Ozone Systems

Installation & Operation Manual

HDO_3 Series

High Dissolved Ozone Generation System

Nonfood Compounds
Program Listed

ClearWater Tech, LLC.
Integrated Ozone Systems
850-E Capitolio Way, San Luis Obispo, Ca 93401 • 805-549-9724 • Fax: 805-549-0306 • E-mail: service@cwtozone.com • www.cwtozone.com

INTRODUCTION

This Installation and Operation Manual is written to assist in the installation, operation and maintenance of ozone delivery systems manufactured by ClearWater Tech, LLC. This equipment has been designed using the most modern materials and technology available.

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

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

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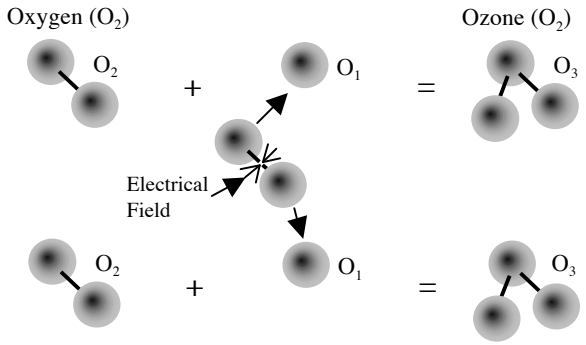
OVERVIEW

How Ozone In 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 oxygen molecules in the air stream, forming ozone (O_3)



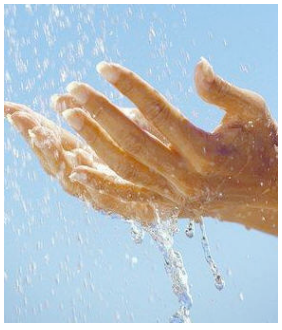
Properties of Ozone

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, waste water, food and beverage processing water, and in many other applications. Ozone is effective in performing the following:

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

Molecular Weight	48
Odor	Readily detectable at concentrations above 0.02 ppm in air
Color	Bluish in ozone generator cell, but ozone/air mixture exiting generator is invisible – even at high ozone concentrations.
Gas Density:	2.144 grams/liter at 32°F (Approximately 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.

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

Safety Information

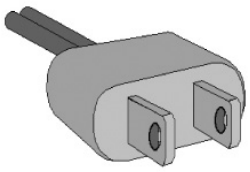
Safety Warnings

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.

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

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



ClearWater Tech corona discharge ozone generators take line voltage and convert it to 48 VDC. A high voltage transformer then boosts the voltage. Proper care must be used by a qualified electrician when making any internal adjustments or performing any maintenance procedures.

