Ozone Systems

Installation & Maintenance Manual

CD-4000 • CD-6000
CD-8000 • CD-12000
&
CD4000HO • CD6000HO
CD8000HO • CD12000HO

Corona Discharge Ozone Generators

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

ClearWater Tech, LLC.

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 ClearWaterTech ozone systems found in the field. If you have any questions, please contact your ClearWater Tech dealer or the ClearWater Tech service department.

CHAPTER

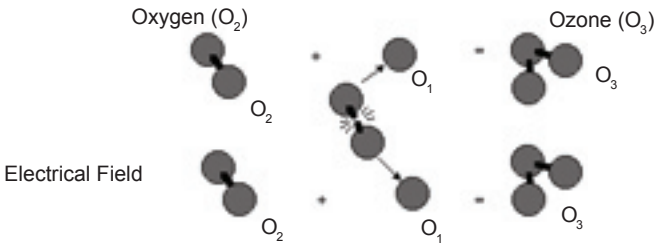
1

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 microflocculation 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 32°F (approx. 150% that of oxygen).
Solubility:	Only partially soluble in water, but about 10-20 times more soluble than oxygen (at 68°F).

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

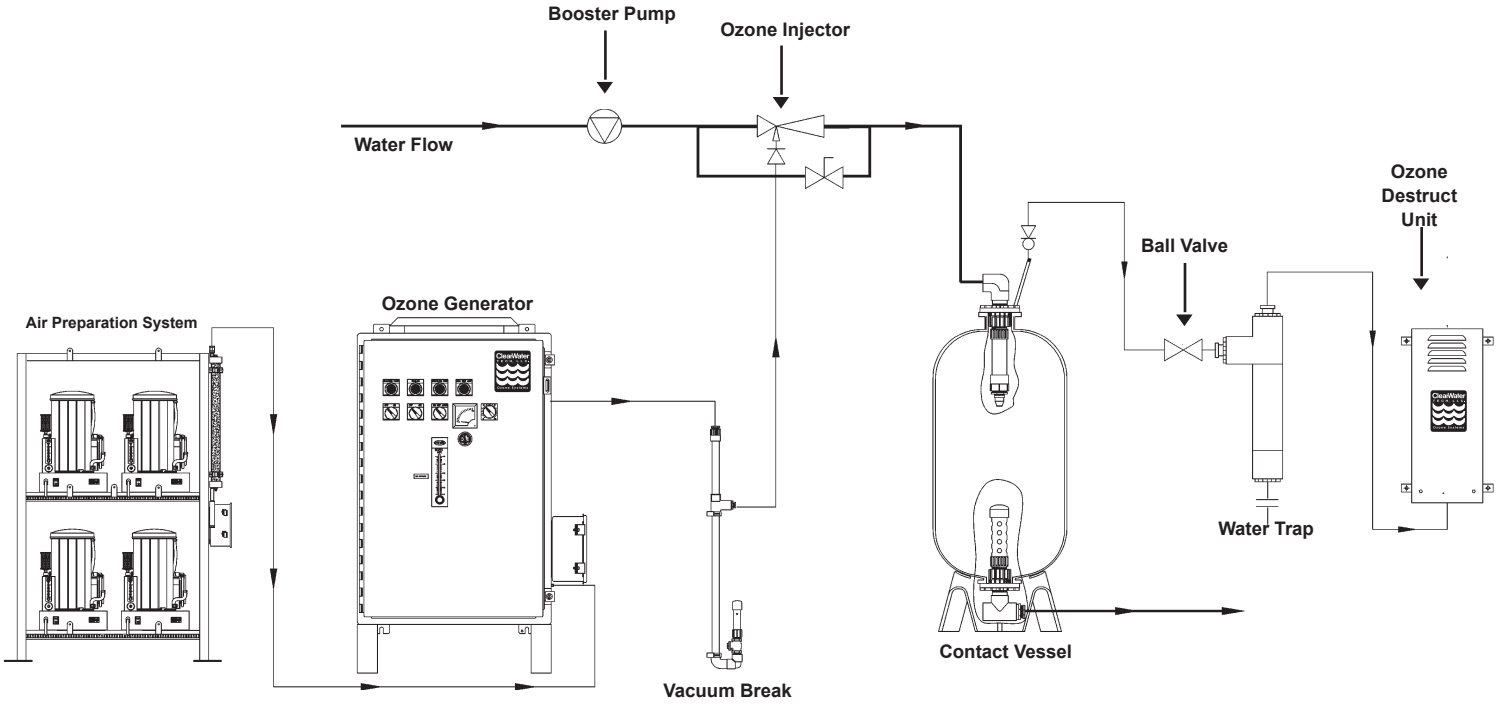
2

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 CD4000HO, CD6000HO, CD8000HO, and CD12000HO ozone generators have been tested and certified by the Water Quality Association according to NSF/ANSI 50. Each complete, integrated system includes the 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 CD-8000HO Ozone System

Air Preparation System

ClearWater Tech commercial cabinet ozone generators require a source of clean, dry, 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 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.

Ozone Generator

The feed gas produced by the air preparation system is supplied to the ClearWater Tech ozone generator at a maximum pressure of 10 pounds per square inch (psi). The built-in pressure regulator filters the feed gas and reduces its supply pressure to a maximum of 5 psi (set at the factory). It then flows into the built-in air flow meter(s); at this point, the feed gas is mostly *drawn* through the ozone generator by the vacuum created at the ozone injector - rather than by the *pressure* from the air preparation system compressors.

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, pressure switch, timer or circulation pump. Many safety features are also built in, including vacuum switch(es), thermal protection and back flow prevention.

Ozone Injection/Contacting

The ozone injector serves two purposes: One, it creates the vacuum required to safely draw the ozone gas out of 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.

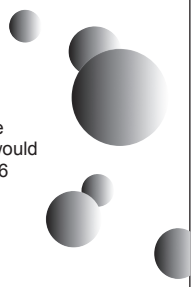
ClearWater Tech injection systems use only Mazzei® injectors for maximum mass transfer efficiency. The injector produces a cavitation effect, enabling the ozone gas to join the water stream in the form of extremely tiny bubbles. These bubbles must be as small as possible in order to increase the ratio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

A Short Course in Fine Bubbles

LESSON 1 - The large bubble (20mm) has a volume of 4.19 cm^3 and a surface area of 12.6 cm^2.

LESSON 2 - 296 small bubbles (3mm) could be made from the large bubble in lesson 1. They would have a total surface area of 83.6 cm^2. This is 6.6 times the surface area of the large bubble.

LESSON 3 - Theoretically, 6.6 times as much water could be ozonated with the same amount of ozone!



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 a 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 stainless steel 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

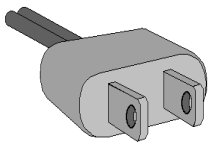
Two aspects of ClearWater Tech ozone generators represent potential dangers – ozone gas and high voltage electricity.

OZONE GAS -

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

ClearWater Tech corona discharge ozone generators are designed to operate under a vacuum condition. While this would normally prevent ozone gas from escaping into the atmosphere, 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 -



WARNING: 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 transformer then takes that current and 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 with 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.

CHAPTER

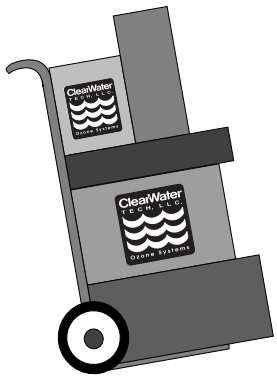
4

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).
  - The pH adjustment chemical injection point should be located *downstream* of the residual sanitizer injection point, if so equipped.
  - 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 concrete surface should be provided for the air preparation system and ozone generator. These components should be securely fastened to the concrete 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 85°F continuous. If the temperature around the equipment consistently exceeds 100°F, additional air cooling must be provided.
  - Humidity: 0 – 90% relative humidity, non-condensing environment
  - Line voltage: +/-10% of rated input

  Note: Equipment installed in extreme environmental conditions will void manufacturer's warranty.

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

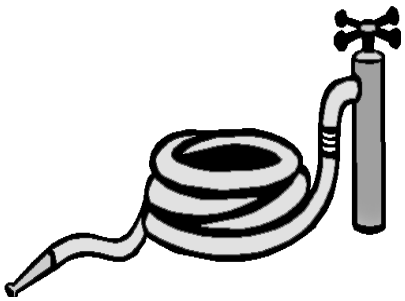
CHAPTER

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.**
- **If so equipped, the injection point for the pH adjustment chemical will always be downstream of all other treatment processes.**
- **Use Schedule 80 PVC for all plumbing connections whenever 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**
  - **Viton**
  - **Teflon®**
  - **Stainless Steel (300 series)**
  - **EPDM**
  - **Kynar®**
  - **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 prints 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 and 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 back pressure to the injector, minimize the number of elbows between the injector manifold(s) and contact vessel. The contact vessel is of 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 vessels. 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 to solid mounting surfaces using appropriate hardware and according to local codes. If installing a ClearWater Tech contact column, use a ClearWater Tech contact column mounting kit and install according to the instructions below. If installing a contact tank, secure to a solid horizontal surface using mounting flange or feet.

Step 8: Install the contact vessel venting system into the top of the vessel. If using the ClearWater Tech contact column, the vent kit supplied includes fittings, a control valve and Teflon® tubing. The contact tank venting system includes a stainless steel 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.

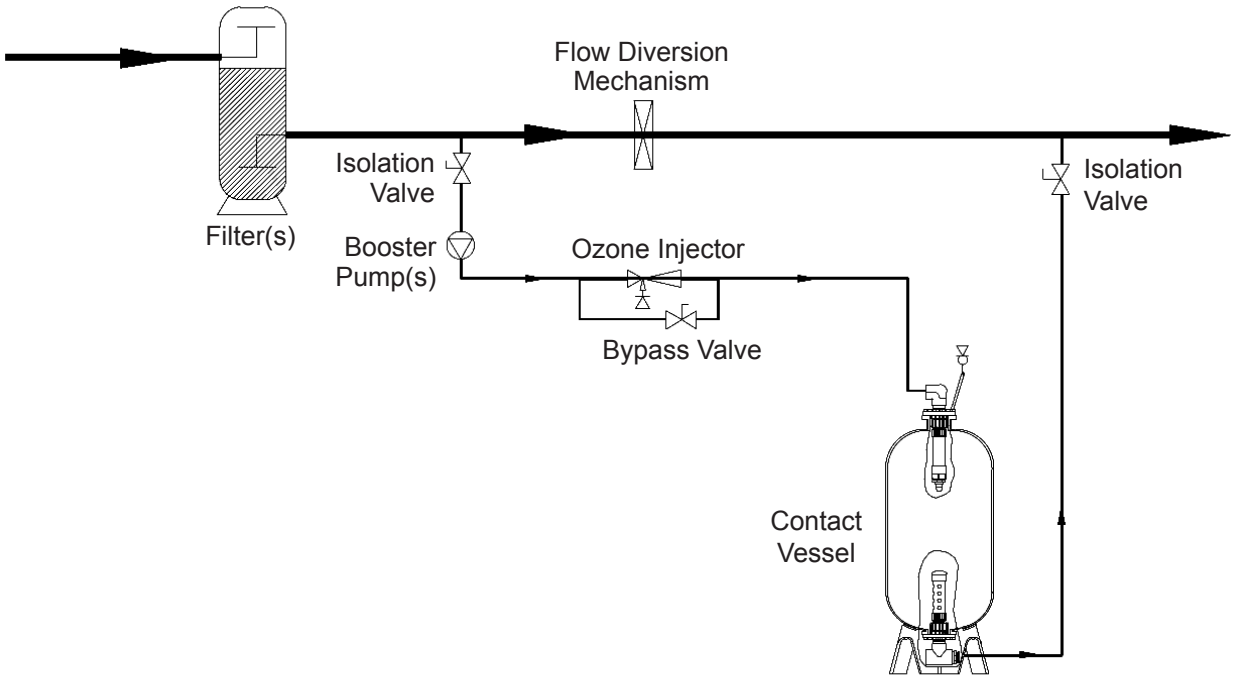
Step 3: Cut the unistrut bar to the desired length and attach it to the 'L' bracket using hardware provided.

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.

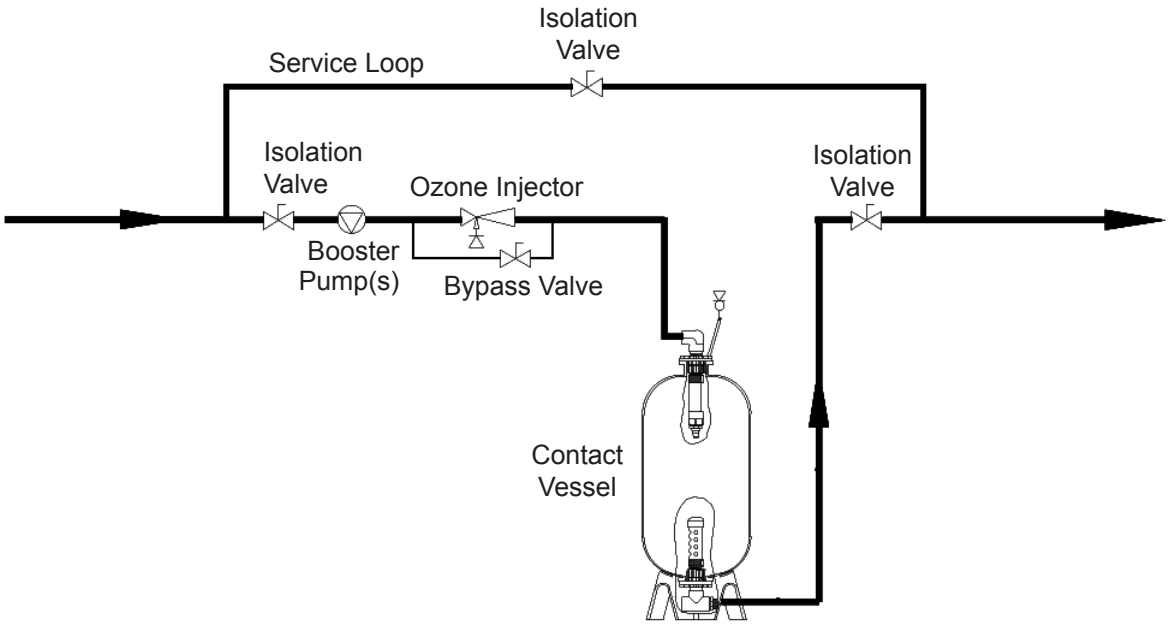
Sidestream Plumbing Installation Diagram

Figure 5-1



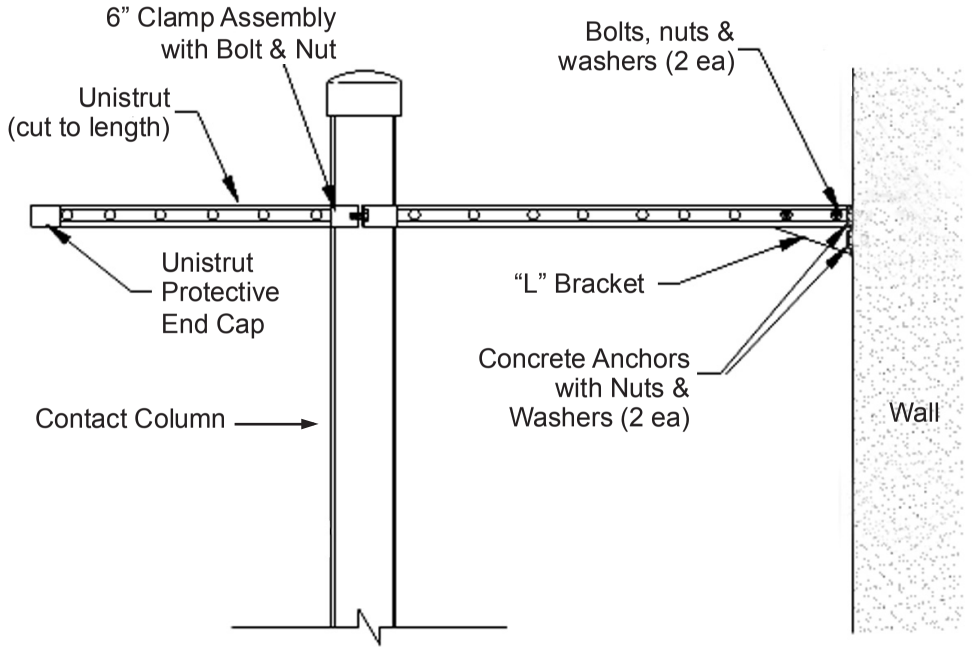
Full Flow Plumbing Installation Diagram

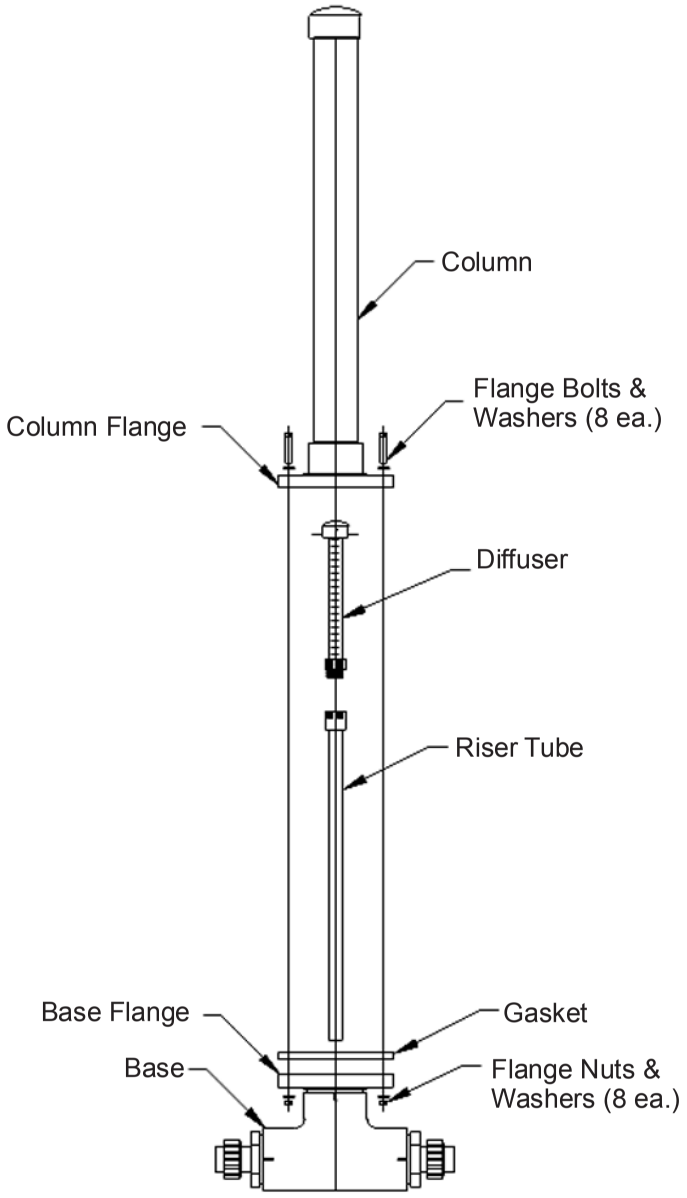
Figure 5-2



Contact Column Installation Diagram

Figure 5-3





Contact Column Exploded View

Figure 5-4

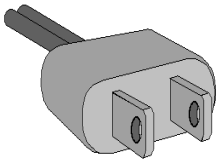
CHAPTER

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-F). 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.

NOTES:

- **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 starters. 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 – A power source (CD-4000 and CD4000HO) or a control signal circuit (CD- 6000 through CD12000HO) for the ozone air preparation system. **Note: Refer to Figure 6-2, A-C for air preparation system hook-up box diagrams.**

• **CD-4000/CD4000HO:** The air preparation system (two individual oxygen concentrator modules) receives its power from the ozone generator hook-up box. Depending on local codes, use either the OXS100 series power cords (plugs removed) or wire in conduit to terminate the oxygen concentrators on terminals 3 & 4 and 5 & 6 of the ozone generator hook-up box. Terminals 3 & 5 are "hot" and terminals 4&6 are neutral. Make sure the power switch on each of the oxygen concentrators is in the 'ON' position, as power to them will be controlled by the ozone generator.

• **CD-6000 through CD12000HO:** Depending on model, the air preparation system consists of either three, four, or six individual oxygen concentrator modules mounted on a powder-coated steel rack. Called a RMS rack, each 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.

• **CD-6000/CD6000HO:** 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 & 6-2). Make sure the power switch on each oxygen concentrator module is in the 'ON' position.

• **CD-8000/CD8000HO and CD-12000/CD12000HO:** 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. 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.

Step 6: System Neutral – From main power.

• **CD-4000/CD4000HO:** Terminate the neutral (white) main power wire (see Step 2) to terminal 7 in the ozone generator hook-up box.

• **CD-6000 through CD12000HO:** 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.

