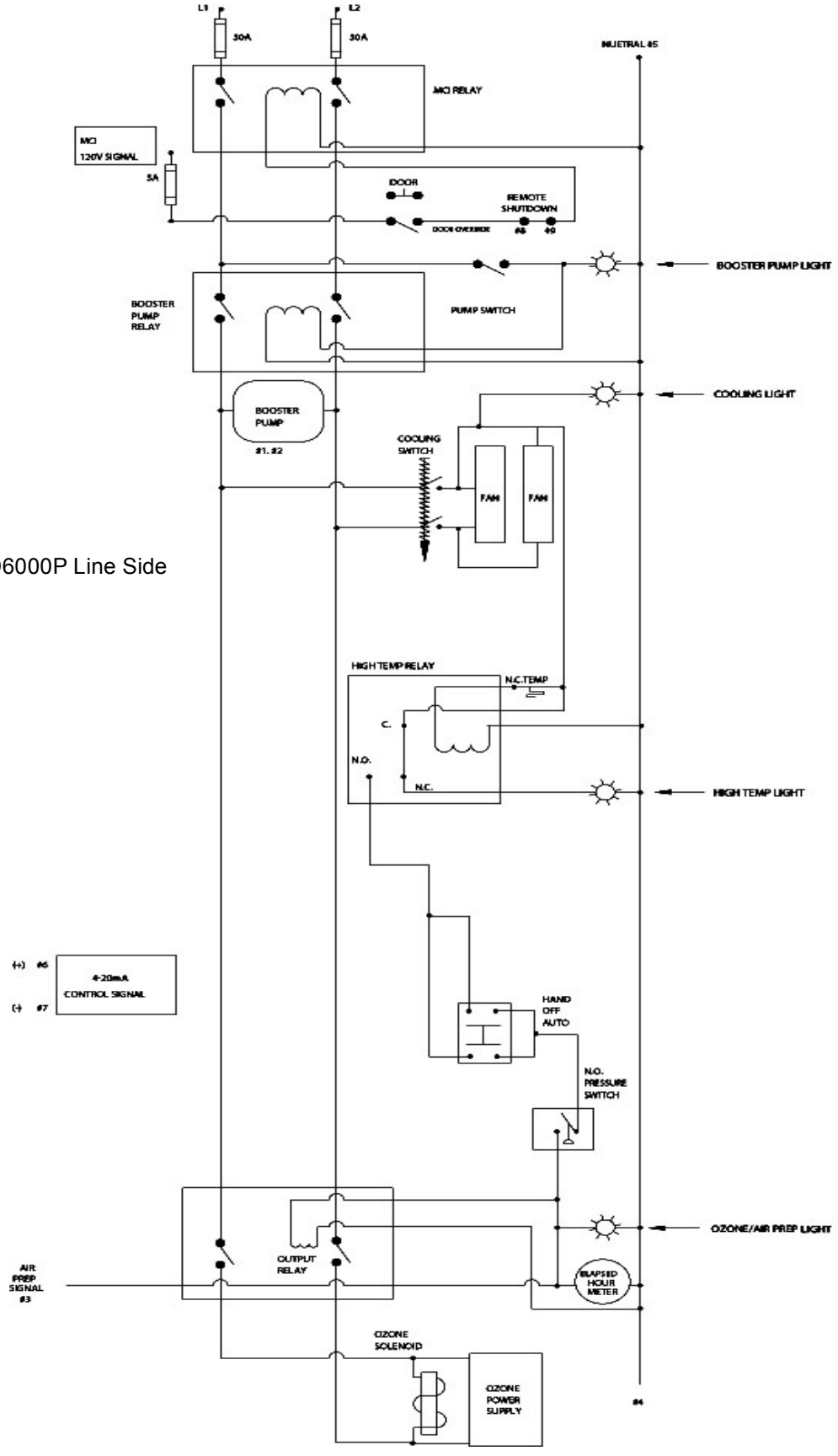
APPENDIX - Section E

Logic Schematics