IMPORTANT SAFETY INSTRUCTIONS

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

1. READ AND FOLLOW ALL INSTRUCTIONS.

2. SAVE THESE INSTRUCTIONS.

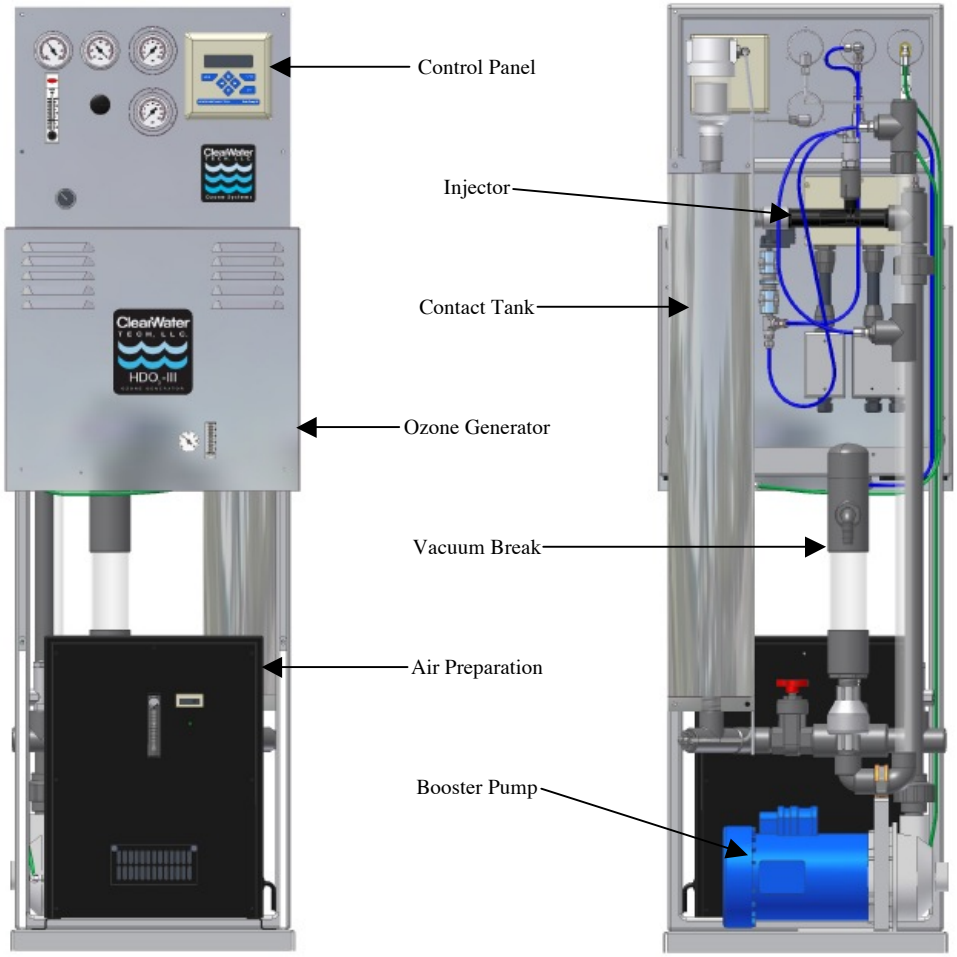
3. All electrical connections should be made by a licensed, qualified electrician.
4. Before attempting any electrical connections, be sure all power is off at the main circuit breaker.
5. Install all electrical equipment at least five feet from any open body of water using non-metallic plumbing.
6. Install check valves and a vacuum break to prevent water from contacting the electrical equipment.
7. The electrical supply for this product must include a suitably rated switch or circuit breaker to open all ungrounded supply conductors to comply with Section 422-20 of the National Electrical Code, ANSI/NFPA 70-1987. The disconnecting means must be readily accessible to the operator(s) but installed at least five feet from any open body of water.
8. Be sure to bond (ground) the system using the copper-bonding lug on the bottom of the ozone generator. The system should be bonded with solid copper wire conforming to all local, state and national electrical codes.
9. The system should be sized appropriately for its intended use by a qualified professional familiar with the application. This equipment must be validated by the manufacturer for its intended use; failure to do so may void the warranty.

Theory of Operation/Product Description

The HDO_3 Series systems are a complete, advanced ozone delivery system and engineered to efficiently produce high levels of dissolved ozone in water of municipal quality or better. The HDO_3 system takes water from a clean water source, re-pressurizes it, injects ozone to the water, and then allows contact time under pressure to achieve maximum ozone solubility. Equipped with an integrated dissolved ozone monitor/controller, this system can be regulated to achieve most desired dissolved ozone levels required. 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, injector/contacting, and the system control.

Complete Ozone System

Figure 1



Air Preparation System

ClearWater Tech pressurized ozone generators require a source of clean, dry, oil-free, oxygen-enriched air for effective ozone production. To meet that need, ClearWater Tech employs pressure swing adsorption (PSA) technology with an oil-less compressor to increase the concentration of oxygen and reduce the moisture content in the feed gas (the air supplied to the ozone generator). This substantially improves the output capability of the ozone generator and prevents premature failure of key internal components. These air preparation systems deliver 90%+/-3% oxygen purity at -60°F dew point and at very low pneumatic pressures, minimizing noise and reducing compressor wear.