Standard Output Models (CD-4000 through CD-12000): The ORP controller supplies a 120VAC control signal to the ozone generator. With the ozone generator in the 'AUTO' position (see cabinet control panel diagrams-Figure 8-3, A or C), this signal controls the 'ON' and 'OFF' function of the ozone generator. In the 'MANUAL' position, the ORP feature is disabled.

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 'hot' lead from the ORP controller to terminal 8 (CD-4000) or terminal 6 (CD-6000 through CD-12000) in the ozone generator hook-up box.

Step 3: Using #18 AWG, wire the 'neutral' from the ORP controller to terminal 9 (CD-4000) or terminal 7 (CD-6000 through CD-12000) 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. Pay particular attention to the location of the probes and consider the application.

High Output (HO) Models (CD-4000HO through CD-12000HO): 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 (4 mA = 0% output, 20 mA = 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, B or D). The percent of maximum ozone output (0-100%) is indicated by the meter to the left of (CD4000HO & CD6000HO) or directly above (CD8000HO & CD12000HO) 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 (CD4000HO) or terminal 6 (CD6000HO through CD12000HO) in the ozone generator hook-up box.

Step 3: Using #18 AWG, wire the 'negative'(-) lead from the ORP controller to terminal 9 (CD4000HO) or terminal 7 (CD6000HO through CD12000HO) in the ozone generator hook-up box.

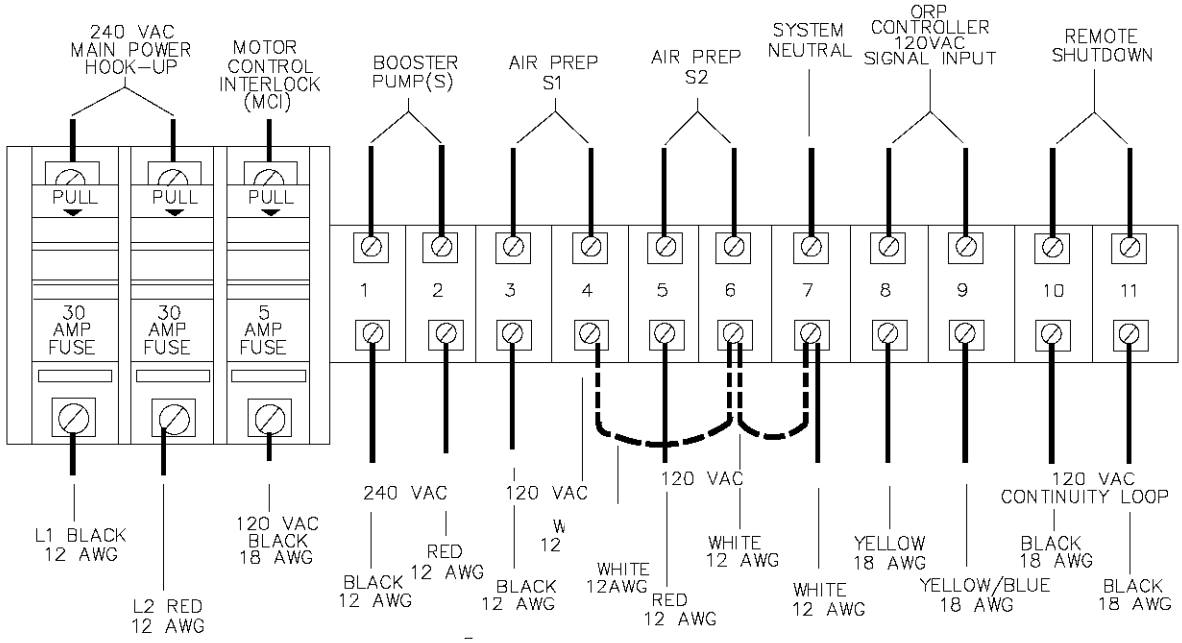
Step 4: Complete the required programming and calibration steps as outlined in the installation manual supplied with the ORP controller.

2. Remote Shutdown Device – A *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 (CD-4000 & CD4000HO) or terminals 8 & 9 (CD-6000 through CD12000HO). The jumper *must* be removed if this feature is utilized.

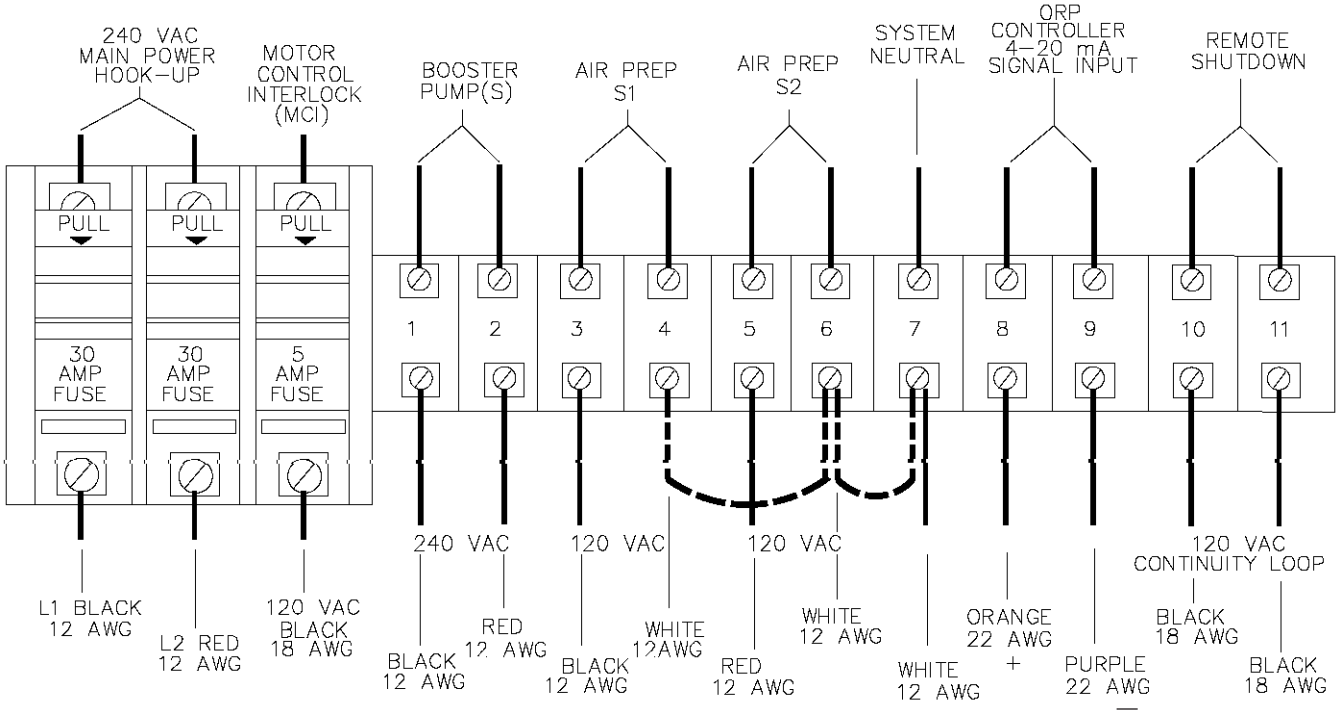
Step 1: Using #18 AWG (minimum), wire from terminal 10 (CD-4000 & CD4000HO) or terminal 8 (CD-6000 through CD12000HO) in the ozone generator hook-up box to the common of the device's alarm relay.

Step 2: Using #18 AWG (minimum), wire from terminal 11 (CD-4000 & CD4000HO) or terminal 9 (CD-6000 through CD12000HO) in the ozone generator hook-up box to the device's normally-closed alarm relay.

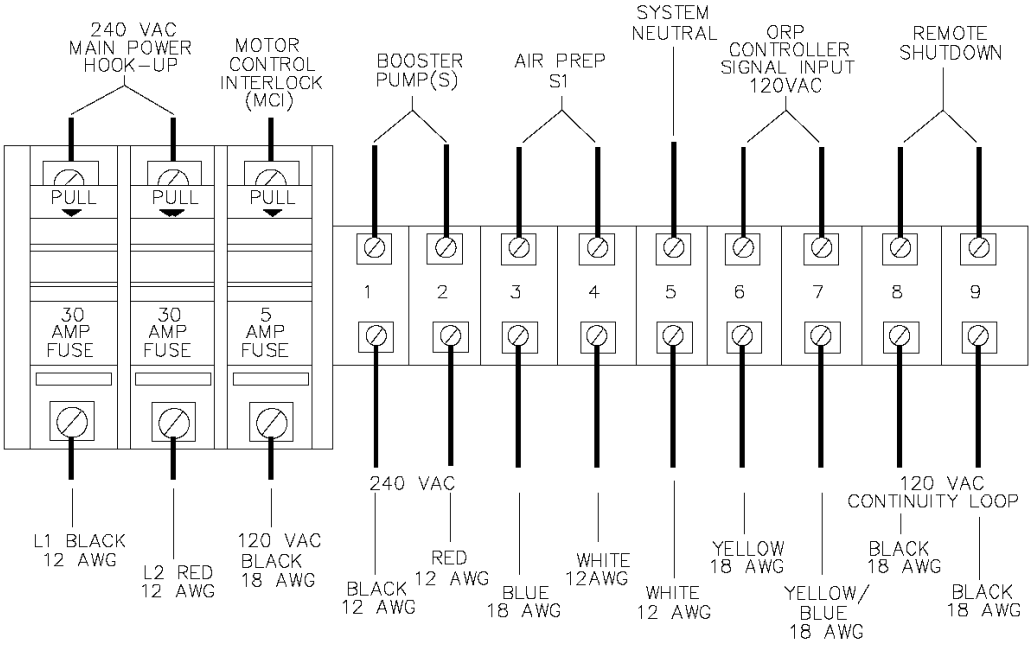
ELECTRICAL HOOK-UP BOX DIAGRAM
CD-4000 240 VAC, 50/60 Hz
1Ø, 18 amp system Figure 6-1 A



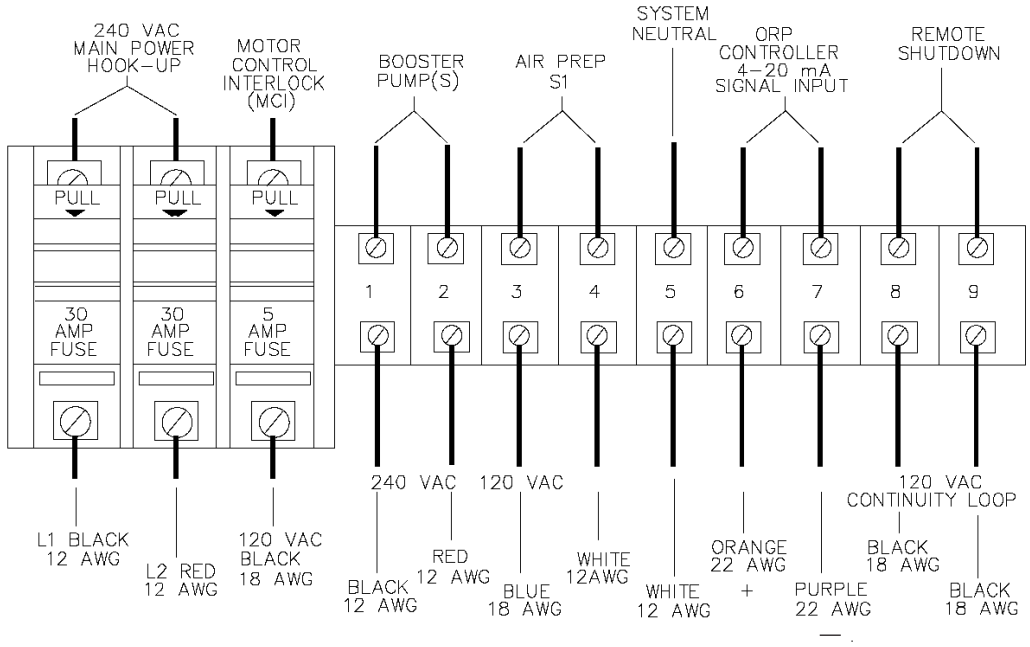
ELECTRICAL HOOK-UP BOX DIAGRAM
CD4000HO 240 VAC, 50/60 Hz
1Ø, 18 amp system Figure 6-1 B



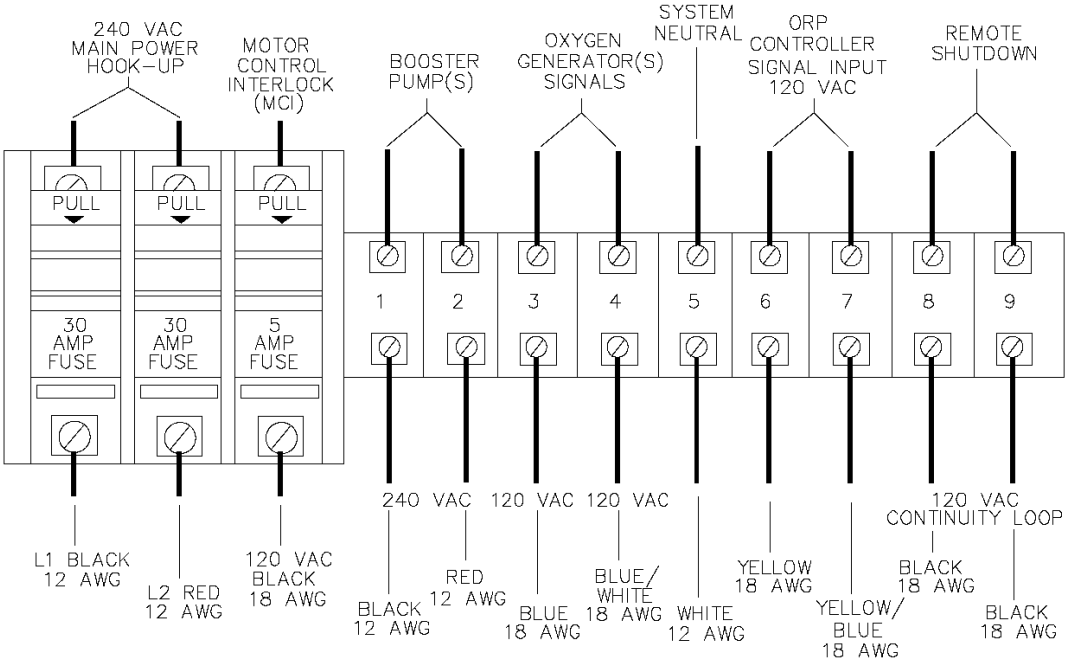
ELECTRICAL HOOK-UP BOX DIAGRAM
CD-6000 240 VAC, 50/60 Hz
1Ø, 30 amp system Figure 6-1 C



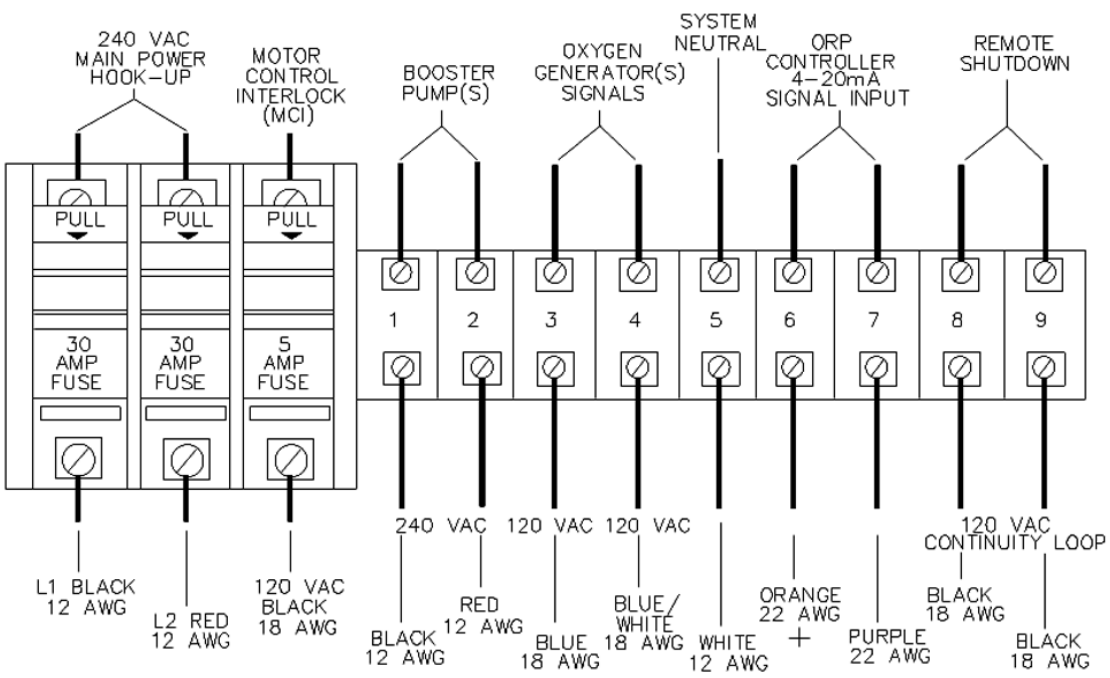
ELECTRICAL HOOK-UP BOX DIAGRAM
CD6000HO 240 VAC, 50/60 Hz
1Ø, 30 amp system Figure 6-1 D



ELECTRICAL HOOK-UP BOX DIAGRAM
CD-8000 - CD-12000 240 VAC, 50/60 Hz
1Ø, 30 amp system Figure 6-1 E

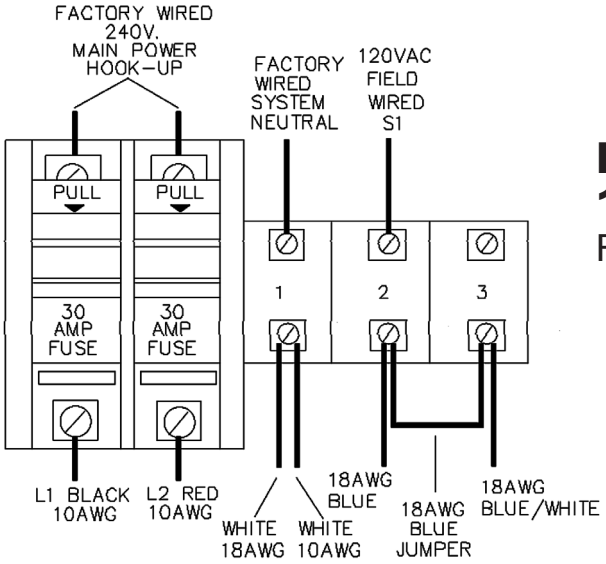


ELECTRICAL HOOK-UP BOX DIAGRAM
CD8000HO - CD12000HO 240 VAC, 50/60 Hz
1Ø, 30 amp system Figure 6-1 F