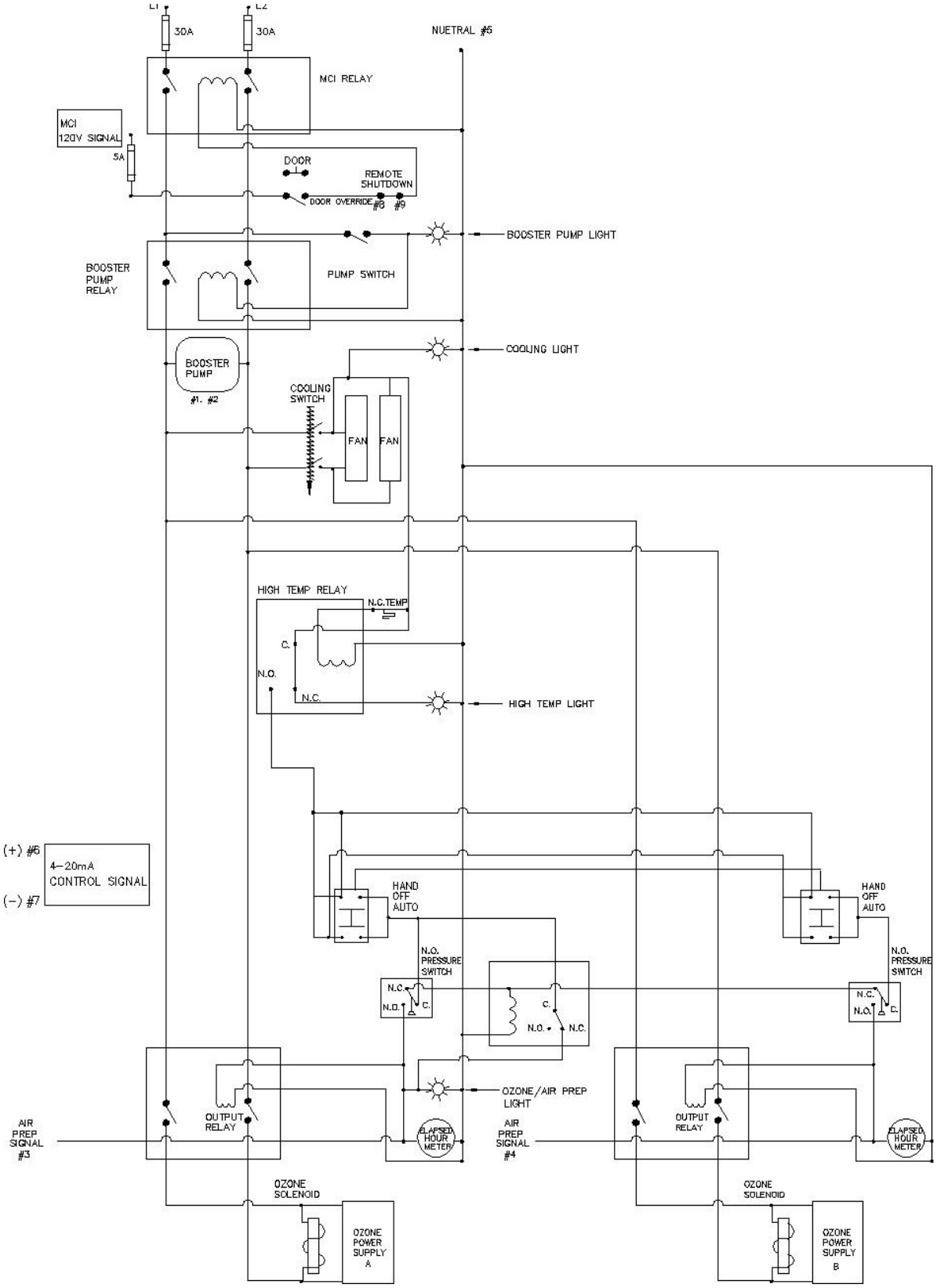
Shown: Electrical Schematic – CD4000P Line Side