The air preparation system directly affects how many grams of ozone is produced per hour which in turn the ozone concentration, also known as "percent by weight." Since ozone is produced with oxygen, the greater the percent of oxygen that enters the ozone generator the greater percent of ozone that will come out of the ozone generator. Using a PSA oxygen concentrator allows the HDO_3 Series ozone generation systems to produce ozone at a high grams per hour while also maintaining a high percent by weight. The high percent by weight results in a high solubility of the ozone gas in solution to ensure the grams of ozone produced make it into solution resulting in a high dissolved ozone level.

Ozone Generator

HDO_3-I and HDO_3-II - Only: The ClearWater Tech HDO_3-I is equipped with a CD12 ozone generator where as the HDO_3-II is equipped with CD2000 ozone generator. The oxygen feed gas produced by the air preparation system is supplied to the ozone generator at a maximum pressure of 5 pounds per square inch (psi). It then flows into the built-in air flow meter; 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. A stainless steel needle valve, located on the control panel of the HDO_3-I and HDO_3-II, is used to maintain optimum pneumatic parameters inside the ozone reaction chambers.

HDO_3-III - Only: The HDO_3-III system is equipped with a ClearWater Tech CD2000P ozone generator designed to supply high concentrations of ozone gas at 10 PSI. The oxygen feed gas produced by the air preparation system is supplied to the ozone generator, which flows through the built-in flow meter. A stainless steel needle valve, located on the control panel of the HDO_3-III, is used to maintain optimum pneumatic parameters inside the ozone reaction chambers. After this point the vacuum created at the ozone injector draws the ozone gas into the water line. The ozone generator is equipped with a pressure switch, which prevents ozone production if pressure within the ozone reaction chambers drops below 9 PSI.

The feed gas of the HDO_3 systems 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. ClearWater Tech ozone generators are designed to supply high concentrations of ozone gas. The oxygen feed gas produced by the air preparation system is supplied to the ozone generator. The vacuum created at the ozone injector draws the ozone gas created by the ozone generator into the water line. A flow meter and a pressure gauge on the control panel allow for close monitoring of the feed gas and normal operating parameters. The ozone generator is equipped with a vacuum switch, which prevents operation if the vacuum from the injector drops below -3 inches of mercury (inHg). This is a safety feature to prevent ozone production if the delivery line to the injector becomes damaged, or if the injector malfunctions.

Ozone Injection/Contacting

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

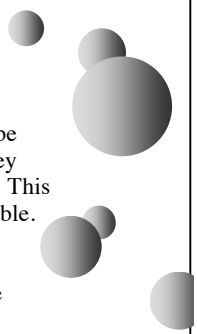
ClearWater Tech HDO_3 systems use only Mazzei® injectors for maximum mass transfer efficiency. The injector produces a cavitation effect, enabling the ozone gas to join the water stream in the form of extremely tiny

A Short Course in Fine Bubbles

Lesson 1 – The large bubble (20mm) has a volume of 4.19 cm3 and a surface area of 12.6 cm2.

Lesson 2 – 296small bubbles (3mm) could be made from the large bubble in lesson 1. They would have a total surface area of 83.6cm2. This is 6.6 times the surface area of the large bubble.

Lesson 3 – Theoretically, 6.6 times as muchwater could be ozonated with the same amount of ozone!



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.

Incorporated on the HDO_3 systems is a stainless steel contacting vessel and auto vent to provide sufficient contacting of the ozone gas with the water and off-gas any residual ozone. By design, the operating water pressures of this system and the ClearWater Tech engineered contacting system allows for high levels of dissolved ozone to be maintained in the water in this single pass configuration.

The HDO_3 systems incorporate a water pressure relief valve and positive atmospheric vacuum break as standard safety equipment to protect the system. This water-pressure relief valve is located downstream of the dissolved ozone sensor and is set to relieve at 55 PSI. If excessive backpressure is applied to the system this relief valve will open protecting the dissolved ozone sensor. The vacuum break is located on the backside of the HDO_3 system and is a positive atmospheric break between the ozone injector and ozone generator. If the ozone injector check valve were to fail water would flow back to the vacuum break and out to drain instead of back to the ozone generator.