ELECTRICAL HOOK-UP BOX DIAGRAMS

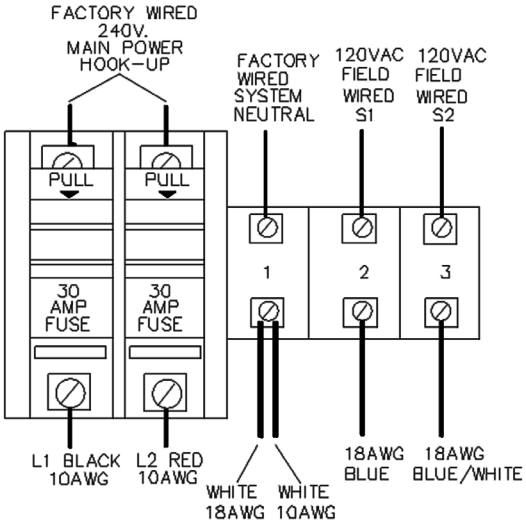
Air Preparation Systems



RMS-45 240 VAC, 50/60 Hz 1Ø, 11 amp system

Figure 6-2 A

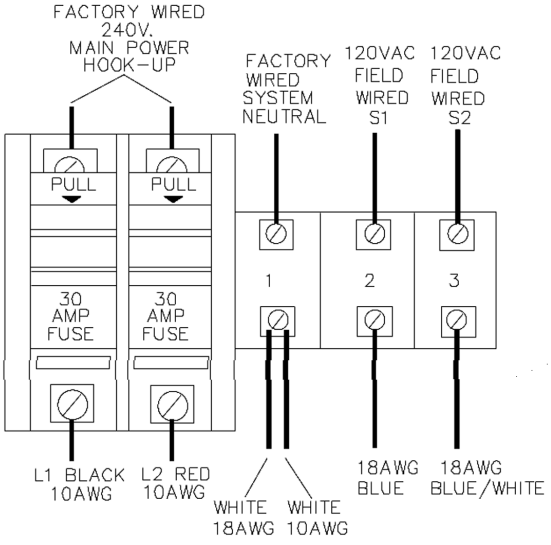
For CD-6000 & CD6000HO



RMS-60 240 VAC, 50/60 Hz 1Ø, 11 amp system

Figure 6-2 B

For CD-8000 & CD8000HO



RMS-90 240 VAC, 50/60 Hz 1Ø, 17 amp system

Figure 6-2 C

For CD-12000 & CD12000HO

CHAPTER

7

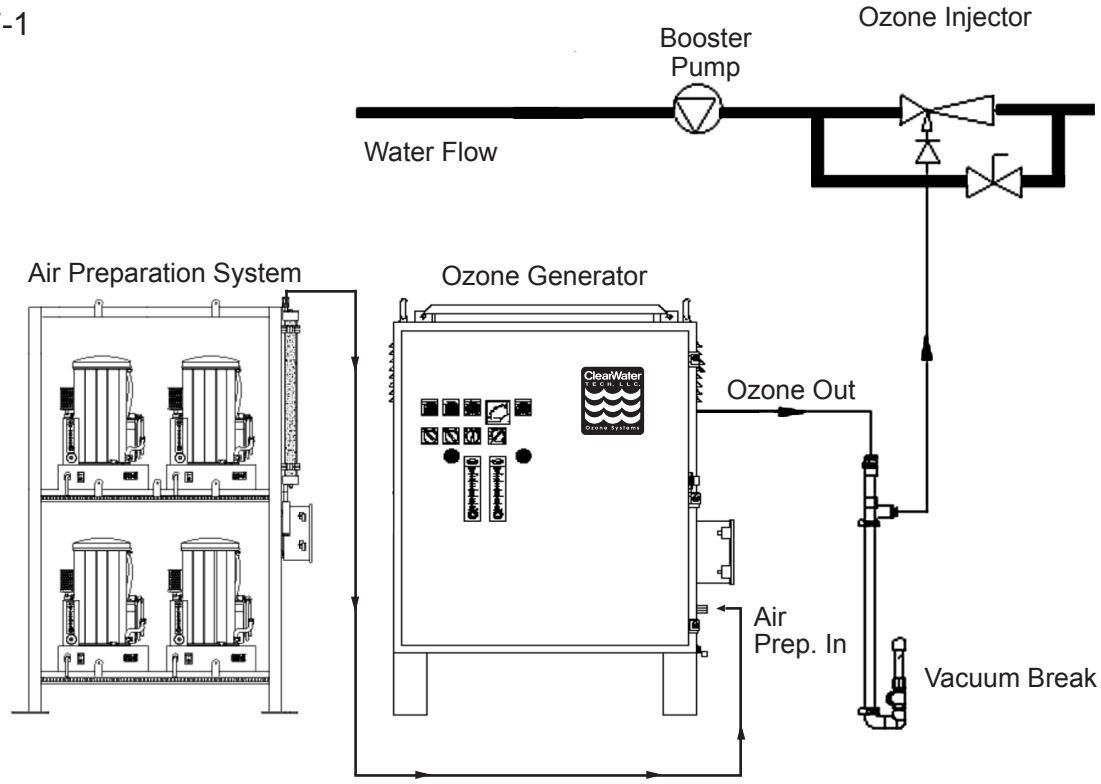
Installation Procedures

Pneumatic

INSTALLATION PROCEDURES - Pneumatic

This section outlines the steps required to complete the ozone system pneumatic hook-ups. The system components involved 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, oxygen-enriched air (90% +/- 3% oxygen purity at -100˚F dew point). The air is drawn through the ozone generator (where ozone is produced from the oxygen in the air stream) and 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: CD-4000 & CD4000HO: Follow instructions included in the hook-up kit provided for these models.

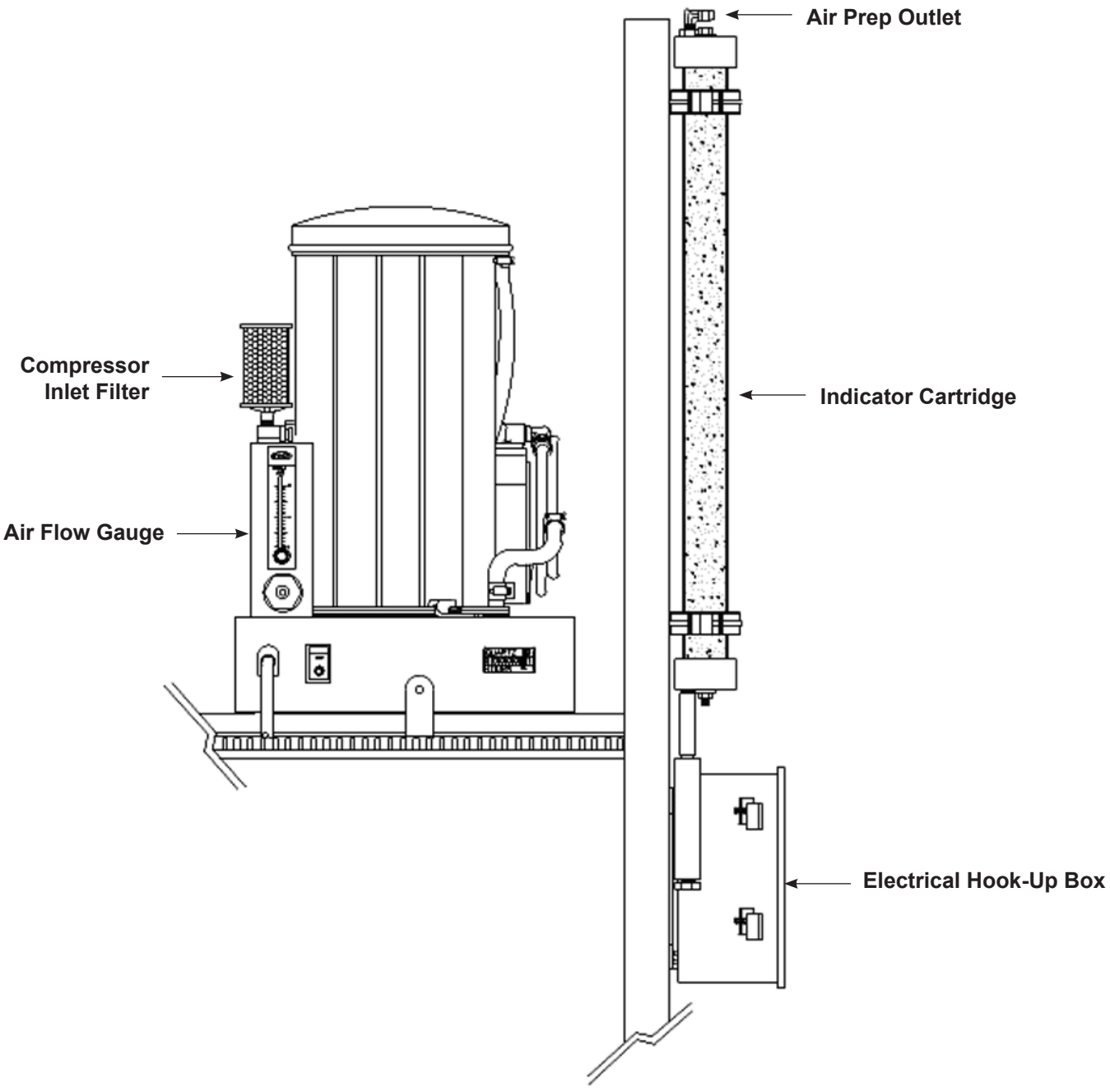
CD-6000 through CD12000HO: Using a suitable length of 3/8" braided tubing (20 feet is provided), attach one end to the brass fitting *on top* of the clear indicator cartridge on the RMS rack (see Figure 7-2). Secure the tubing to the brass fitting with one of the hose clamps provided.

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 the drain port, protecting the ozone generator from potential water damage.

Installation Steps

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 Port is *below* the level of the ozone generator's 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 illustration).

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 water begins to flow out of the Drain Port.

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 Kynar® 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. CD-4000 through CD6000HO models have a single outlet labeled "Ozone Out". CD-8000 through CD12000HO models have dual ozone outlets, labeled "Ozone A" and "Ozone B".

Step 6: Connect one end of a suitable length of Teflon® ozone delivery line to the Kynar® fittings installed into the ozone outlets (see Step 5 above). Attach the other end of the Teflon® delivery line to the Kynar® 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 CD-6000 through CD12000HO 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.

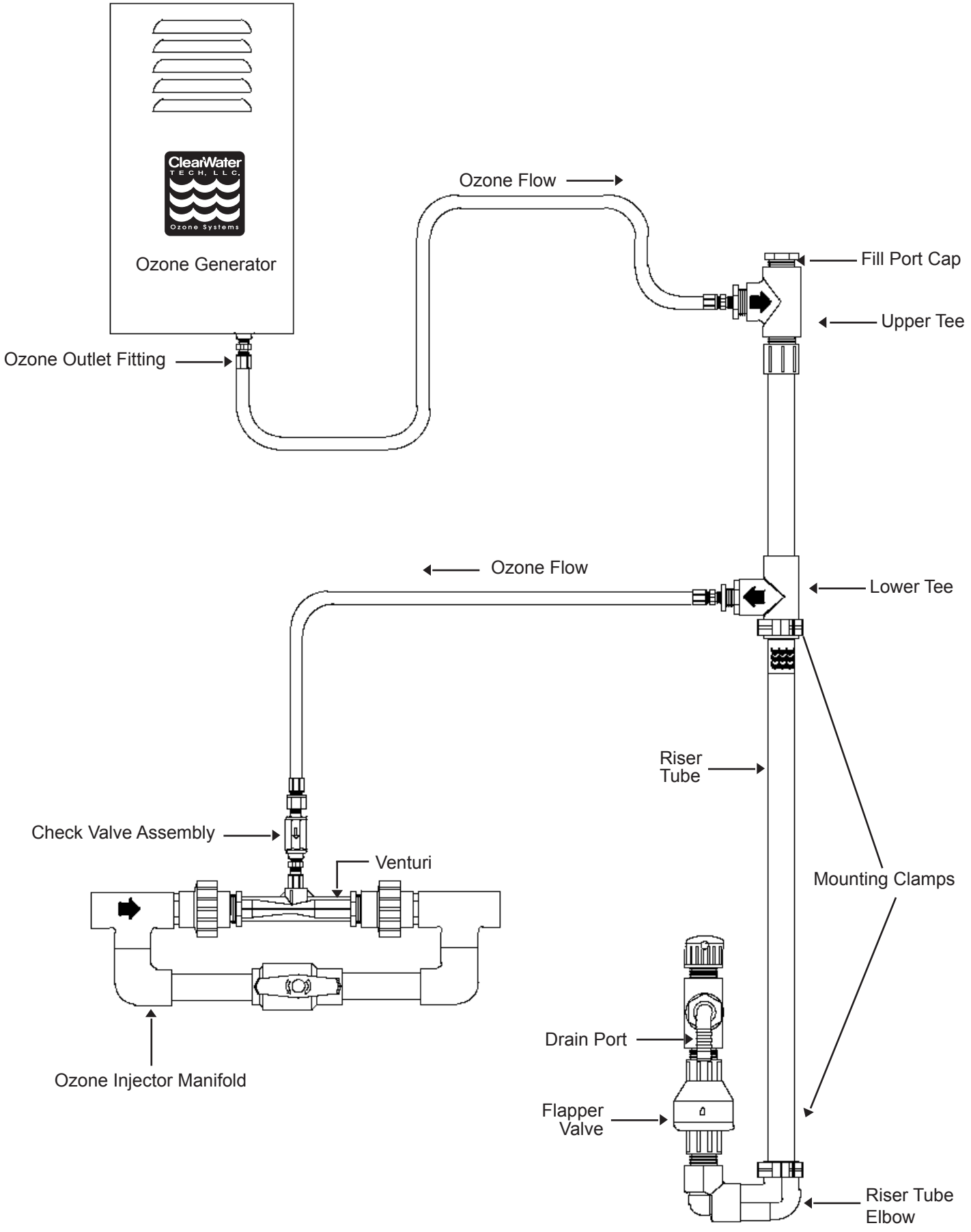
Step 7: Connect one end of a second length of Teflon® delivery line to the Kynar® fitting threaded into the Lower Tee. Attach the other end of the delivery line to the Kynar® fitting located on top of the check valve assembly.

Step 8: If necessary, attach one end of a suitable length of 3/4" braided vinyl tubing (not included) to the barbed fitting on the Drain Port. For safety considerations and/or to prevent potential damage to other equipment in the area, direct the other end of tubing to suitable waste.

Step 9: Adjustments to the valve on the ozone injector manifold will be necessary. These steps are covered in Chapter 8 - "Initial 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 stainless steel off-gas vent, this two-stage ozone destruct system is an efficient way to properly vent the ozone system contact vessel.

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) of the water trap.

Step 4: Using the Kynar® thread-by-compression fitting provided, attach one end of a suitable length of the 1/4" 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 stainless steel 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.

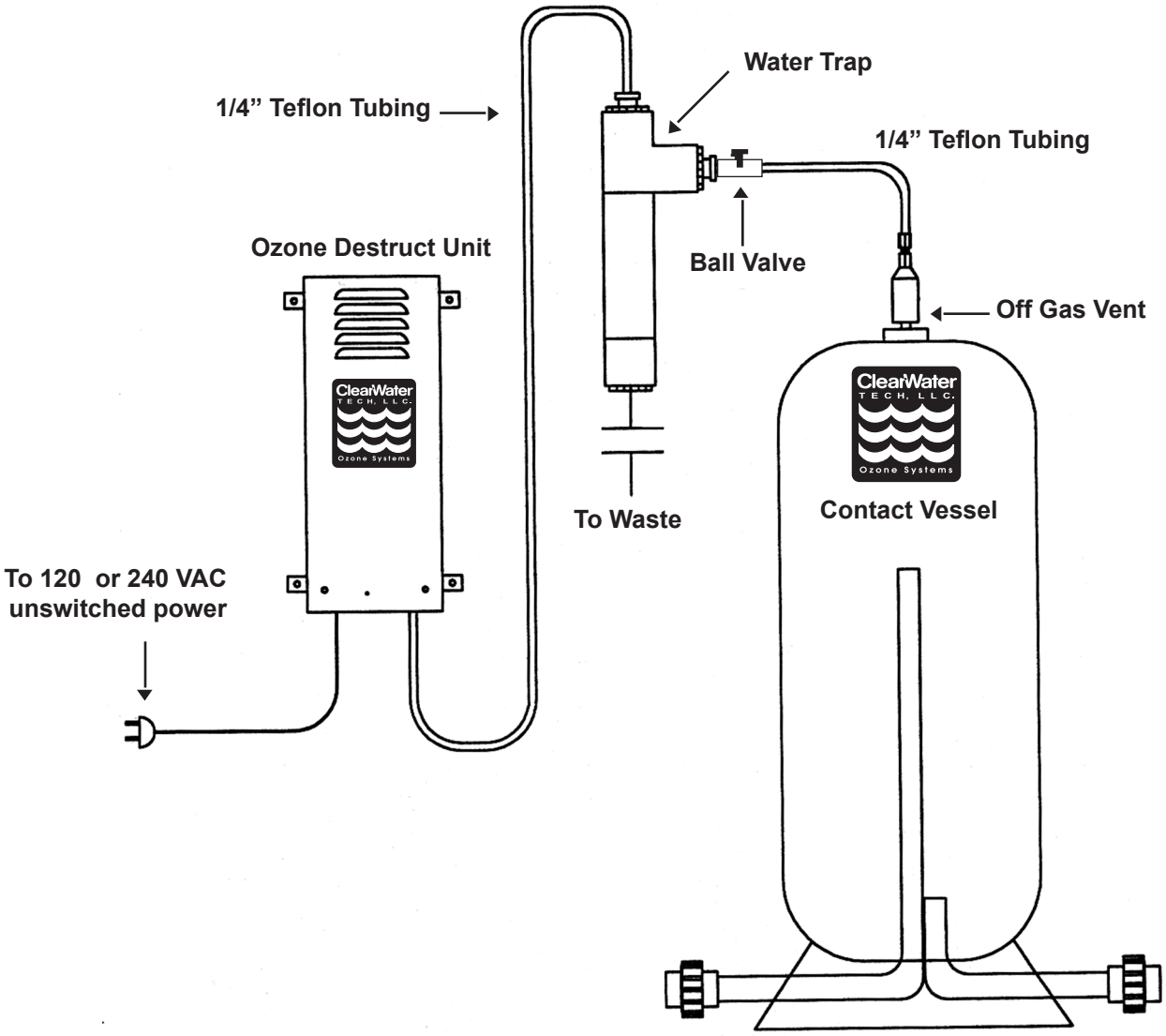
Step 5: Using the Kynar® thread-by-compression fitting provided, attach another suitable length of Teflon® tubing to the fitting on top of the water trap. Attach the other end of the tubing to the Kynar® inlet fitting on the bottom of the ozone destruct unit.

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.

Step 7: Plug the ozone destruct unit into an unswitched 120VAC outlet or wire to unswitched 240VAC power and allow it to warm up.

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 a slight vacuum (measured in inches of mercury, or "in.Hg"). Air from the air preparation system is flowing *toward* the ozone generator under pressure, and *from* the ozone generator under vacuum (created by the ozone injector manifold). The change from pressure to vacuum occurs at the air flow gauge adjustment valve(s) on the ozone generator cabinet door. If the vacuum level is too high but air flow levels are correct, opening the ball valve on the injector manifold(s) slightly will *decrease* the vacuum by increasing the amount of water flowing through the bypass of the ozone injector manifold. Similarly, if the vacuum level is too low, closing the ball valve on the injector manifold(s) slightly will *increase* the vacuum.

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

Step 1: Disconnect the Teflon® ozone delivery line(s) from the Kynar® ozone outlet fitting(s) located on the right side of the ozone generator.

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

Step 3: Make sure electrical power is on to all ozone system electrical components. Check to make sure the power switch on each of the oxygen concentrator modules (2, 3, 4, or 6 individual units) of the air preparation system is in the 'ON' position.

Step 4: 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). 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 5: Check for vacuum (suction) at the Teflon® ozone delivery line(s) (disconnected in Step 1 above) by placing a finger over the end of the tubing. If *no* vacuum is present, gradually close the bypass valve(s) on the injector manifold(s) until vacuum is detected. **Note: Procedures to achieve the *correct* amount of vacuum appear later in this section.**

Step 6: 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 4 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.**

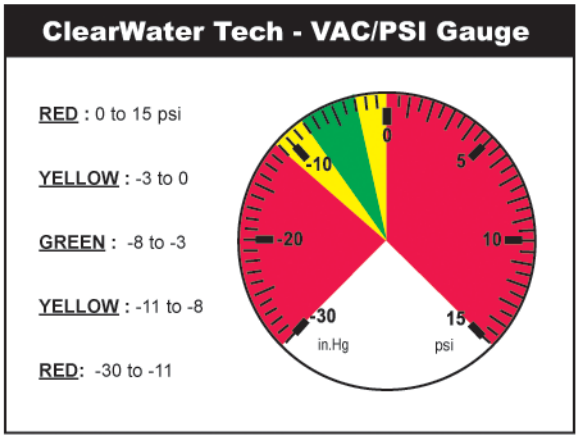
Step 7: Verify that there is power to the air preparation system and that the signal is interlocked to the ozone generator by turning the 'Ozone/Air Prep' switch(es) on the ozone generator cabinet door to the 'ON' position. The air preparation system and the light(s) directly above the 'Ozone/Air Prep' switch(es) should come on. Check to make sure the compressor on each oxygen concentrator module of the air preparation system is operating, then immediately turn the 'Ozone/Air Prep' switch(es) to the 'OFF' position. **Note: If this procedure takes more than 15 seconds, the ozone generator will automatically shut down. This is a safety feature designed to prevent the ozone generator from operating without vacuum from the ozone injector(s). If this occurs, the timing mechanism in the ozone generator must be reset. To reset, simply turn the 'Ozone/Air Prep' switch to the 'OFF' position, then immediately to 'ON'. The switch may now be turned back to the 'OFF' position to correctly turn the ozone generator off.**

Step 8: Locate the ozone injector manifold(s) and close the ball valve on the injector manifold(s) about half way. Using your thumb or a ClearWater Tech vacuum test assembly, check for the presence of vacuum (suction) at the end of the Teflon® ozone delivery line(s) (disconnected from the ozone generator in Step 1 of this section). If no suction is present, continue to close the ball valve on the injector manifold(s) equally until vacuum is detected.

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

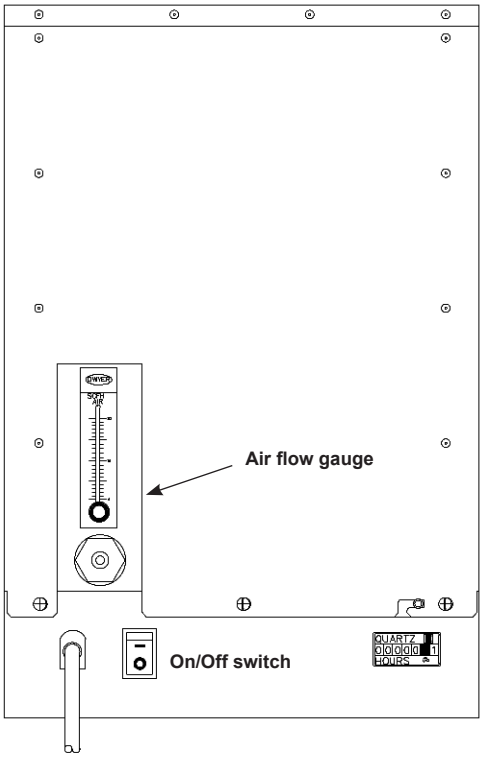
Step 10: Turn the 'Ozone/Air Prep' switch(es) on the ozone generator cabinet door back to the 'ON' position. The light(s) directly above the 'Ozone/Air Prep' switch(es) should come on. The solenoid valves inside the ozone generator will now open, allowing oxygen from the air preparation system to flow through the ozone generator and out to the ozone injector manifold(s).