Logic Schematics - **continued**



Shown: Electrical Schematic – CD6000P Line Side

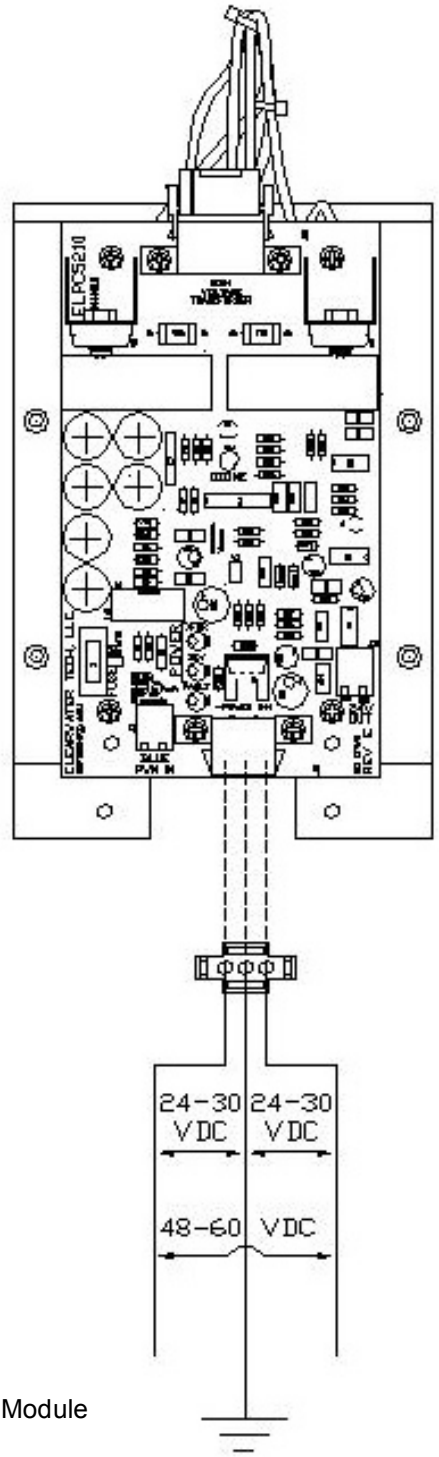
Logic Schematics – continued



Shown: Electrical Schematic – CD8000P and CD12000P Line Side

APPENDIX - Section F

Drive Module Input Voltages