Control Panel

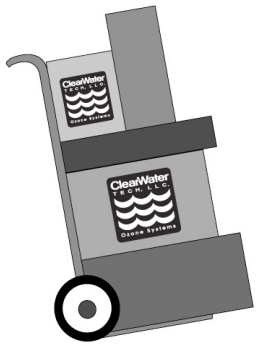
The HDO_3 systems incorporate a user-friendly instrumentation control panel, which includes; ozone generator oxygen flow meter, ozone generator vacuum or pressure gauge, injector vacuum gauge, high water pressure gauge, low water pressure gauge, stainless steel injector vacuum control valve and a dissolved ozone parts per million (PPM) monitor/controller. This dissolved ozone monitor/controller can be used to monitor the dissolved ozone level produced and is factory set to control the ozone generator output via a 4-20mA output signal, other alarm relays are also available on the monitor/controller.

Ozone Destruct

The ClearWater Tech off-gas destruct systems (offered separately), consists of two components the ozone destruct unit (a heated chamber filled with manganese dioxide and copper oxide) and a water trap. Used in conjunction with a ClearWater Tech off-gas vent, the ozone destruct system is an effective way to vent the contact vessel when it is impractical to send the off gas to atmosphere or reintroduce it to the water. See the “Ozone Off-Gas Destruct” manual for installation and maintenance procedures.

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 on the equipment pad, 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 the HDO_3 Series systems are included in Appendix A.

Like any electronic component, performance and longevity is enhanced by favorable operating conditions. Also, since the air preparation system and ozone generator is air-cooled, a relatively dust-free, well-ventilated area is required. No caustic chemicals should be stored in the area surrounding the equipment. A minimum clearance of six inches from the vents on either side of the ozone generator is required.

The equipment is heavy and requires proper support. Therefore, a clean, dry, level surface should be provided for the HDO_3 Series systems.

The HDO_3 Series systems are designed for specific voltage requirements and to withstand typical outdoor elements, though should not be subjected to outdoor extremes including 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 (-6.5°C) to 95°F (35°C) continuous. If the temperature around the equipment consistently exceeds 95°F (35°C), 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.

Water Quality

For anticipated results the HDO_3 Series systems require a source of clean water and free of any contaminate load, which may include but not limited to:

- Bacteria
- Viruses
- Algae
- Iron
- Manganese
- Hydrogen Sulfide
- Nitrates
- Nitrites
- pH below 7.0 or above 7.5
- Chlorine
- No particulate matter – Pre-filtration is required for any water supply that has particulate mater.

Installation Procedures – Plumbing

The HDO_3 system anticipated results are based on water quality and gallons per minute (GPM) flow rate and water pressure. Based on desired dissolved ozone levels measured in parts per million (PPM), the system should be plumbed using either a sidestream or full flow configuration, see Figure 2 for desired ppm level at the suggested gpm flow rate. The sidestream method takes a portion of the water from the main flow and diverts it into a sidestream through the HDO_3 system, then returns the water back into the full flow, see Figure 3. In a full flow configuration, the water is simply plumbed into the HDO_3 system, and then out of the system to the point of use, see Figure 4.

Note: The HDO_3 Series systems have specific flow through rates that must not be exceeded. If the full flow GPM flow rate exceeds the maximum flow through rate of the HDO_3 system the sidestream configuration must be used, see Figure 2. Dissolved ozone levels may decline from the anticipated result listed in Figure 2 if the system inlet water pressure is less than 20PSI.

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

NOTES:

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

Hydrolic Specification Chart

Figure 2

	HDO_3 - I	HDO_3 - II	HDO_3 - III
GPM @ 1.0 PPM Dissolved Ozone	24.5GPM (92.7 LPM)	59 GPM (223 LPM)	150 GPM (568 LPM)
GPM @ 3.5 PPM Dissolved Ozone	8 GPM (30 LPM)	16 GPM (60 LPM)	50 GPM (189 LPM)
GPM @ 4.5 PPM Dissolved Ozone	N/A	13 GPM (49 LPM)	30 GPM (113 LPM)
Minimum Flow Through Rate	8 GPM (30 LPM)	13 GPM (49 LPM)	13 GPM (49 LPM)
Min/Max Inlet Pressure	0 to 20 PSI		
Water Inlet/Outlet Connection	1-1/4” fpt / 1” fpt		

Step 1: Arrange the HDO_3 system according to mechanical print or as dictated by equipment layout and serviceability considerations. Do not secure the system to equipment pad 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 for the sidestream configuration (see Figure 3).