Step 11: Locate the vacuum/pressure (VAC/PSI) gauge on the front panel of the ozone generator (see diagram at right). 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. Remember: Because of the vacuum safety interlock, the system will not operate for more than 15 seconds in a *pressure* condition. If the system shuts down due to lack of vacuum, reset the timing mechanism by turning the 'Ozone/Air Prep' switch on the ozone generator to the 'OFF' position then immediately back to 'ON'.
CAUTION: In all cases, extreme vacuum or pressure *must* be avoided!



Step 12: Using the air flow gauge adjustment valve on each module of the air preparation system (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.

Step 13: Using the air flow gauge adjustment valve(s) 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. **Note:** A pressure regulator-located on the inside of the ozone generator cabinet door-is preset by the factory at 5 psi. If there is insufficient air flow at the air flow gauge(s) on the ozone generator cabinet door and the air preparation system air flow is correct, the pressure regulator may be opened slightly. **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 9-3), 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 valves (on both the air preparation system modules and ozone generator), make final adjustments to vacuum and air flow levels. The air flow readings for the air preparation system and ozone generator should be in the prescribed SCFH range and vacuum should be in the green ozone on the VAC/PSI gauge.

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 (vacuum switch).
- The ozone generator cooling fans must be ON.
- The ozone generator cabinet must have vacuum from the injector manifold(s).
- 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 brass flapper valve, it will open, causing a loss of vacuum. No vacuum means air cannot flow through the ozone generator, which in turn can shut down the ozone generator.

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

CD-4000 and CD4000HO (2 modules)

	Operating Range	Optimum
Air prep. system air flow (each module)	11 to 14 scfh	14 scfh
PSI (gauge - inside of cabinet door)	0 to 5 psi	5 psi
Ozone generator air flow (gauge - outside of cabinet door)	23 to 28 scfh	28 scfh
Vacuum (VAC/PSI gauge – outside of cabinet door)	-3 to -8 inches	-5 inches
SCFH @ venturi (if equipped w/ gauge @ venturi)	32 to 35 scfh	32 scfh

CD-6000 and CD6000HO with Rack-Mount Air Prep. System (3 modules)

	Operating Range	Optimum
Air prep. system air flow(*each* module)	11 to 14 scfh	14 scfh
PSI (gauge - inside of cabinet door)	0 to 5 psi	5 psi
Ozone generator air flow (gauge - outside of cabinet door)	36 to 42 scfh	42 scfh
Vacuum (VAC/PSI gauge – outside of cabinet door)	-3 to -8 inches	-5 inches
SCFH @ venturi (if equipped w/ gauge @ venturi)	45 to 50 scfh	45 scfh

CD-8000 and CD8000HO with Rack-Mount Air Prep. System (4 modules)

	Operating Range	Optimum
Air prep. system air flow(*each* module)	11 to 14 scfh	14 scfh
PSI (gauge - inside of cabinet door)	0 to 5 psi	5 psi
Ozone generator air flow (gauge - outside of cabinet door)	23 to 28 scfh (ea. gauge)	28 scfh
Vacuum (VAC/PSI gauge – outside of cabinet door)	-3 to -8 in. (ea. gauge)	-5 in. (ea. gauge)
SCFH @ venturi (if equipped w/ gauge @ venturi)	30 to 35 scfh (ea. gauge)	30 scfh (ea. gauge)

CD-12000 and CD12000HO with Rack-Mount Air Prep. System (6 modules)

	Operating Range	Optimum
Air prep. system air flow(*each* module)	11 to 14 scfh	14 scfh
PSI (gauge - inside of cabinet door)	0 to 5 psi	5 psi
Ozone generator air flow (gauge - outside of cabinet door)	36 to 42 scfh (ea. gauge)	42 scfh (ea. gauge)
Vacuum (VAC/PSI gauge – outside of cabinet door)	-3 to -8 in. (ea. gauge)	-5 in. (ea. gauge)
SCFH @ venturi (if equipped w/ gauge @ venturi)	45 to 50 scfh (ea. gauge)	45 scfh (ea. gauge)

Figure 8-3A

CABINET CONTROL PANEL DIAGRAM
CD-4000 & CD-6000

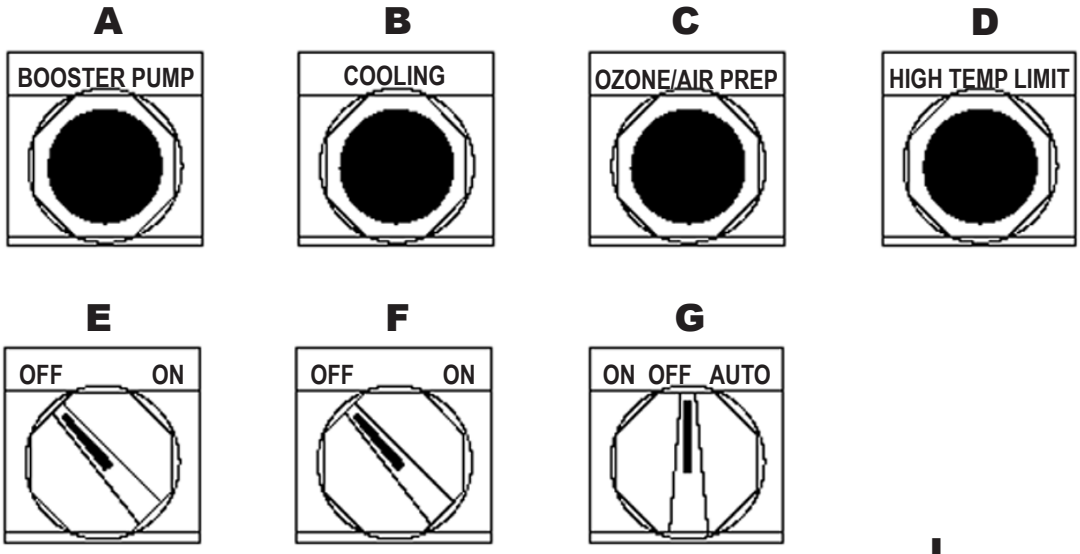
INDICATOR LIGHTS:

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 (150ºF).



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). Ozone on 100%.

<u>Off</u> = No ozone output

<u>Auto</u> = Ozone ON/OFF controlled by external source (if so equipped).

GAUGES:

H. Air flow gauge

I. Air flow adjustment valve

J. Vacuum/pressure gauge

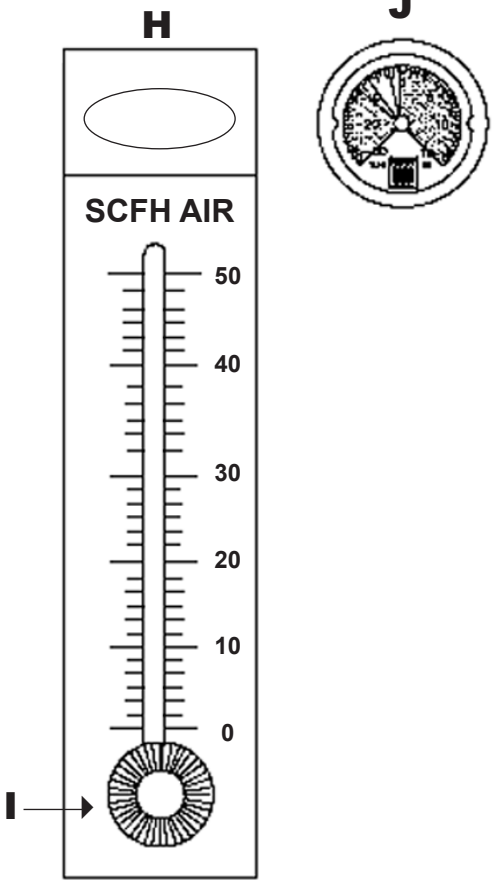


Figure 8-3B

CABINET CONTROL PANEL DIAGRAM
CD4000HO & CD6000HO

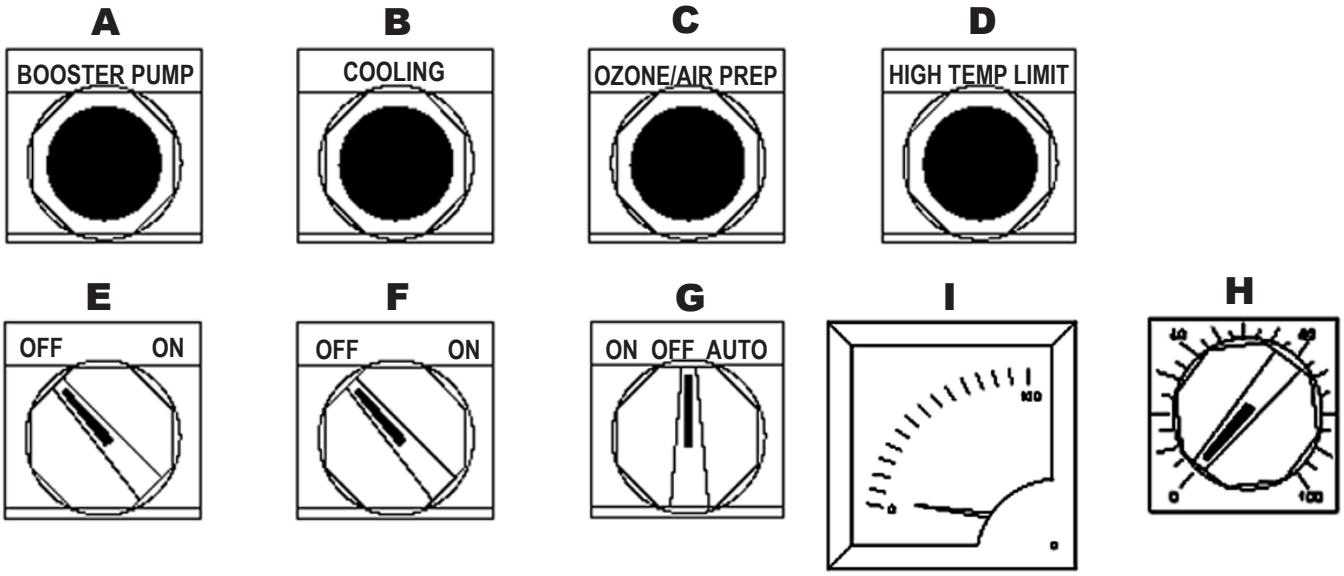
INDICATOR LIGHTS:

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 (150ºF).



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).

Off = No ozone output.

<u>Auto</u> = Output controlled by 4-20 mA control signal from external source.

H. Potentiometer - Adjusts ozone output.

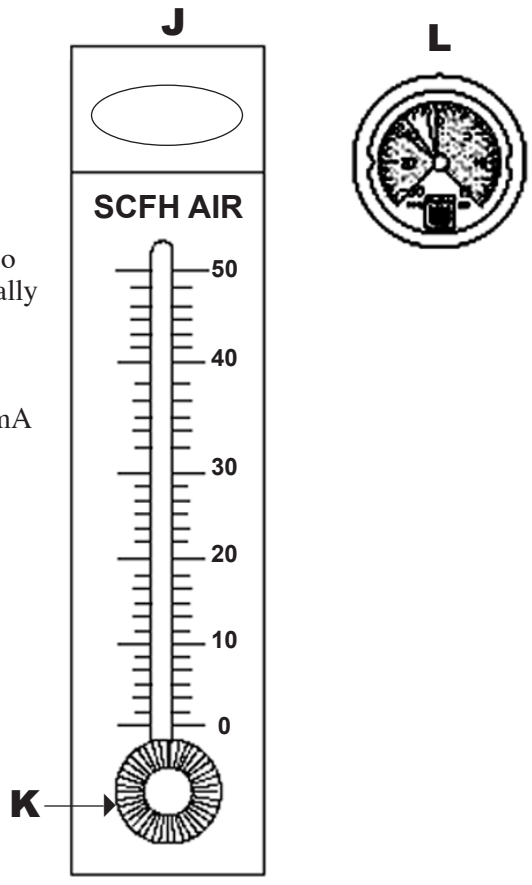
GAUGES:

I. Ozone output gauge (0-100%)

J. Air flow gauge

K. Air flow adjustment valve

L. Vacuum/pressure gauge



CABINET CONTROL PANEL DIAGRAM
CD-8000 & CD-12000

Figure 8-3C

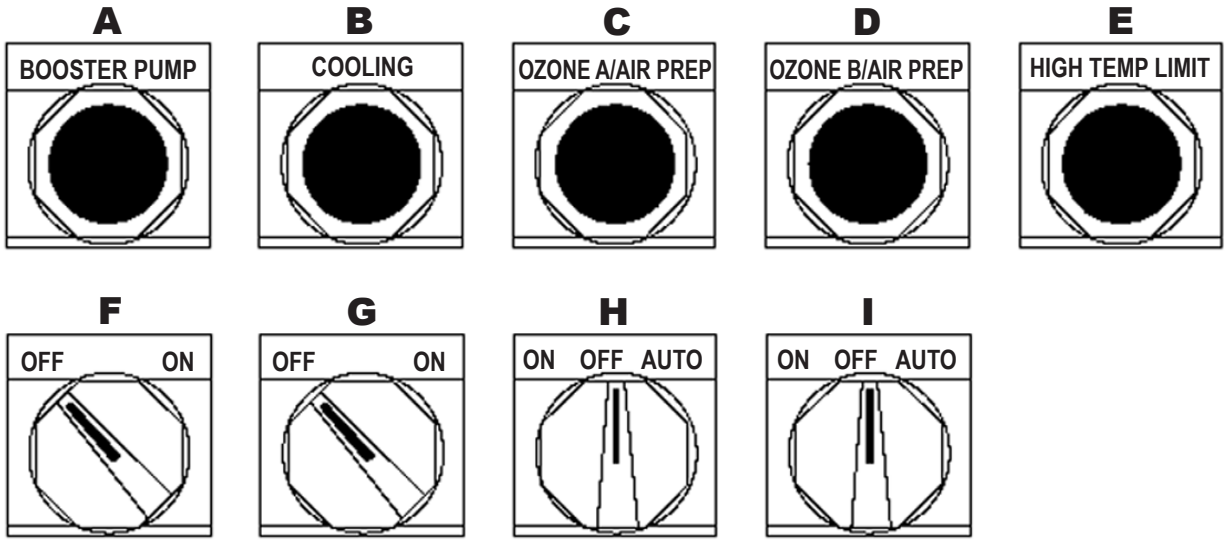
INDICATOR LIGHTS:

A. Booster pump ON = booster pump terminals energized.

B. Cooling ON = ozone generator cooling fans operating.

C/D. Ozone/Air Prep ON = ozone cells and air prep. terminals energized.

E. High Temp Limit ON = ozone generator has reached temperature limit (150ºF).



CONTROL SWITCHES:

F. Booster pump ON/OFF

G. Cooling system ON/OFF

H. Ozone "A"/Air Prep ON/OFF/AUTO

I. Ozone "B" Air Prep ON/OFF/AUTO

<u>On</u> = Overrides external signal (if so equipped). Ozone on 100%.

<u>Off</u> = No ozone output.

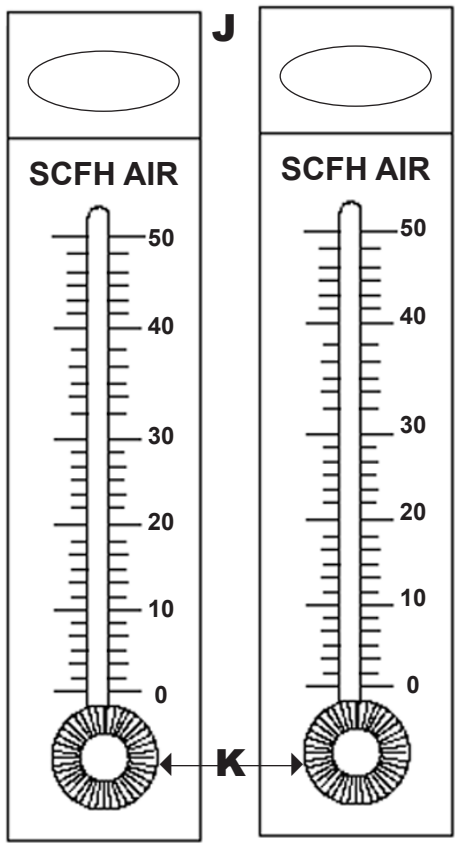
<u>Auto</u> = Ozone ON/OFF controlled by external sources (if so equipped).

GAUGES:

J. Air flow gauges (left & right)

K Air flow adjustment valves (left & right)

L. Vacuum/pressure gauges (left & right)



CABINET CONTROL PANEL DIAGRAM
CD8000HO & CD12000HO

Figure 8-3D

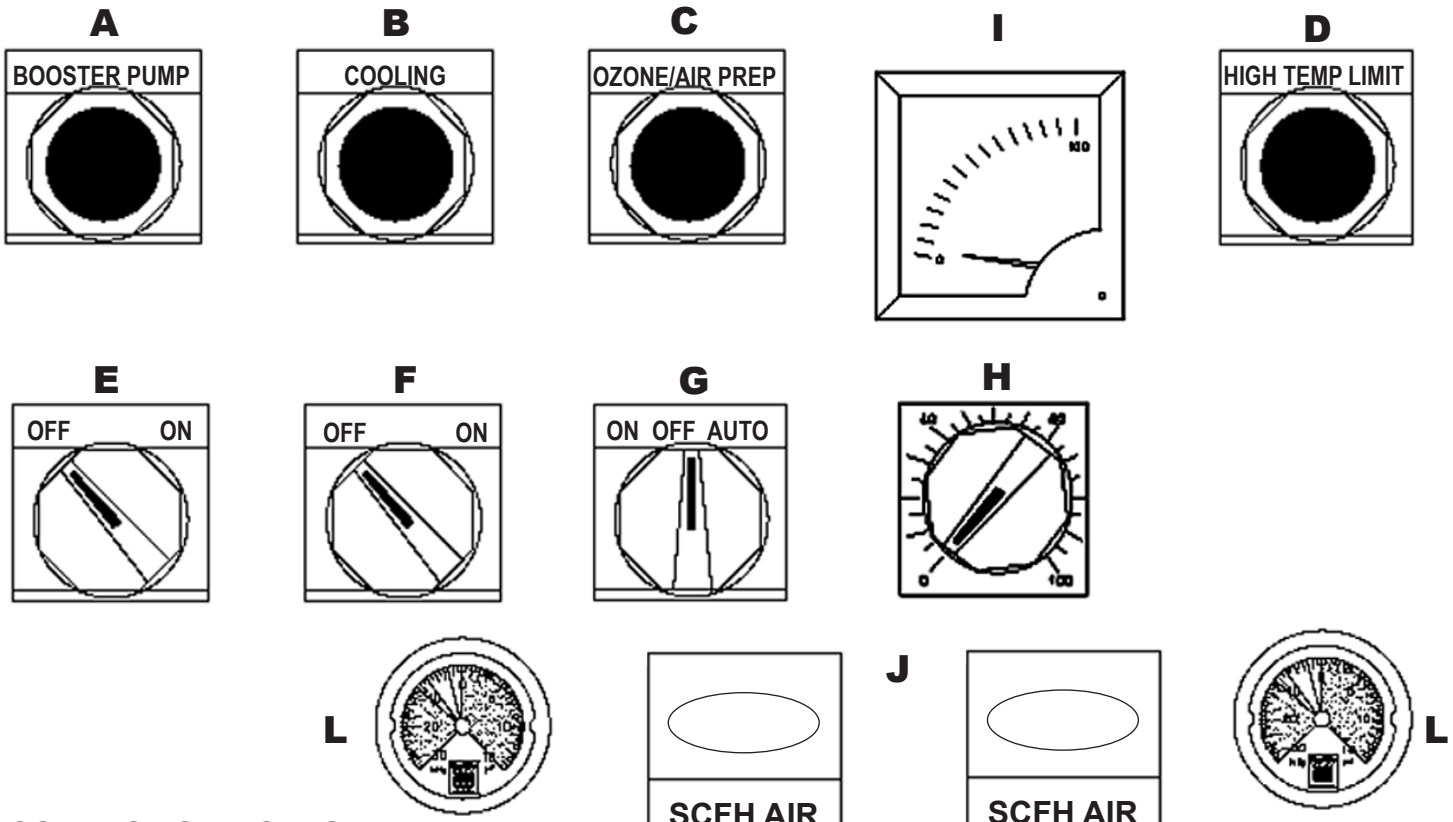
INDICATOR LIGHTS:

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 (150ºF).