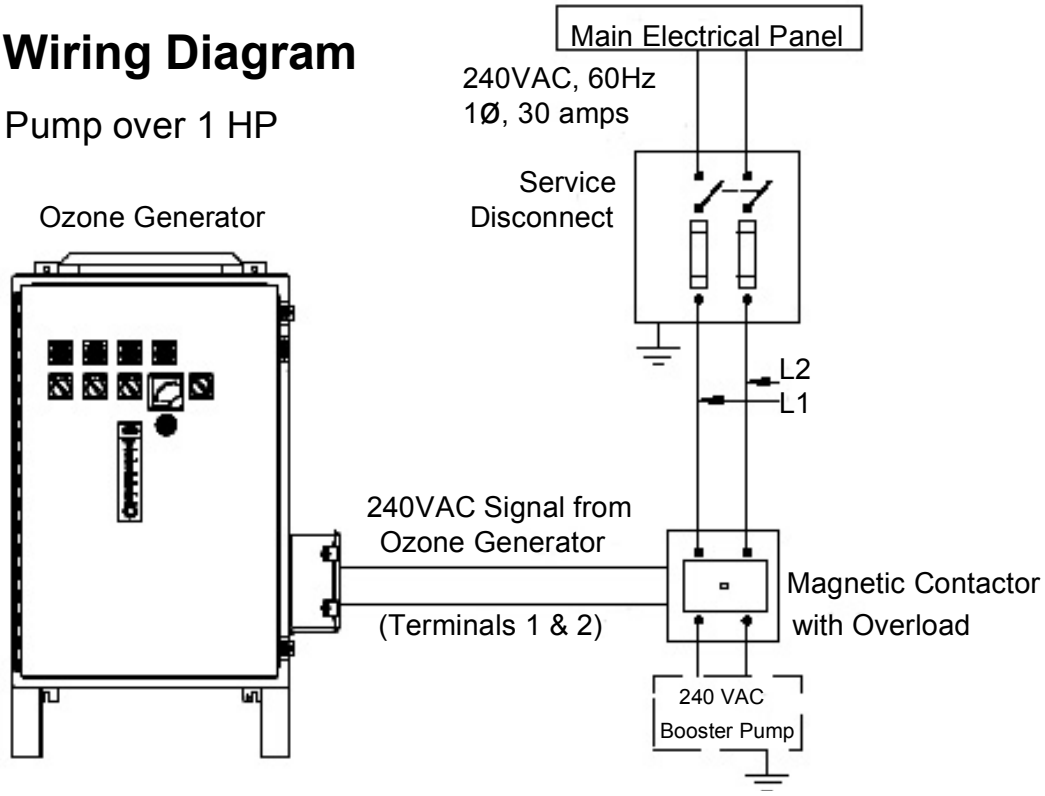


Shown: HO Drive Module

APPENDIX - Section G

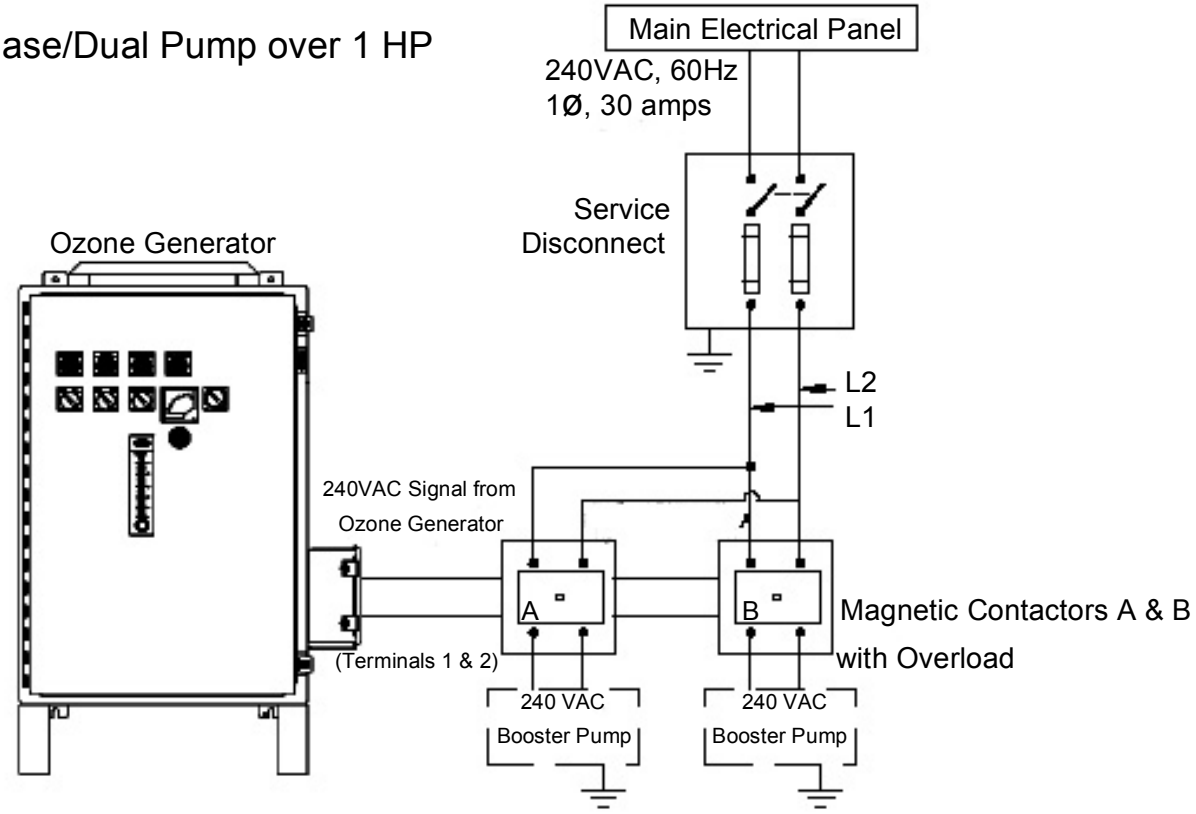
Booster Pump Wiring Diagram

Single Phase/Single Pump over 1 HP



Booster Pump Wiring Diagram

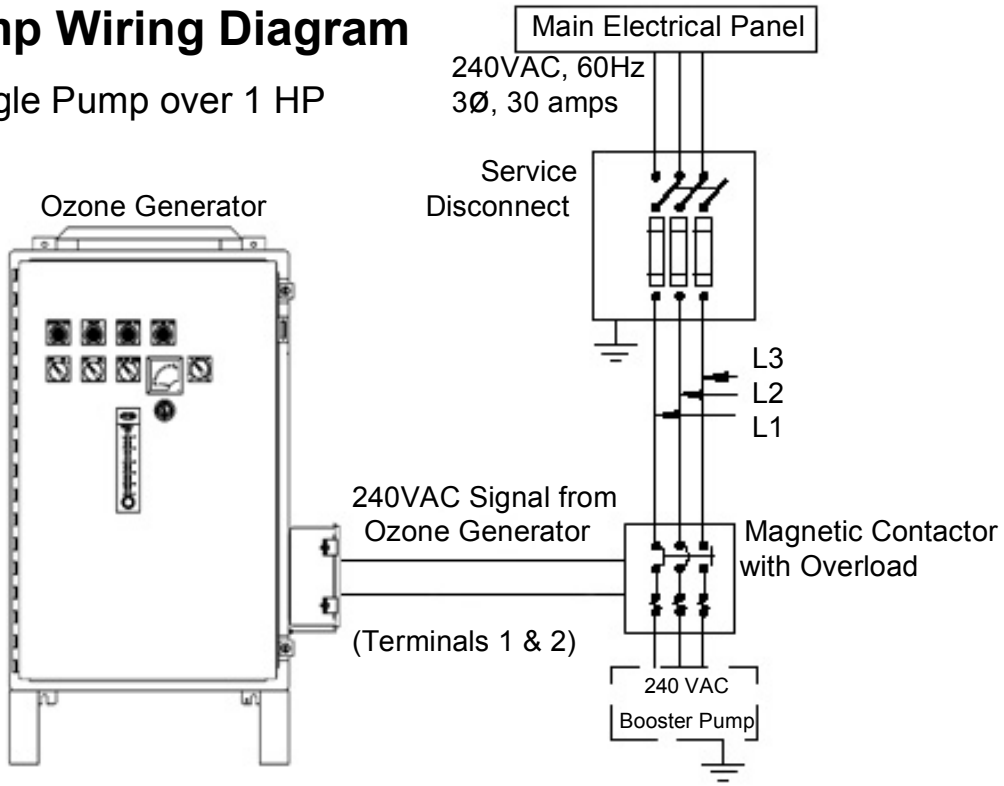
Single Phase/Dual Pump over 1 HP