Step 3: Remove the PVC plugs (installed at the factory to keep the dissolved ozone probe wet during transportation) from the inlet and outlet of the HDO_3. **Note: The dissolved ozone probe is calibrated to the dissolved monitor/controller at the factory. The probe must not be out of water for more than a 24-hour period to retain this calibration. If the duration exceeds 24 hours re-calibration may be required.**

Step 4: Plumb a line, from the tee or plumbing saddle for the sidestream configuration or from the main water supply line for the full flow configuration, to the HDO_3 booster pump. For serviceability of the equipment be sure to install an isolation valve before the HDO_3 system booster pump. Notes: A pressure reducing valve may be required if the inlet water supply pressure is greater than 20PSI. The full flow configuration can also be used to re-circulate an atmospheric vessel, although the HDO_3 system must have a flooded suction to the inlet of the integrated booster pump. **If the HDO_3 system operates without water flow, damage may occur to the booster pump and warranty will be void.**

Step 5: Using a tee or plumbing saddle, plumb from the outlet of the HDO_3 back into the main water line for the sidestream configuration or to the point of use for the full flow configuration. For serviceability of the equipment be sure to install an isolation valve after the HDO_3 system.

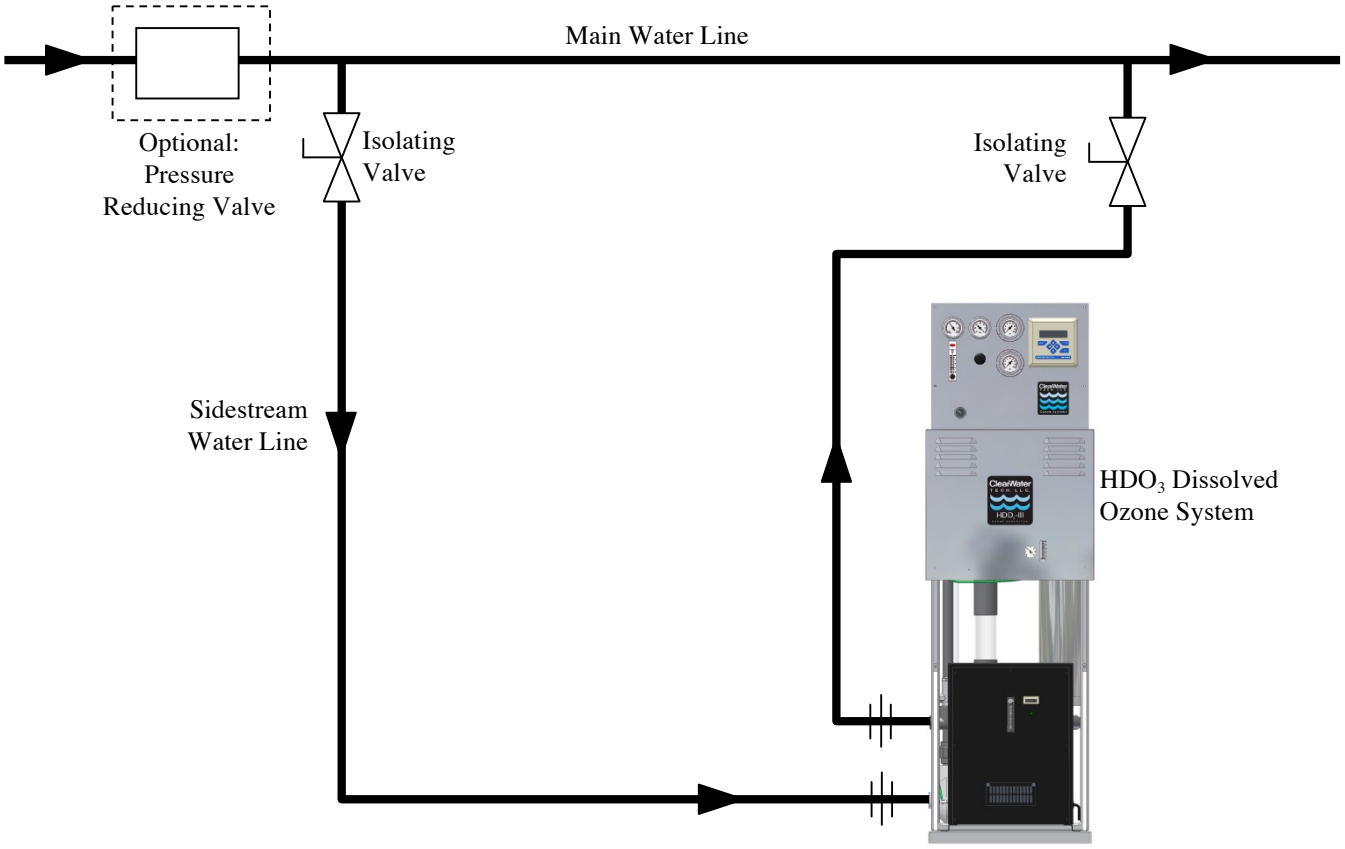
Step 6: Secure the HDO_3 system to solid mounting surfaces using appropriate hardware and according to local codes.