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> = Ozone 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 gauges (left & right)

K. Air flow adjustment valves (left & right)

L. Vacuum/pressure gauges (left & right)

CHAPTER

9

Maintenance Procedures

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.

- 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 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" (Figure 8-2) . Adjust if necessary by following Step 12 of the "Start-Up & Calibration" section.

Ozone Generator:

- Indicator Lights - Check the indicator lights on the ozone generator cabinet door (see Figure 8-3). 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(s) on the ozone generator cabinet door. Make sure air flow is within the SCFH range shown on the "Ozone generator air flow" line of the "Pneumatic Operating Parameters" (see Figure 8-2). Adjust if necessary by following Step 13 of the "Start-Up & Calibration" section.

- Vacuum - Check the VAC/PSI gauge located on the ozone generator cabinet door. Make sure vacuum is within the range shown on the "Vacuum" line of the "Pneumatic Operating Parameters" chart (see Figure 8-2). Adjust if necessary by following Steps 11-14 of the "Start-Up & Calibration" section.

Vacuum Break:

- Water Level - check the water level in the vacuum break. Make sure it is *above* the brass flapper valve in the overflow tube (see Figure 7-3). Fill as required by removing the threaded fitting on top of the riser tube until water begins to flow out of the drain holes in the overflow tube.

Injector Manifold:

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

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 Trouble shooting 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

Air Preparation System:

- CD-4000/CD4000HO models *only*: Check to make sure the cooling fan mounted inside the cover of each air preparation system module is operating. If not, refer to the Troubleshooting Guide. Remove the air inlet filter from the cover of each module and clean with soap and water, drying them completely before reinstalling. **Note: Operating conditions in the equipment area will dictate the frequency required for this procedure.**

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 9-3). **⚠ 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 Power –
  - CD-4000 through CD-12000: With the ozone generator cabinet door open, check to make sure the red power LED on each drive module is illuminated (see Figure 9-1).

  - CD4000HO through CD12000HO: With the ozone generator cabinet door open, check to make sure both red and green LEDs on each drive module are illuminated (see Figure 9-2). Green = power to the drive board. Red = high voltage to the reaction chamber.

- 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 Trouble-shooting Guide. 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.

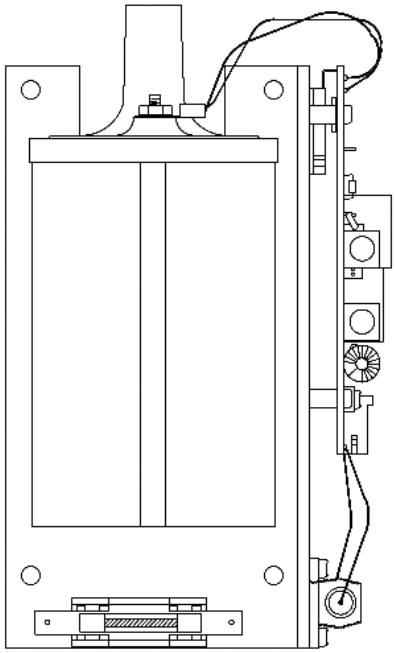
- Cooling Fan Filters – Check the cooling fan filter elements – mounted on the *underneath* side of the ozone generator bottom panel - and clean as required. Operating conditions in the equipment area will dictate the frequency required for this procedure. If cleaning is required, remove the thumbnuts and the protective grills (see Figure 9-4). Remove the filter elements and clean with soap and water, drying them completely before reinstalling. **Note: A slot-head screwdriver or similar tool may be required to loosen the filter elements from the fan.**

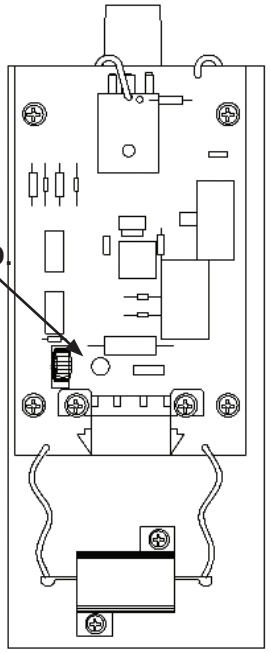
Booster Pump(s):

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

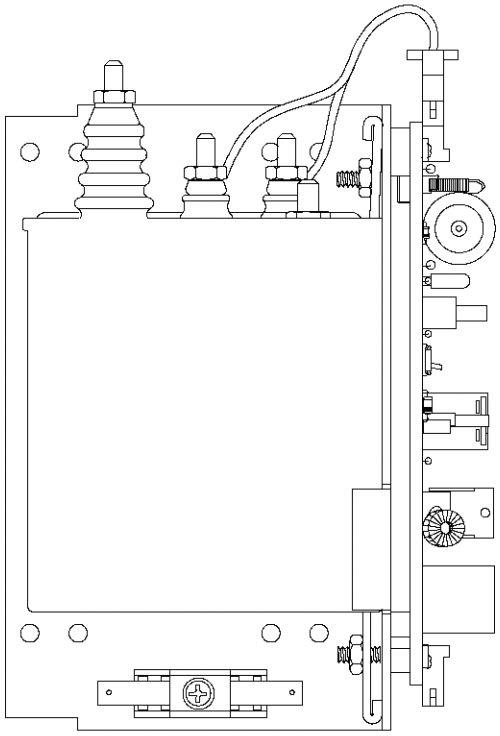
Drive Module CD-4000 - CD-120000

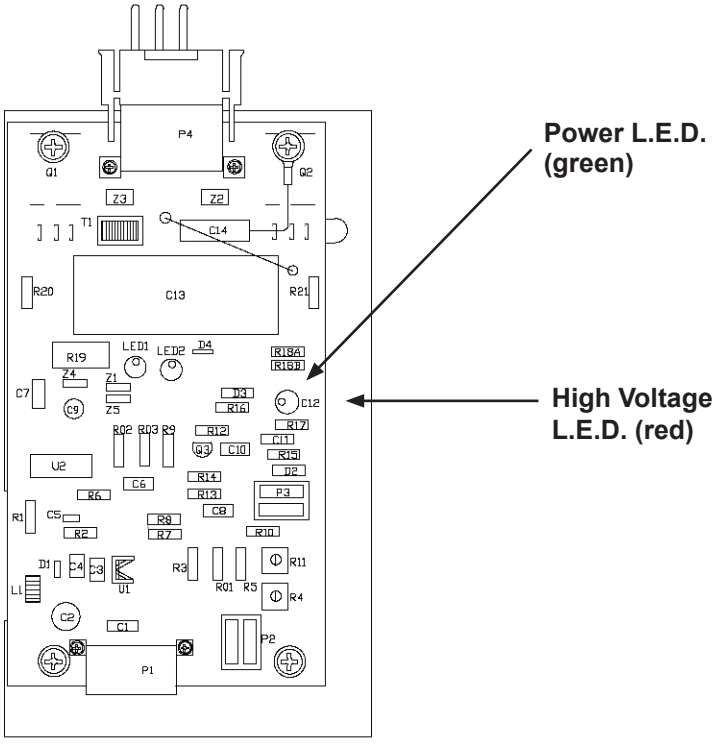
Figure 9-1





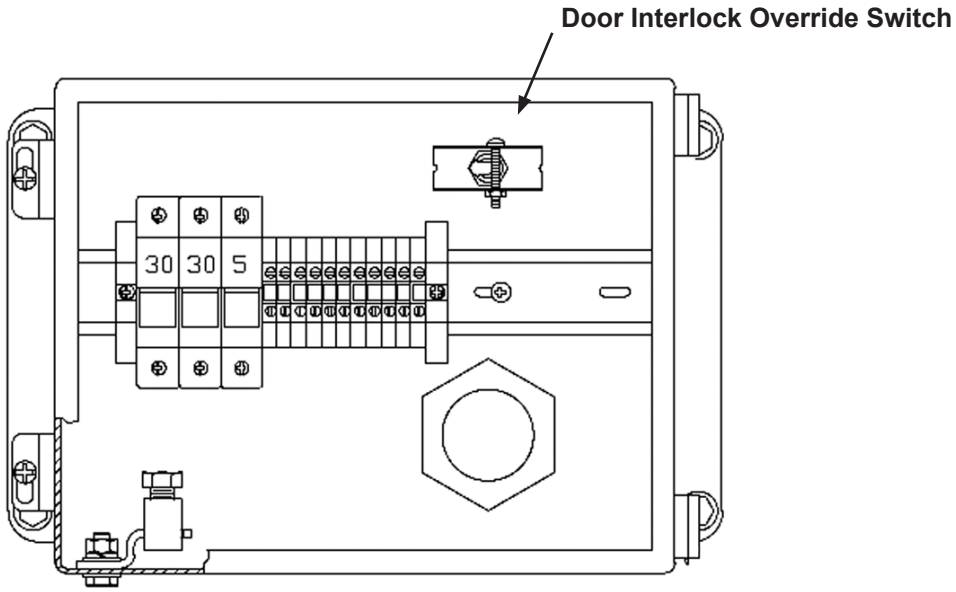
Drive Module CD4000HO - CD120000HO





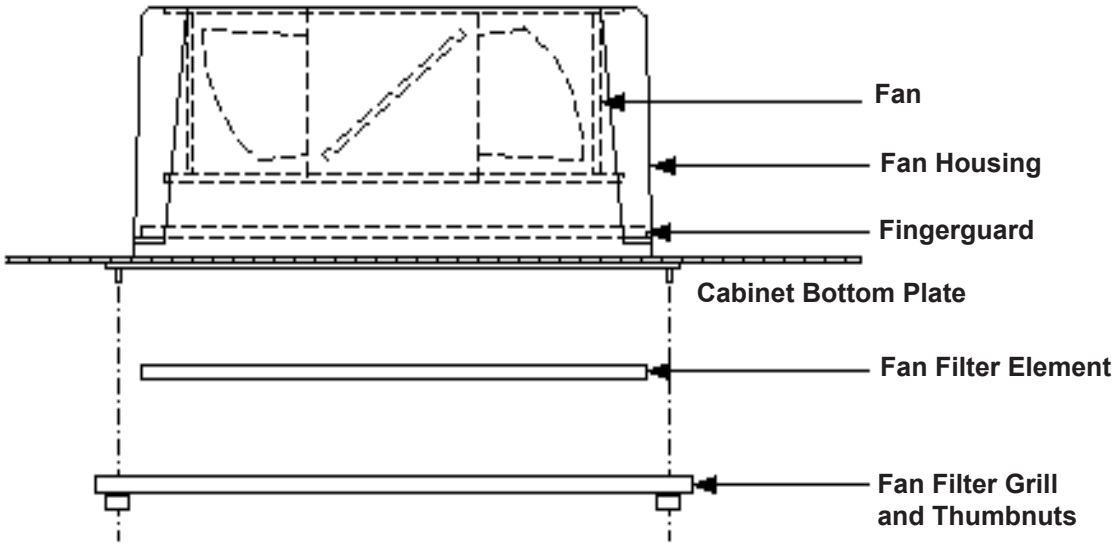
Electrical Hook-Up Box

Figure 9-3



Ozone Generator Cooling Fan Assembly

Figure 9-4



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(es) on the ozone generator cabinet door to the 'OFF' position. The light(s) directly above the switch(es) 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. The booster pump(s) will be disabled.

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:** Manufacturer's 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:

- CD-4000/CD4000HO models *only*: Replace the cooling fan filter element built into the cover of each of the two air preparation system modules. **Note:** Operating conditions in the equipment area will dictate the required frequency of this procedure.

- Compressors - Following the procedures outlined in the compressor rebuild kit, rebuild the two compressor heads on each air preparation system module. **Note:** Manufacturer's recommended interval is 5,000 to 12,000 hours of operation. Compressor performance and/or operating conditions in the equipment area will dictate the required frequency of this procedure.

Ozone Generator:
Note: (CD6000HO through CD12000HO models *only*): The clear plastic air flow shield built must be removed before beginning these ozone generator maintenance procedures.

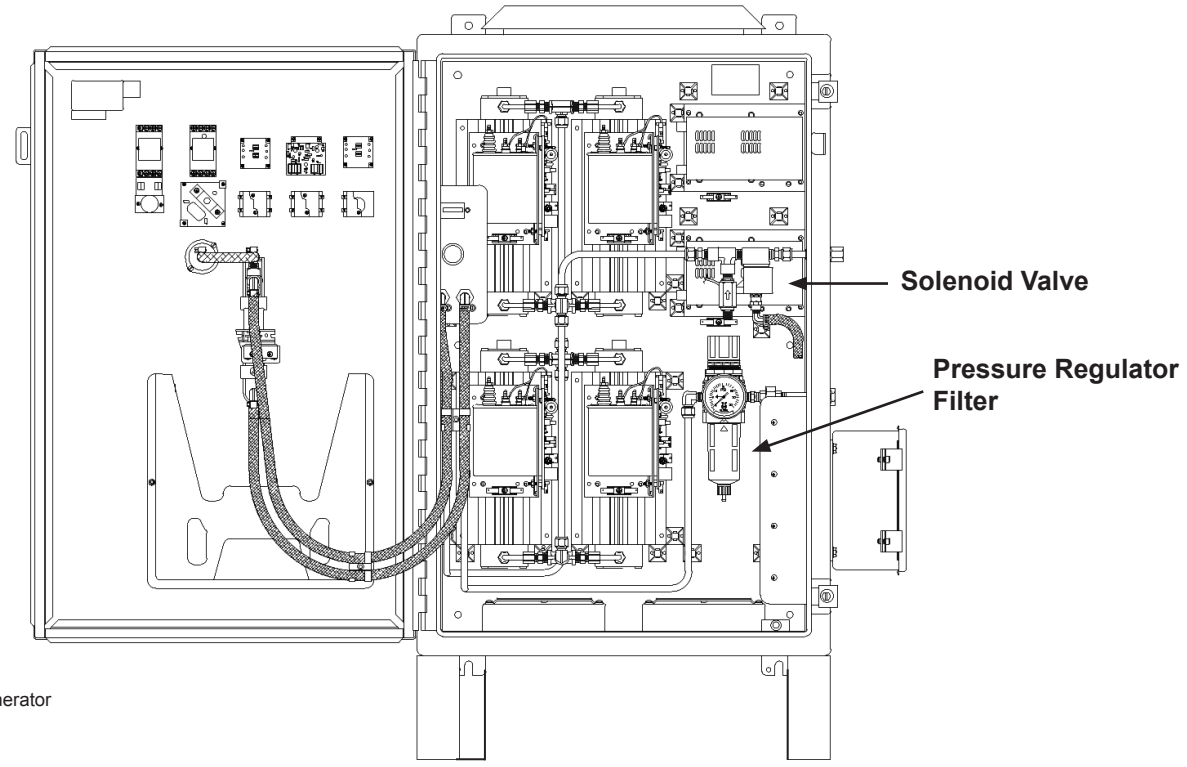
- Cooling Fan Filters – Clean or replace the cooling fan filter elements as required.

- Pressure Regulator Filter – Replace the filter and O-ring inside the pressure regulator filter bowl. Follow instructions included in filter replacement kit.

- Solenoid Valve(s) – To prevent water from flowing back into the ozone generator, each stainless steel ozone outlet is equipped with an in-line solenoid valve. Rebuild the solenoid valve(s) according to the directions included with the solenoid rebuild kit.

Internal View - Ozone Generator

Figure 9-5



Shown: CD4000HO ozone generator

- Reaction Chambers – Remove and disassemble one reaction chamber according to the steps outlined below (see Figure 9-6). The chamber in the lower right corner of the ozone generator is most likely to become fouled, so it is recommended that this chamber is 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 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 to the reaction chamber).

Step 3: Disconnect Teflon® tubing connections from 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.

Step 8: Remove the high voltage end cap and dielectric from the heat sink/cathode assembly.

Step 9: 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 onto the end of the high voltage end cap (the one with the white power lead attached) center screw. Thread the high voltage contact brush into the hex nut brush adapter.

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: The end cap must be pressed onto the end of the heat sink/cathode assembly *furthest* from the drive assembly mounting holes (see Figure 9-6).**

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.

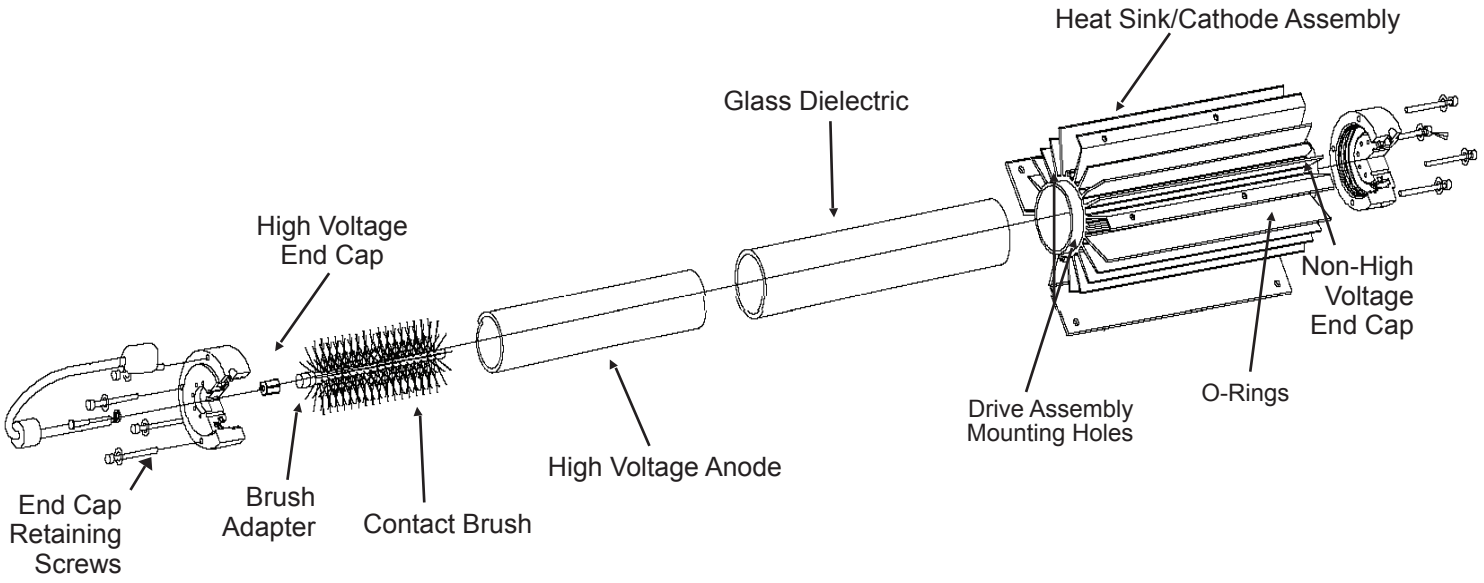
Step 7: *Slowly* insert the high voltage end cap assembly into the dielectric. **Note: Do not bend center wire of the brush during this procedure.** It is normal for the *bristles* to bend. Using a gentle twisting motion, press the high voltage end cap onto the heat sink/cathode assembly until flush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

2" Reaction Chamber - Exploded View

Figure 9-6



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 cloth. 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 on top of the ozone injector 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. Clean vent by soaking overnight in a 50/50 solution of water and muriatic acid. Rinse the vent thoroughly with water and re-install.

- Ozone Destruct Unit – Under normal operating conditions, this unit may require no annual maintenance. How ever, 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.