Section G – Booster Pump Wiring Diagram

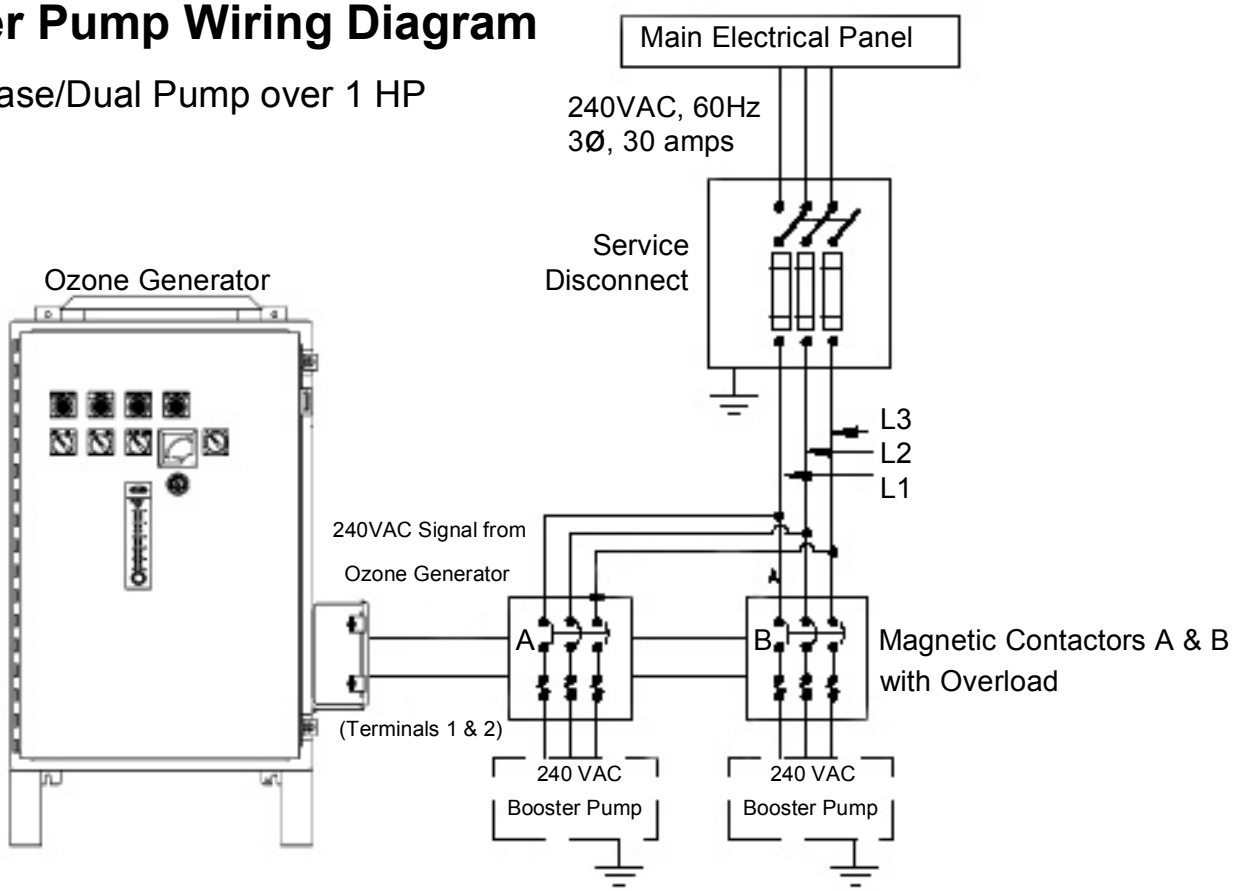
Booster Pump Wiring Diagram

Three Phase/Single Pump over 1 HP



Booster Pump Wiring Diagram

Three Phase/Dual Pump over 1 HP



APPENDIX - Section H

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.