Step 7: Depending on conditions, the vented gas from the contact tank off-gas vent may be directed to an ozone destruct system or to atmosphere. **Note: Do not direct the tubing to the suction side of a pump.**

Step 8: The HDO_3 system incorporates a water pressure relief valve (located on the water outlet line of the system) set at 55 PSI, to protect the dissolved ozone probe. If the water pressure downstream of the probe reaches 55 PSI the pressure relief valve will open. Plumb a line from the ½” fpt outlet port of the pressure relief valve to waste.

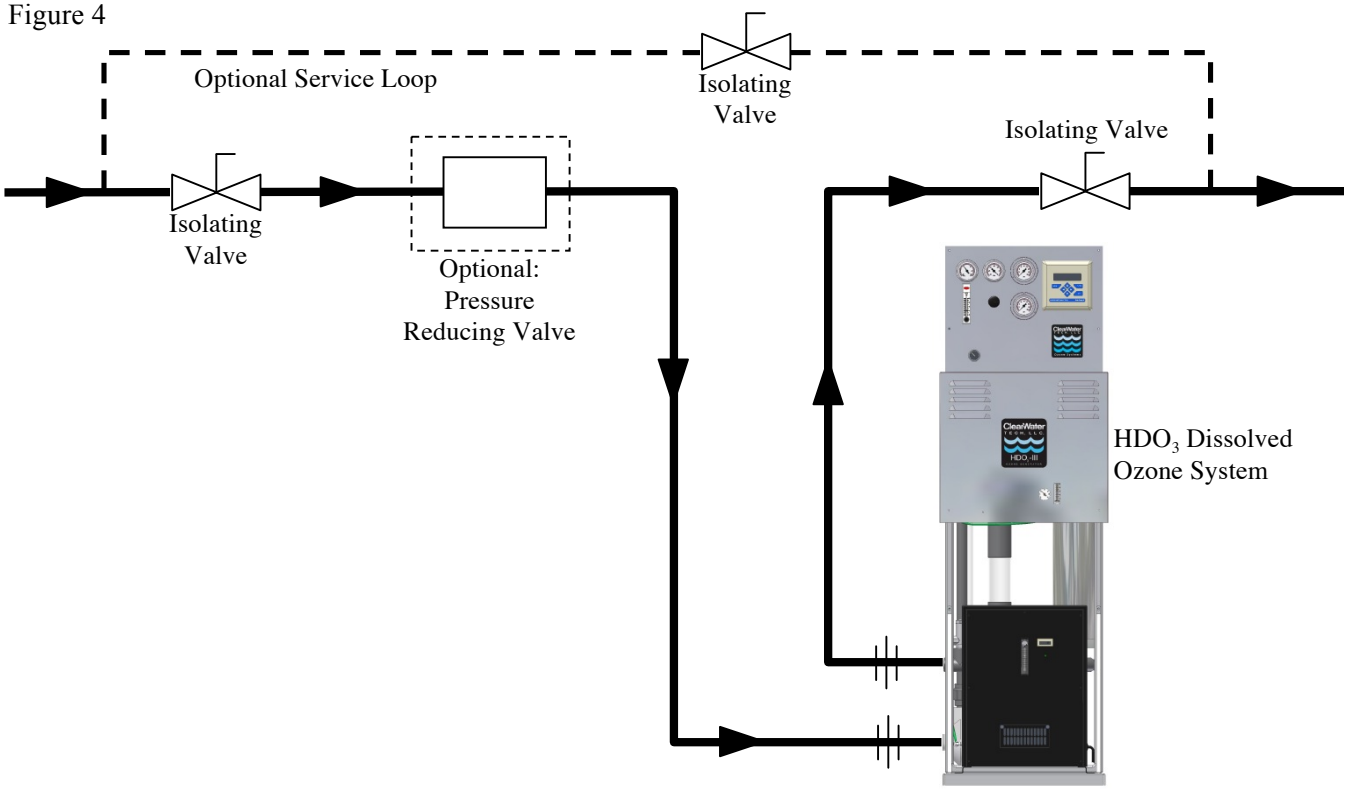
Sidestream Plumbing Installation Diagram