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 vacuum	- Adjust injector See 'Start-Up & Calibration' Step 11
	- Incorrect wiring	- See 'Installation Procedures - Electrical'
	- Fuse blown	- Replace fuse
Low air flow or no air flow	- Flow meter out of adjustment	- Adjust flow meter See 'Start-Up & Calibration'-Step 12
	- Fouled compressor inlet filter	- Replace inlet filter
	- Compressor not functioning	- Rebuild or replace as needed
	- Back pressure in system	- Check solenoid(s) and check valves for proper operation & replace as needed
Compressor pressure relief valve making noise	- Back pressure in system	- Check solenoid(s) and check valves for proper operation & replace as needed
	- Pinched tubing	- Replace tubing
	- Compressor not functioning	- Rebuild or replace as needed
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 needed
		- 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
Unit does not turn on	- No power to unit	- Check circuit breakers
	- Power switch(es) in 'Off' position	- Turn switch(es) to '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	- Access damage, correct cause and rebuild as required
Unit does not stay on	- Unit overheating	- Check fan for proper operation and clean fan filter as needed
	- Insufficient vacuum	- Adjust injector See 'Start-Up & Calibration' - Step 11
	- Defective check valve	- Replace check valve
Unit makes excessive noise	- Unit not properly secured to floor or wall	- Secure firmly in place
	- Shipping damage	- Locate damage and repair/replace parts
	- Fan blocked	- Clear obstructions
'Ozone Generator' indicator lights not on	- Lamp burned out	- Replace lamp
	- Switch not on	- Turn on switch
	- Blown fuse	- Replace fuse
	- Incorrect wiring	- See 'Installation Procedures' - Electrical
Receive an electrical shock upon touching the unit	- Incorrect wiring	- See 'Installation Procedures' - Electrical clean fan filter(s)
	- 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	- Check fan(s) for proper operation and clean fan filter(s) - Check operating temperature - See 'Installation Procedures - Getting Started...Equipment Placement'

OZONE GENERATOR - continued

PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
Ozone generator drive module indicator LED not on	- No power to drive module	- Check power from power supply to drive - See Appendix - Section F
	- Blown fuse	- Replace fuse
	- Drive module inoperable	- Replace drive module
	- Drive is overheating	- Check fan for proper operation/clean fan filter
Fan not operating	- 'Cooling' switch off	- Turn 'Cooling' switch on
	- Fan inoperable	- Replace fan
Low air flow or no air flow	- Air prep. system no operating properly	- See 'Start Up & Calibration - Step 11
	- Fouled regulator filter	- Change regulator 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 11
	- 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 needed
	- No water in vacuum break	- Fill vacuum break with water See 'Start-Up & Calibration - Vacuum Break'
High vacuum	- Air leak	- Check all fittings as needed
	- Hydraulics/Pneumatics out of adjustment	- See 'Start-Up & Calibration' - Step 11
	- Change in hydraulics - excessive water flow through ozone injector	- See 'Start-Up & Calibration' - Step 11

OZONE GENERATOR - continued

PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
Over vacuum relief valve making noise (located to the left of solenoid valve in 'HO' models only)	- Over vacuum due to change in hydraulics	- Adjust injector See 'Start-Up & Calibration'- Step 11
Unit flooded with water	- Defective check valve(s)	- Replace check valve(s) - Assess damage, correct cause install vacuum break and rebuild as needed
Ozone smell detected in or around unit	- Insufficient vacuum	- Adjust injector See 'Start-Up & Calibration'- Step 11
	- 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'
No vacuum at venturi inlet port	- Ozone injector out of adjustment	- See 'Start-Up & Calibration'- Step 13
	- Low water flow through ozone injector	- Check for obstructions upstream of ozone injector
	- Back pressure in hydraulic line	- Check for obstructions downstream of ozone injector
	- Booster pump not functioning properly	- Check booster pump (contact dealer)
Ozone smell detected around vacuum break or ozone injector	- Loose fittings	- Tighten all fittings
	- Broken fittings	- Replace fittings

OZONE DESTRUCT

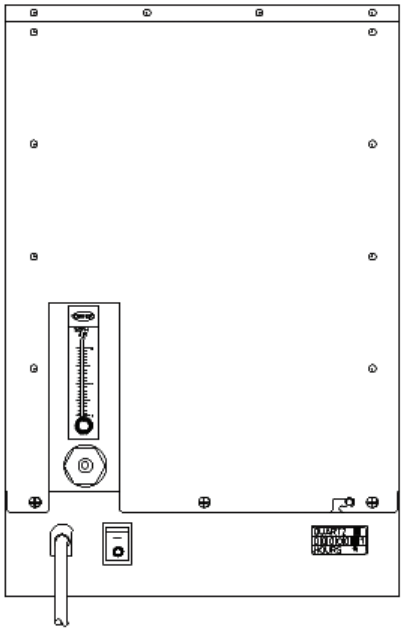
PROBLEM/SYMPTOM	POSSIBLE CAUSE	SOLUTION
Excessive water in water trap	- Failed off gas vent	- Clean vent by soaking overnight in a 50/50 solution of water and muriatic acid, or replace as required.
	- Failed spring check valve in water trap	- Replace water trap
Ozone destruct unit not operating	- No power to unit	- Check main power to unit
	- Switch not on	- Turn on switch
	- Fuse blown	- Replace fuse
	- Incorrect wiring connections	- See 'Installation Procedures - Electrical'
Ozone destruct unit trips circuit breaker	- Incorrect wiring	- See 'Installation Procedures - Electrical'
	- Incorrect circuit breaker	- Replace with correct circuit breaker
	- Water back flow into unit	- Assess damage and rebuild as needed
Ozone destruct indicator lights not on	- Lamp burned out	- Replace lamp
	- Switch not on	- Turn on switch
	- 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

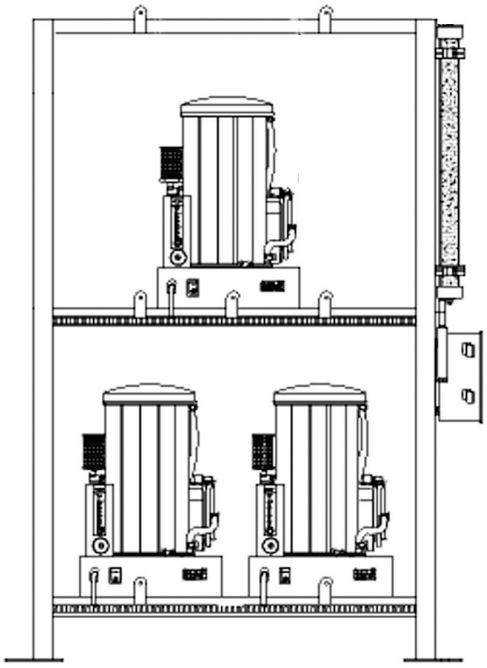
11

Appendix

Specifications



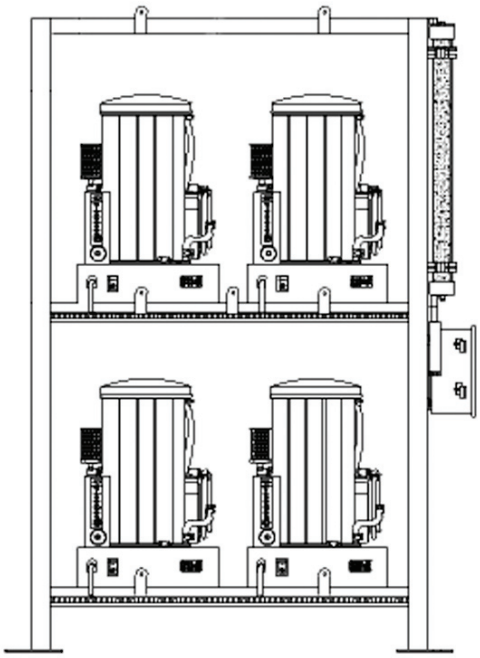
Shown: ClearWater Tech OXS100 Air Prep. Module
(drawings not to scale)



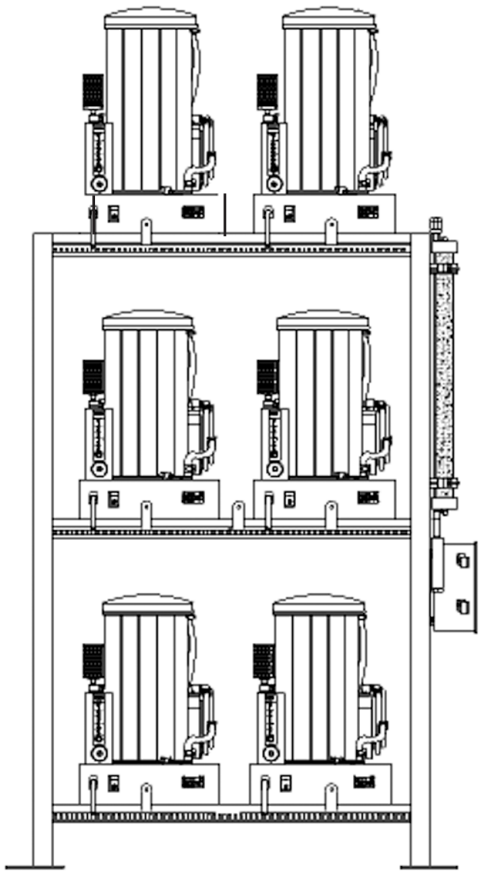
Shown: ClearWater Tech RMS45 Air Prep. System

AIR PREP. SYSTEM	SPECIFICATIONS	O_2 OUTPUT/SCFH
OXS100 (single air prep. module)	21.5” h x 14” w x 17” d, 52 lbs	90% (+/- 3%) @ 15 scfh
RMS45 (3 air prep. modules)	55” h x 42.5” w x 23” d, 213 lbs	90% (+/- 3%) @ 45 scfh

Section A - Specifications



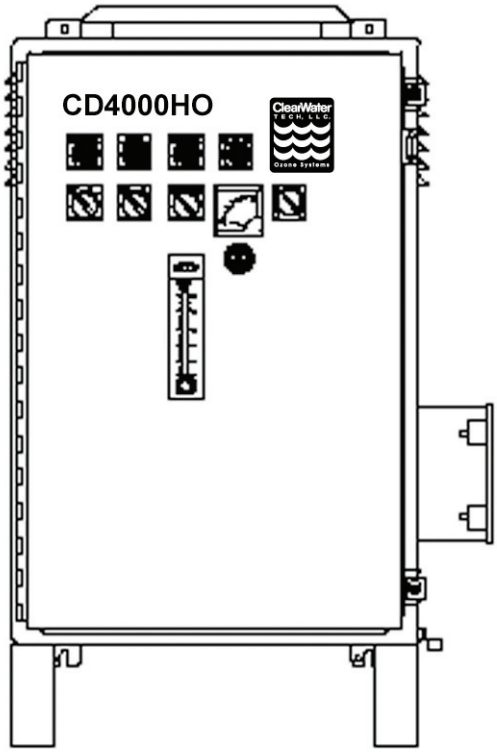
Shown: ClearWater Tech RMS60 Air Prep. System



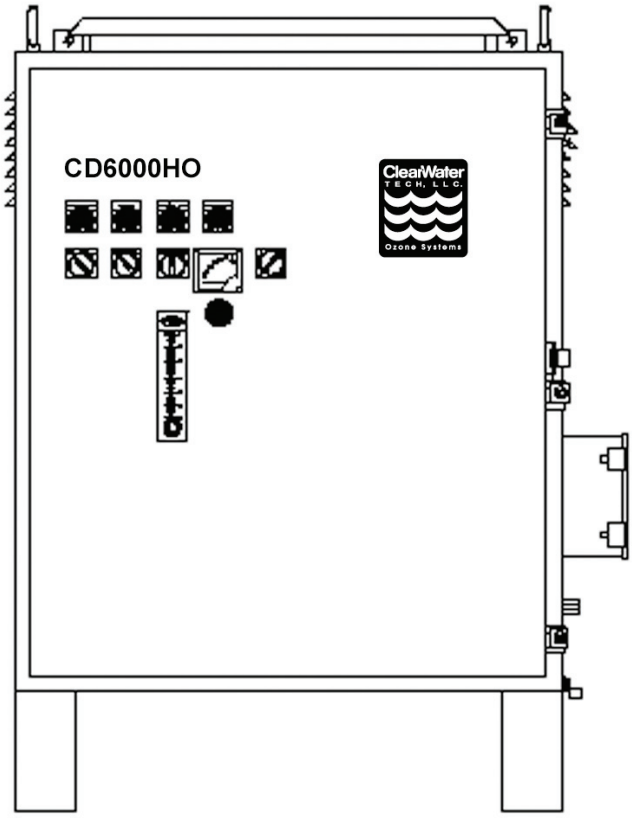
Shown: ClearWater Tech RMS90 Air Prep. System

AIR PREP. SYSTEM	SPECIFICATIONS	O_2 OUTPUT/SCFH
RMS60 (4 air prep. modules)	55” h x 42.5” w x 23” d, 274 lbs	90% (+/- 3%) @ 60 scfh
RMS90 (6 air prep. modules)	74” h x 42.5” w x 23” d, 396 lbs	90% (+/- 3%) @ 90 scfh

Section A - Specifications



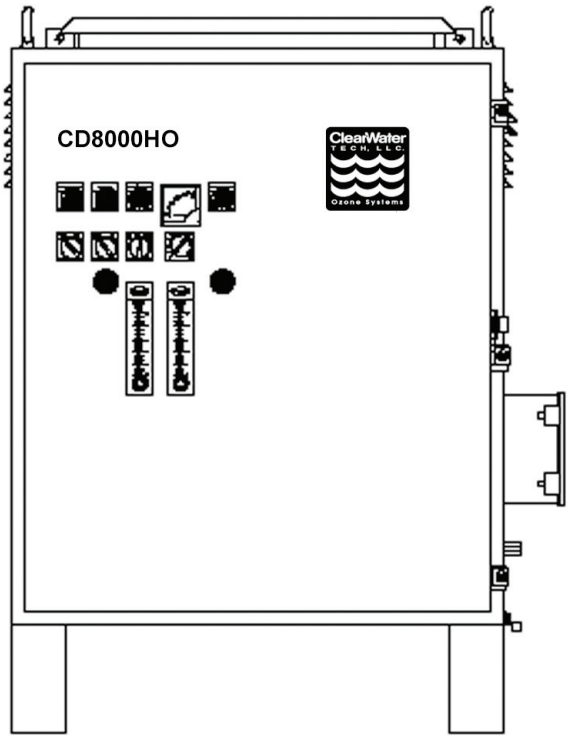
Shown: ClearWater Tech CD4000HO Ozone Generator



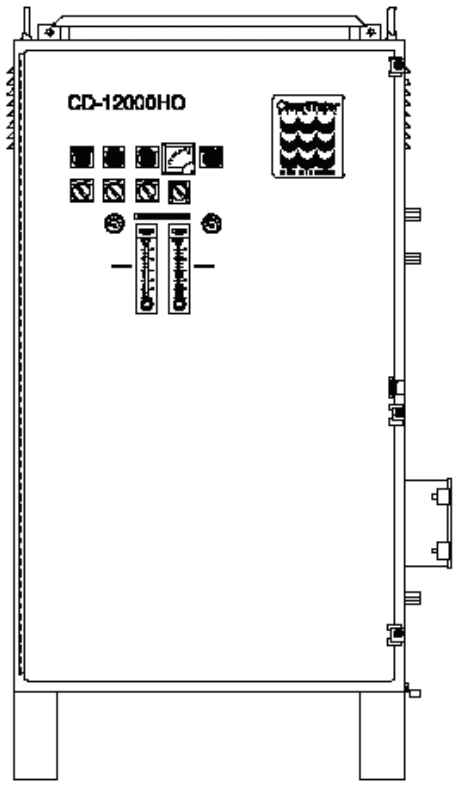
Shown: ClearWater Tech CD6000HO Ozone Generator

OZONE GENERATOR	SPECIFICATIONS	OZONE OUTPUT/SCFH STANDARD	H.O.
CD-4000 & CD4000HO	42” h x 28.5” w x 14” d, 149 lbs	28 g/h @ 28 scfh	40g/h @ 28scfh
CD-6000 & CD6000HO	52” h x 40.5” w x 18” d, 264 lbs	37g/h @ 42 scfh	60g/h @ 42 scfh

Section A - Specifications



Shown: ClearWater Tech CD8000HO Ozone Generator

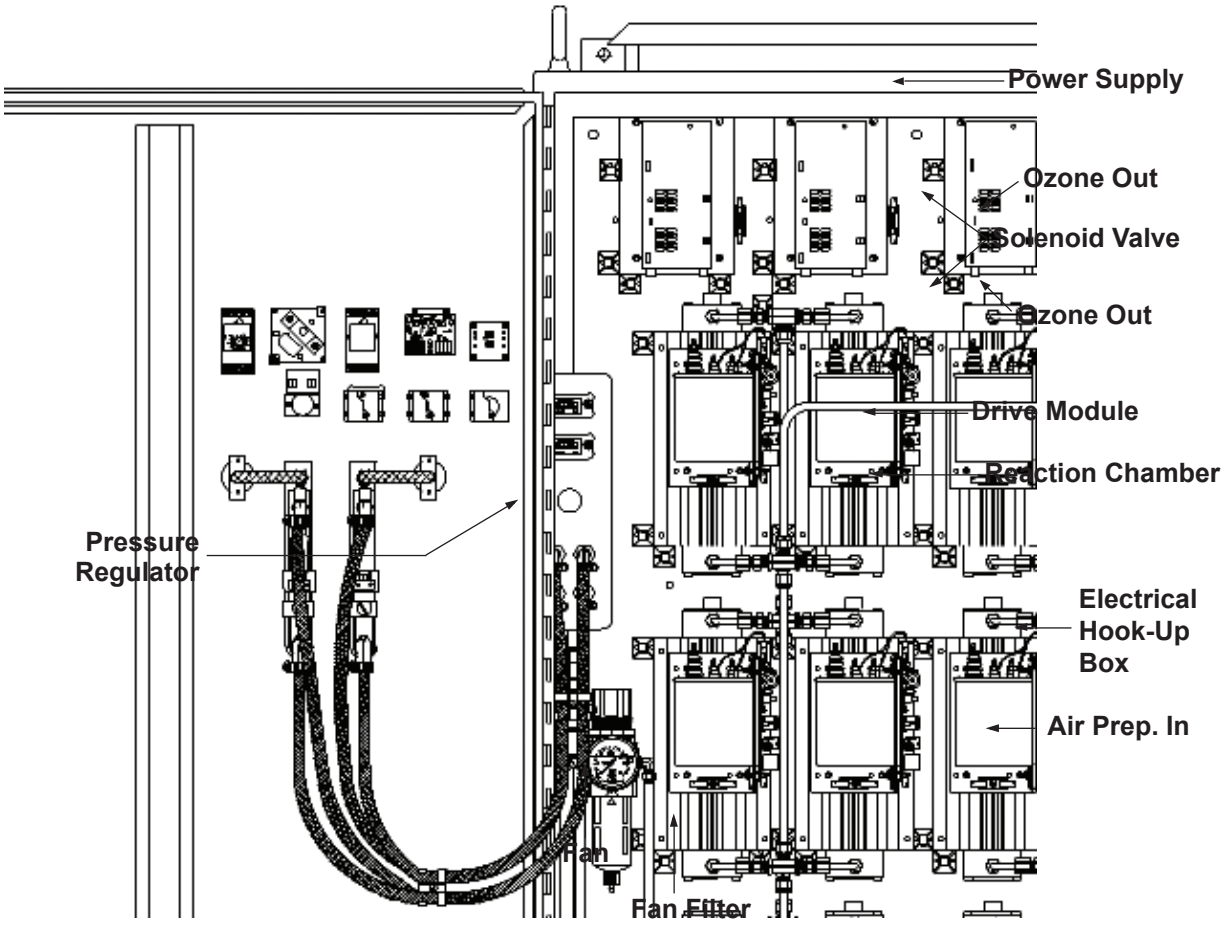


Shown: ClearWater Tech CD12000HO Ozone Generator

OZONE GENERATOR	SPECIFICATIONS	OZONE OUTPUT/SCFH STANDARD	H.O.
CD-8000 & CD8000HO	52” h x 40.5” w x 18” d, 314 lbs	52g/h @ 56 scfh	80g/h @ 56scfh
CD-12000 & CD12000HO	70” h x 40.5” w x 18” d, 421 lbs	81g/h @ 84 scfh	120g/h @ 84 scfh

APPENDIX - Section B

Ozone Generator - Main Components



Shown: ClearWater Tech CD12000HO Ozone Generator
(Wire harnesses omitted for clarity)

APPENDIX - Section C

Parts List

Air Preparation

Description	CD4000-CD4000HO	CD6000-CD12000HO
Compressor Inlet Filter	OXS350	OXS350
Compressor Rebuild Kit	OXS355	OXS355
Pressure Relief Valve	OXS360	OXS360
Compressor Vibration Mount	OXS365	OXS365
Enclosure Filter	OXS370	
Indicating Desiccant Refill		DES35
Cooling Fan - 120VAC	FA41	
Cooling Fan - 240VAC	FA42	
Fuse - 30 amp, 240VAC		FUS32

Ozone Generator

Description	CD4000-CD12000	CD4000HO-CD12000HO
Reaction Chamber - Complete	RCC4	RCC4
Dielectric Anode 2”	RCC73	RCC73
Non-High Voltage End Cap	RCC107	RCC107
High Voltage End Cap	RCC102	RCC102
O-Ring Set	ORS30	ORS30
Drive Module - Complete	DRM10	DRM12
Drive Module Coil	HVT100	HVT200
Drive Module Board	ELPC5100	ELPC5200
Power Supply	PS305	PSR910
Cooling Fan - CD4000 & CD4000HO	FA62	FA62
Cooling Fan - CD6000- CD12000 & CD6000HO-CD12000HO	FA91	FA91
Cooling Fan Filter CD4000 & CD4000HO	FA60	FA60
Cooling Fan Filter 6000-CD12000 & CD6000HO-CD12000HO	FA90	FA90
4-20 mA Control Board		ELPC5420
Solenoid Valve Rebuild	SV1500	SV1500
Regulator Filter	FLT42	FLT42
Vacuum Relief Valve		CKVR100
Vacuum Switch	SWT92	SWT92
Thermostat	ECC160	ECC160
Replacement Light	INL11	INL11
Fuse - 30 amp, 240VAC	FUS32	FUS32
Fuse - 5 amp, 240VAC	FUS22	FUS22
Fuse - 5 amp, 240VAC, slow blow	FUS20	FUS20
Off Gas Vent	VAS5	VAS5
Check Valve	CKV21	CKV21

Maintenance Kits

Air Preparation Systems

ASP 85 Maintenance kit - For CD-4000 & CD4000HO air prep. systems

Part #	QTY	Description
OXS350	1	Oxygen Generator - Replacement compressor inlet filter
OXS355	1	Oxygen Generator - Compressor rebuild kit
OXS360	1	Oxygen Generator - Compressor pressure relief valve
OXS370	1	Oxygen Generator - Replacement enclosure air inlet filter

ASP 290 Maintenance kit - For CD-6000 & CD6000HO air prep. systems

Part #	QTY	Description
DES35	1	Desiccant - Indicator cartridge refill
FUS32	2	Fuse - 30 amp - 240VAC
OXS350	3	Oxygen Generator - Replacement compressor inlet filter
OXS355	3	Oxygen Generator - Compressor rebuild kit
OXS360	3	Oxygen Generator - Compressor pressure relief valve

ASP 291 Maintenance kit - For CD-8000 & CD8000HO air prep. systems

Part #	QTY	Description
DES35	1	Desiccant - Indicator cartridge refill
FUS32	2	Fuse - 30 amp - 240VAC
OXS350	4	Oxygen Generator - Replacement compressor inlet filter
OXS355	4	Oxygen Generator - Compressor rebuild kit
OXS360	4	Oxygen Generator - Compressor pressure relief valve

ASP 292 Maintenance kit - For CD-12000 & CD12000HO air prep. systems

Part #	QTY	Description
DES35	1	Desiccant - Indicator cartridge refill
FUS32	2	Fuse - 30 amp - 240VAC
OXS350	6	Oxygen Generator - Replacement compressor inlet filter
OXS355	6	Oxygen Generator - Compressor rebuild kit
OXS360	6	Oxygen Generator - Compressor pressure relief valve

ASP 160 Maintenance kit - For CD-4000 and CD4000HO ozone generators

Part #	QTY	Description
FA60	2	Fan - Filter element only
FLT42	1	Filter - Pressure regulator, element only
FUS20	6	Fuse - 5 amp - 240VAC, slow blow
FUS22	2	Fuse - 5 amp - 240VAC electrical hook-up box, MCI
FUS32	2	Fuse - 30 amp - 240VAC electrical hook-up box, L1-L2
INL11	4	Indicator light - Replacement lamp, 120VAC
ORG10	8	O-ring - 2" CD reaction chamber
ORG110	16	O-ring - 2" CD reaction chamber
SV1500	1	Solenoid valve - 3 way rebuild kit

ASP 176 Maintenance kit - CD6000 and CD6000HO

Part #	QTY	Description
FA90	2	Fan - Filter element only
FLT42	1	Filter - Pressure regulator, element only
FUS20	10	Fuse - 5 amp - 240VAC, slow blow
FUS22	1	Fuse - 5 amp - 240VAC electrical hook-up box, MCI
FUS32	2	Fuse - 30 amp - 240VAC electrical hook-up box, L1-L2
INL11	4	Indicator light - Replacement lamp, 120VAC
ORG10	12	O-ring - 2" CD reaction chamber
ORG110	24	O-ring - 2" CD reaction chamber
SV1500	1	Solenoid valve - 3 way rebuild kit

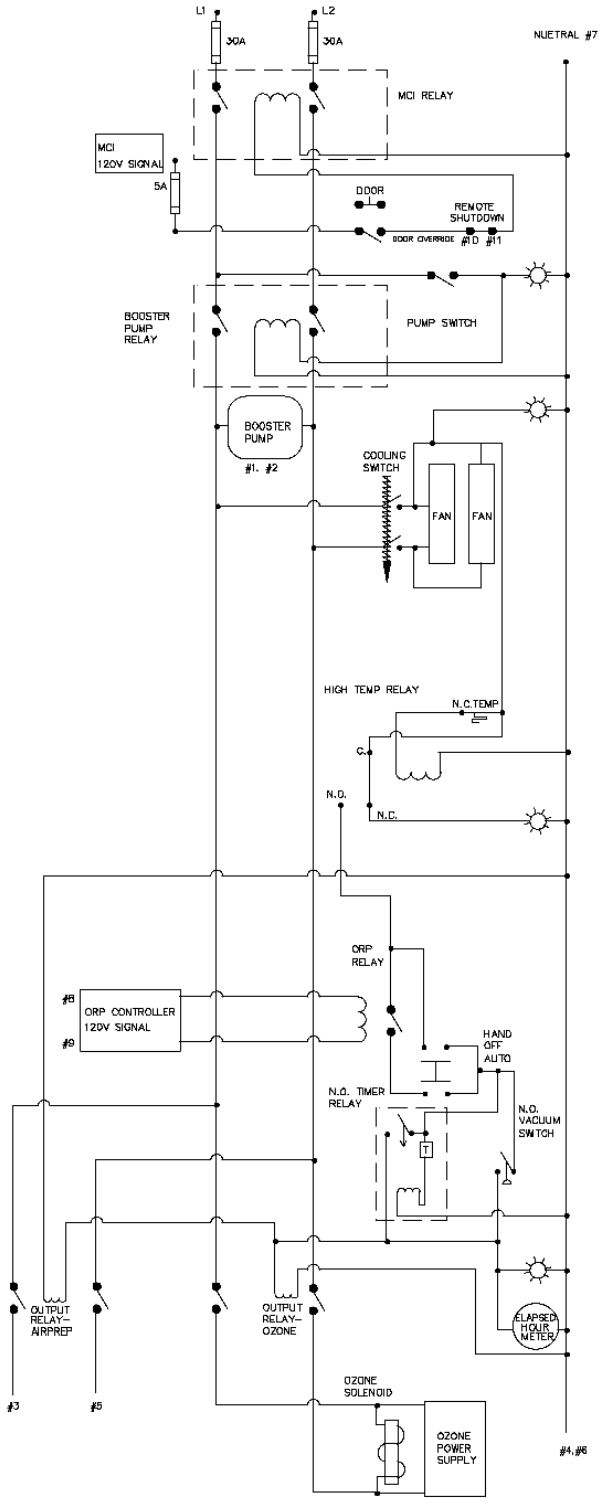
ASP 180 Maintenance kit - CD8000 and CD8000HO

Part #	QTY	Description
FA90	2	Fan - Filter element only
FLT42	1	Filter - Pressure regulator, element only
FUS20	10	Fuse - 5 amp - 240VAC, slow blow
FUS22	1	Fuse - 5 amp - 240VAC electrical hook-up box, MCI
FUS32	2	Fuse - 30 amp - 240VAC electrical hook-up box, L1-L2
INL11	5	Indicator light - Replacement lamp, 120VAC
ORG10	16	O-ring - 2" CD reaction chamber
ORG110	32	O-ring - 2" CD reaction chamber
SV1500	2	Solenoid valve - 3 way rebuild kit

ASP 240 Maintenance kit - CD12000 and CD12000HO

Part #	QTY	Description
FA90	2	Fan - Filter element only
FLT42	1	Filter - Pressure regulator, element only
FUS20	10	Fuse - 5 amp - 240VAC, slow blow
FUS22	1	Fuse - 5 amp - 240VAC electrical hook-up box, MCI
FUS32	2	Fuse - 30 amp - 240VAC electrical hook-up box, L1-L2
INL11	5	Indicator light - Replacement lamp, 120VAC
ORG10	24	O-ring - 2" CD reaction chamber
ORG110	48	O-ring - 2" CD reaction chamber
SV1500	2	Solenoid valve - 3 way rebuild kit

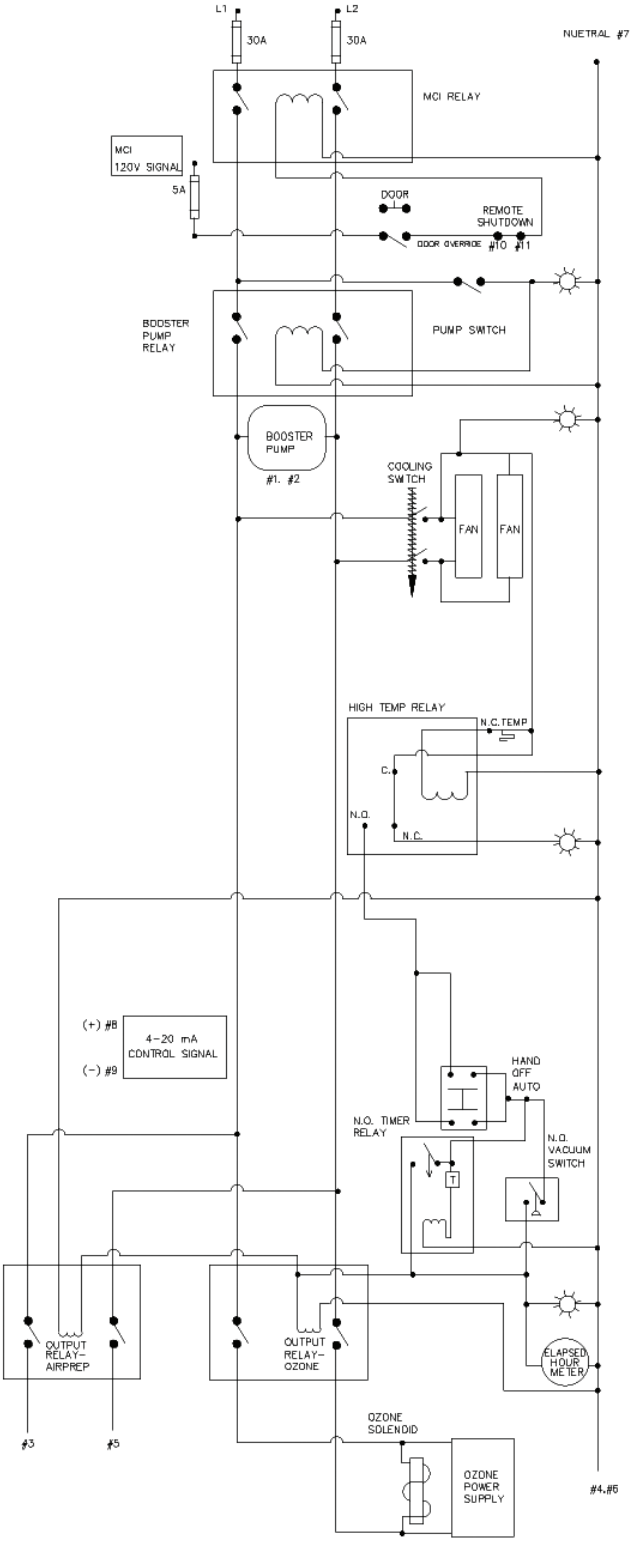
Logic Schematics



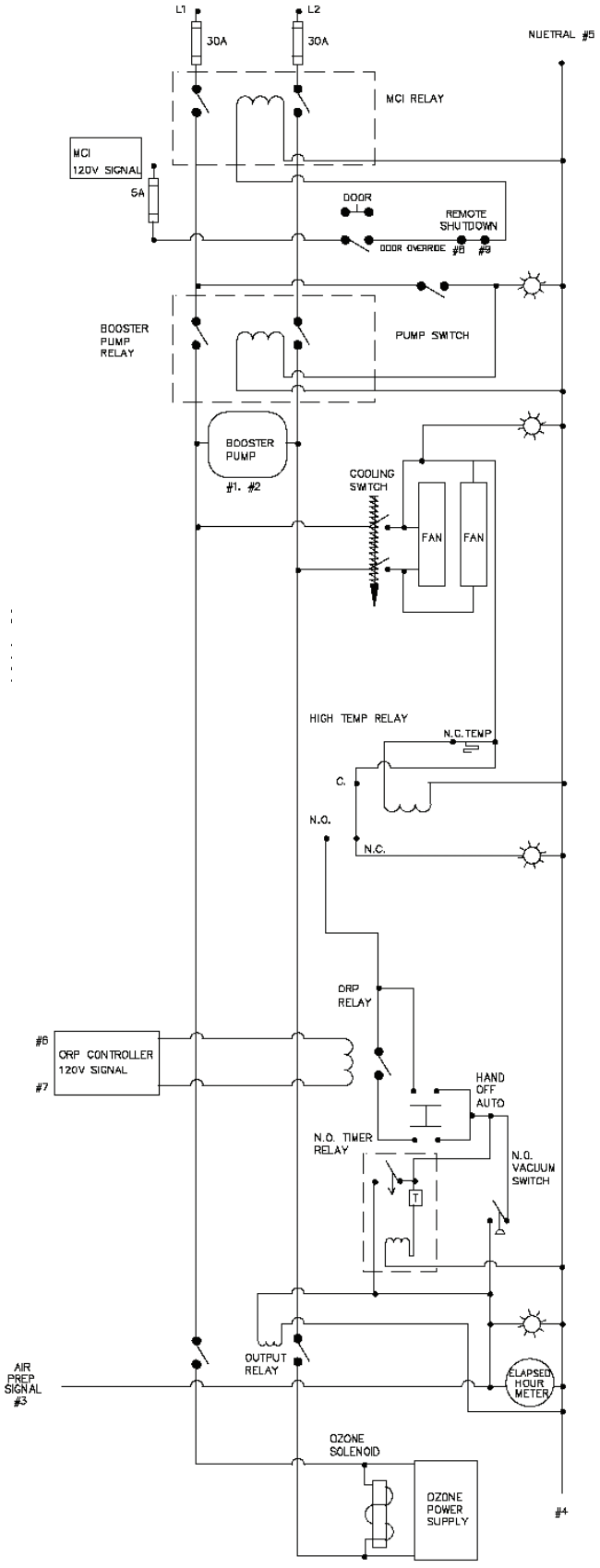
Shown: Electrical Schematic - CD-4000 Line Side

Section E - Logic Schematics

Shown: Electrical Schematic - CD4000HO Line Side

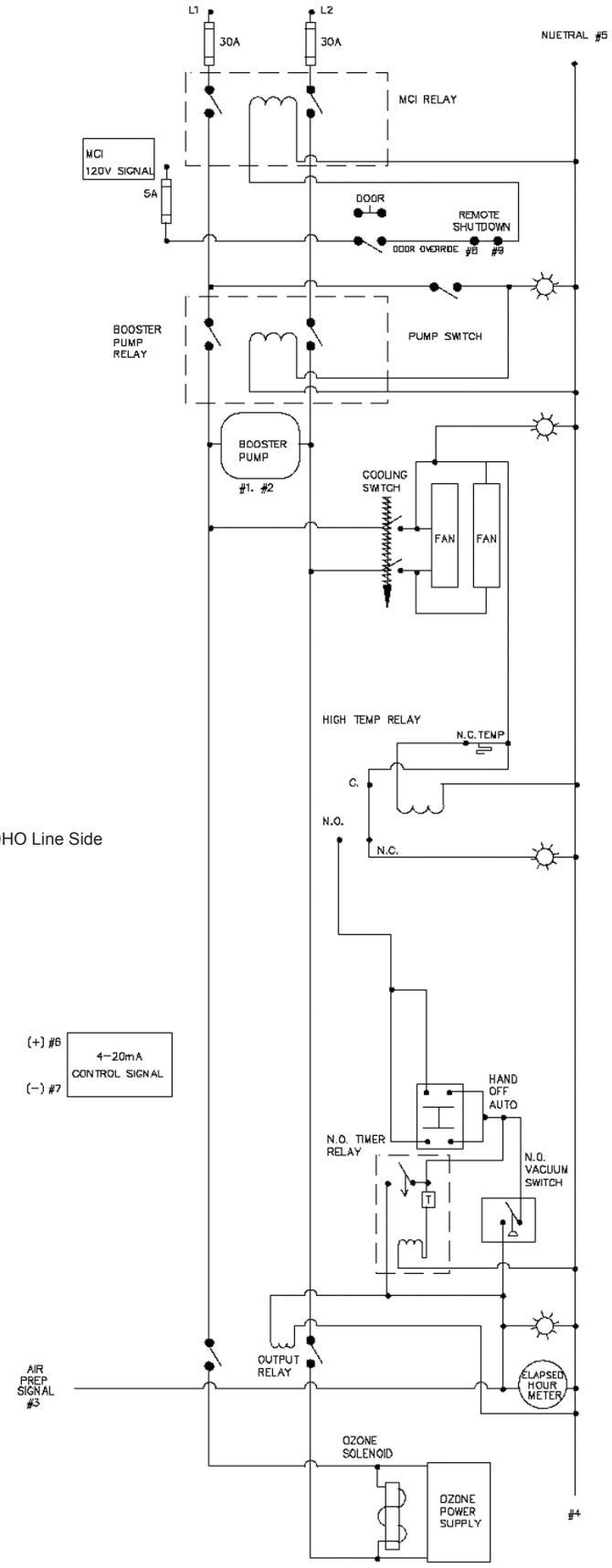


Section E - Logic Schematics



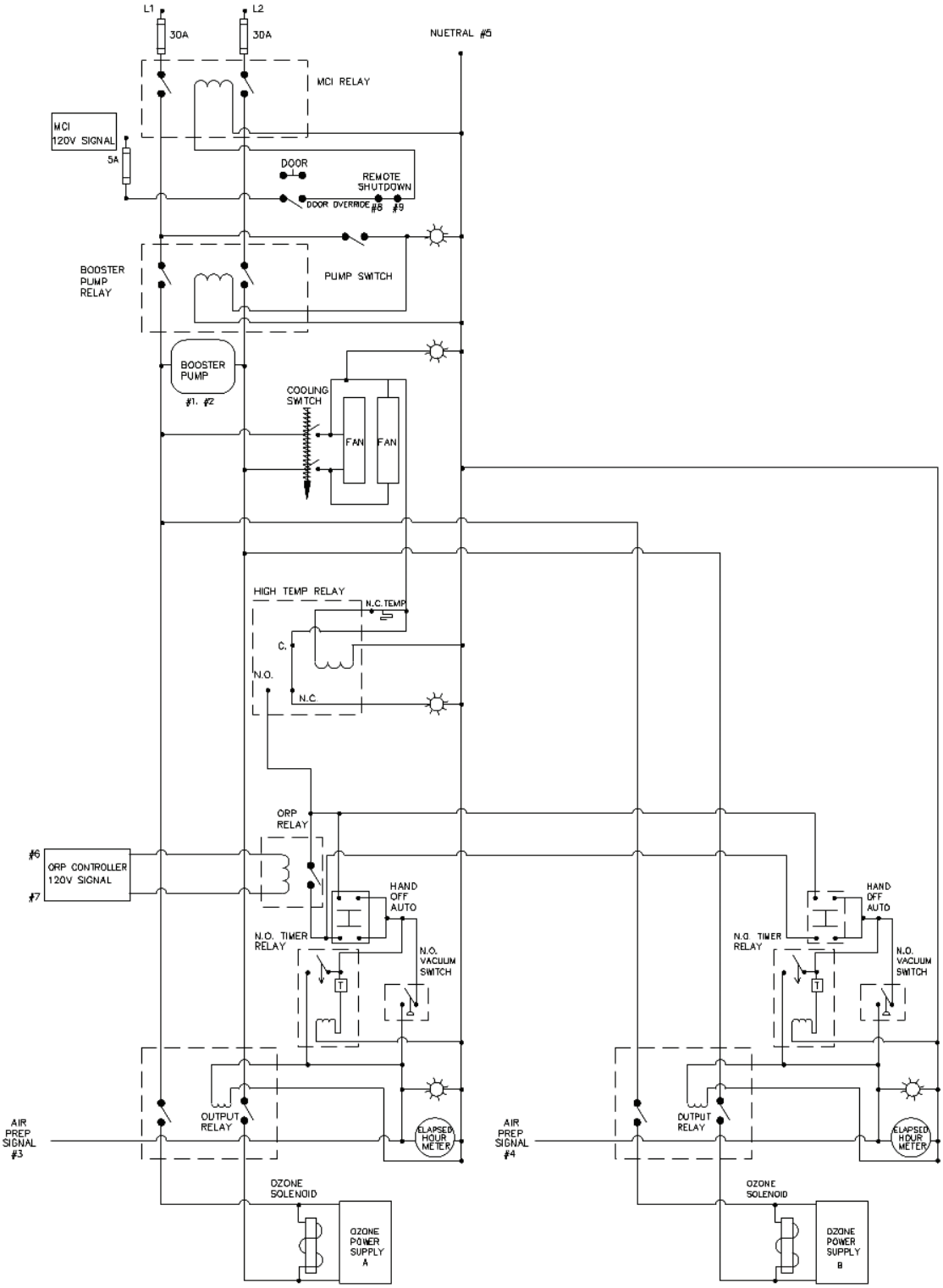
Shown: Electrical Schematic - CD-6000 Line Side

Section E - Logic Schematics



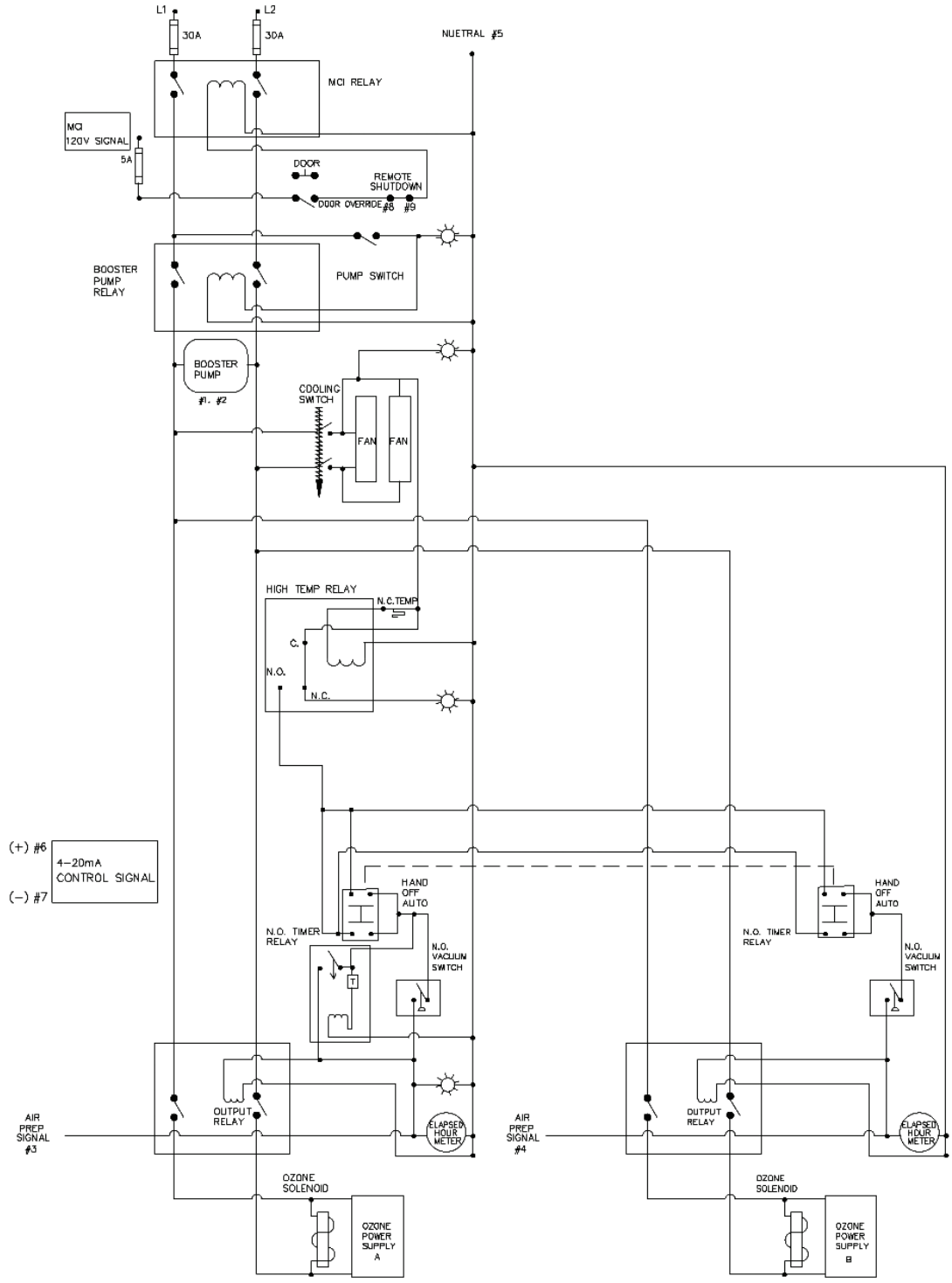
Shown: Electrical Schematic - CD6000HO Line Side

Section E - Logic Schematics



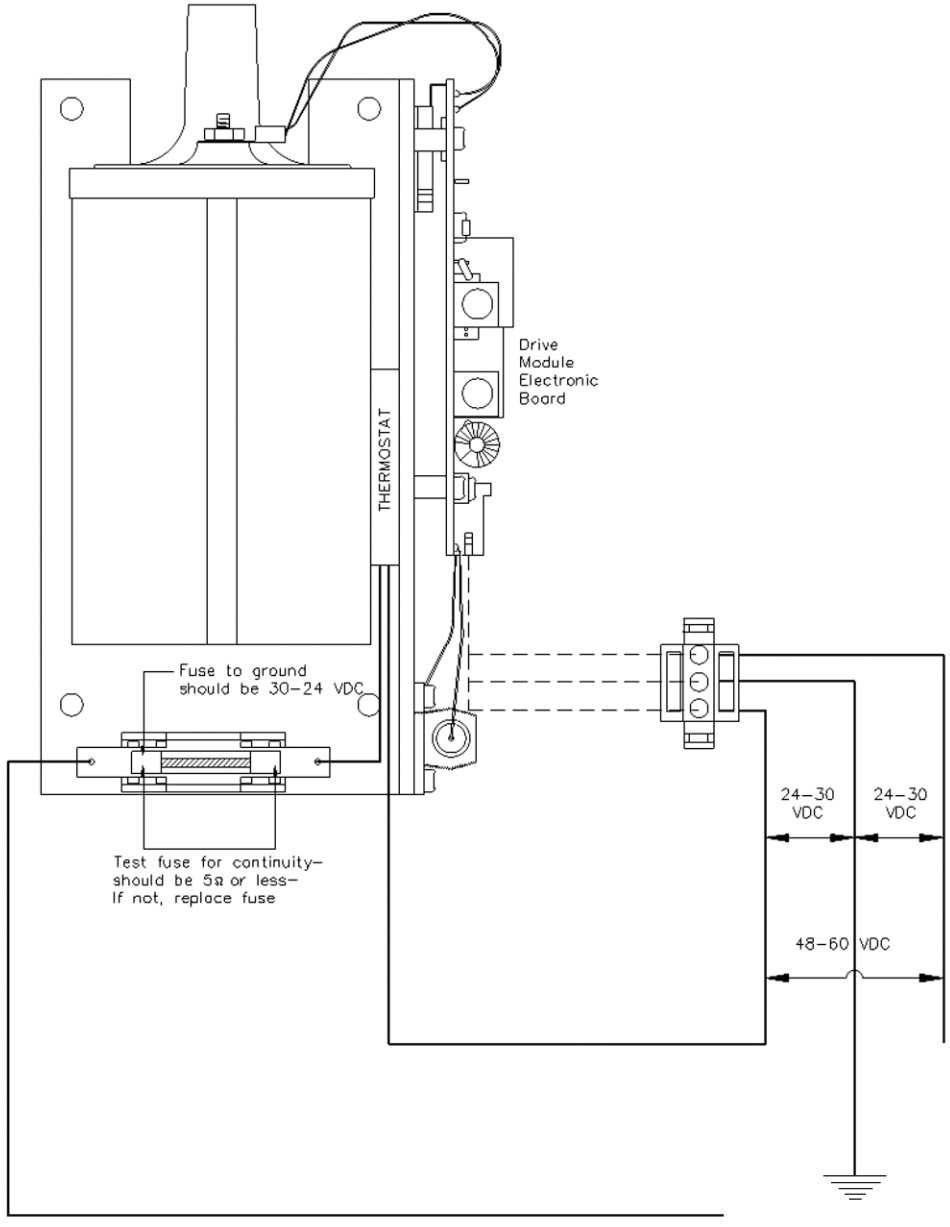
Shown: Electrical Schematic - CD-8000 and CD-12000 Line Side

Section E - Logic Schematics



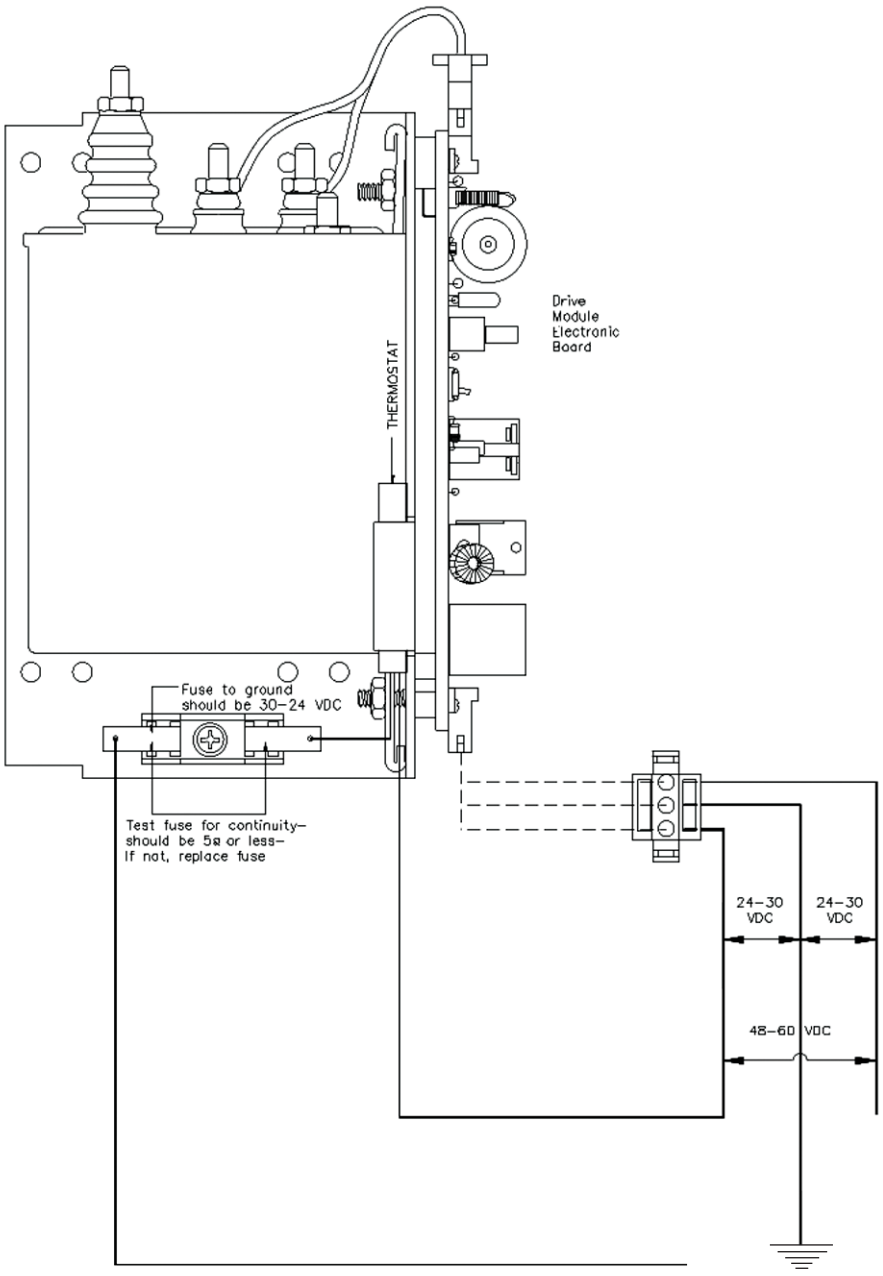
Shown: Electrical Schematic - CD8000HO and CD12000HO Line Side

Drive Module Input Voltages



Shown: Standard Drive Module

Section F - Drive Module Input Voltages

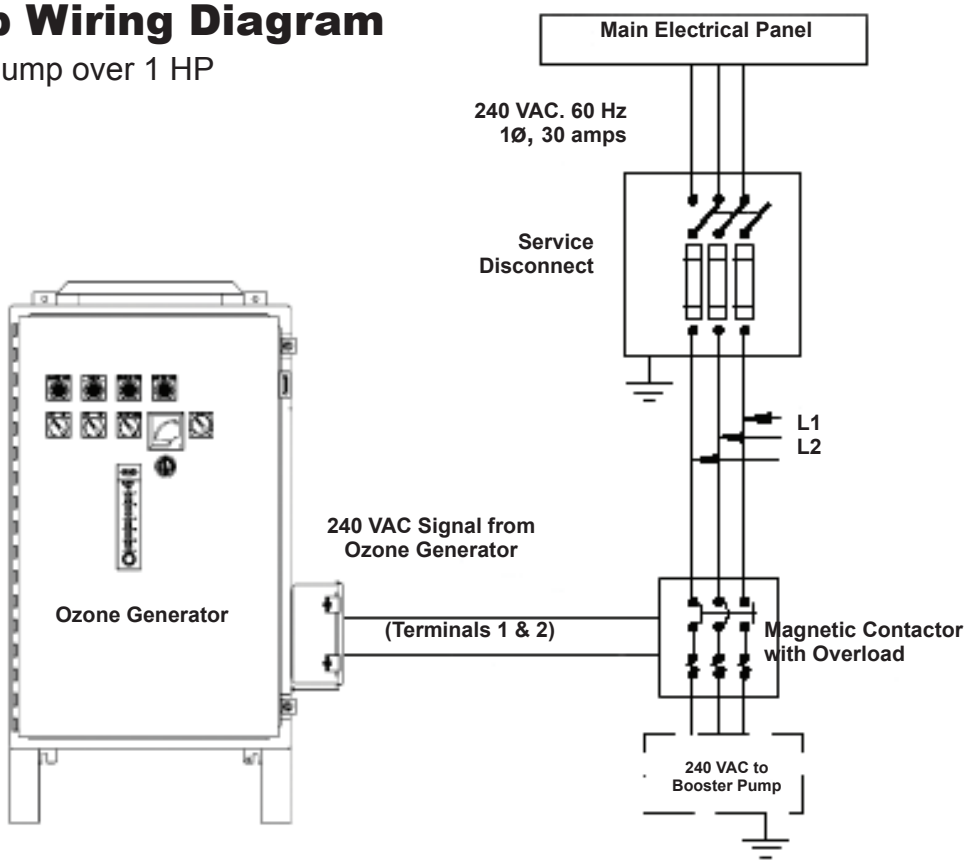


Shown: HO Drive Module

APPENDIX - Section G

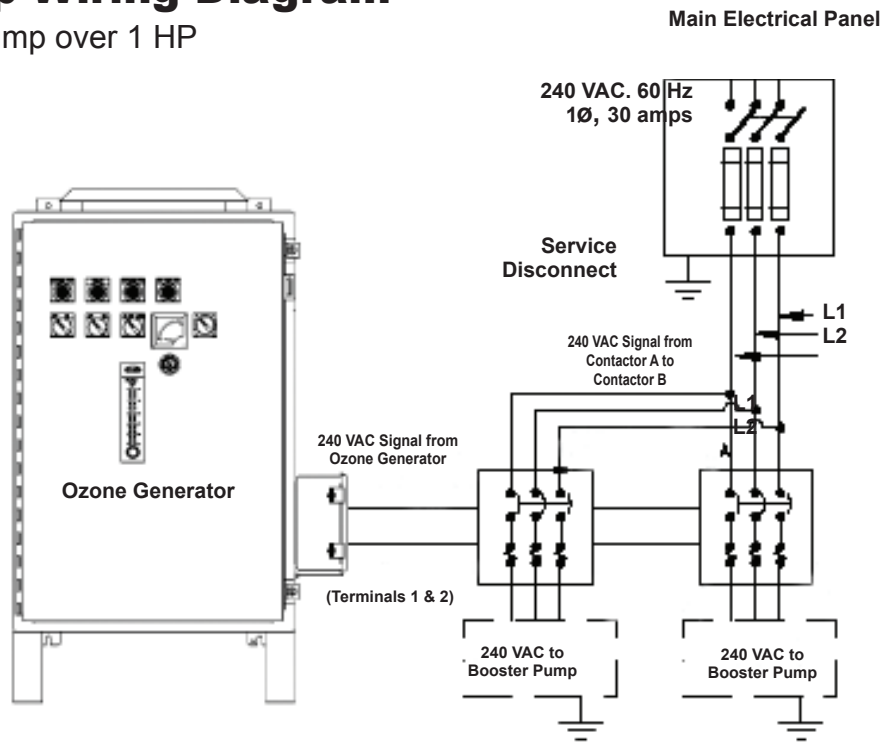
Booster Pump Wiring Diagram

Single Phase/Single Pump over 1 HP



Booster Pump Wiring Diagram

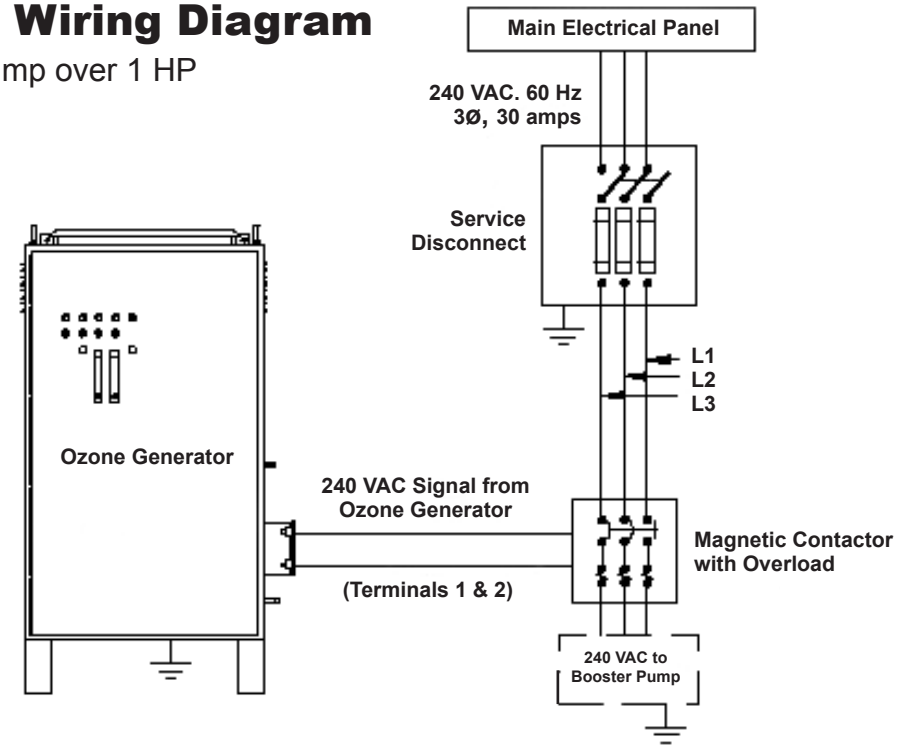
Single Phase/Dual Pump over 1 HP



Section G - Booster Pump Wiring Diagrams

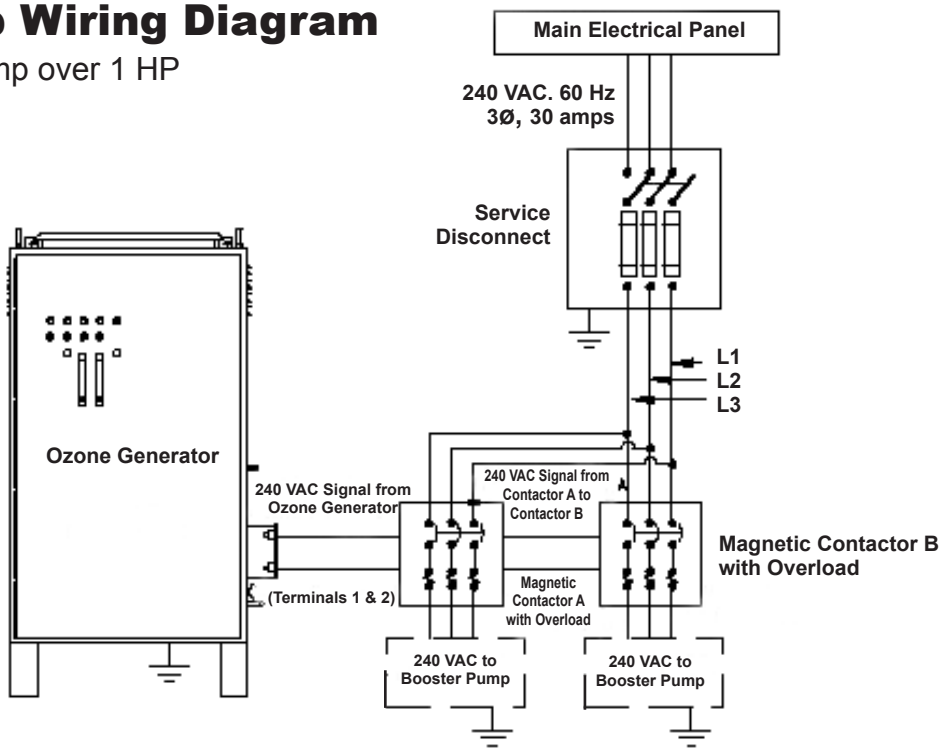
Booster Pump Wiring Diagram

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, extension 23.

EXCLUSIVE WARRANTY

There is no other expressed warranty on CWT products and/or parts. Neither this warranty, or 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 limitations 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.