Figure 3

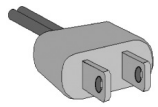


Full Flow Plumbing Installation Diagram

Figure 4



Installation Procedures – Electrical



The HDO_3 Series ozone generation systems are designed to be hard wired to the main power source with the specific input voltage requirements. All possible pre-wiring has been completed at the factory. Logic schematics have been provided in the Appendix D.

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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**

Step 1: Conforming to all local, state and national electrical codes, ground the HDO_3 system to a true earth ground. Use solid copper bonding wire (usually #8 AWG) from the copper-bonding lug located on the base of the HDO_3 system.

Step 2: Main Power – The systems are equipped with a 12AWG 2-pole/3-wire cord 10 foot in length. Wire the HDO_3 system from the main power cord to the main power source with specified input voltage, either 120VAC 60Hz (L1-Black, Neutral-White and Ground-Green), 220VAC 50Hz or 220VAC 60Hz (L1-Black, Neutral/L2-White and Ground-Green), single phase (1ø), +/- 10% of rated voltage.

HDO_3 Series Power Consumption			
Input Voltage	120VAC 60Hz	220VAC 50Hz	240VAC 60 Hz
HDO_3-I	20 Amps	11 Amps	10 Amps
HDO_3-II	20 Amps	11 Amps	10 Amps
HDO_3-III	20 Amps	11 Amps	10 Amps

Step 3: External Loop: The external loop is a true dry contact interface. **Note: The term 'dry contact' means that this loop does not supply output nor accept input voltages. Warning: Supplying voltage to the external loop will cause damage to the ozone generator and void warranty.** Under normal operation, the external loop will effectively interrupt the ozone output when the loop has lost continuity; this will also illuminate the LED located on the 4-20mA control board inside the HDO_3-II and HDO_3-III ozone generators and the EXT LOOP LED on the front cover of the HDO_3-I ozone generator (see Appendix A, for location of 4-20mA board) and turn off the "Ozone Output" LED(s) on the front cover. **Note: When the external loop has lost continuity main power to the ozone generator will remain "ON" giving power to the cooling fan(s).** When continuity is present through the external loop, ozone output will continue. This continuity will effectively turn "OFF" the LED of the 4-20mA board and the EXT LOOP LED and will again illuminate the "Ozone Output" LED(s).

The external loop is connected to a vacuum switch on the venturi side of the needle valve in the pneumatic flow. This is a safety precaution to ensure ozone production stops if the line to the venturi is damaged. If additional control devices are required they must be spliced into this control loop in series with the vacuum switch to maintain the safety of the system

The external loop, a removable two-position plug with a white 18AWG wire located at the bottom panel of the ozone generator (see Appendix A), can be interfaced to any control device, i.e., pressure switch, vacuum switch, flow switch, float switch, ORP controller, PPM controller, or timer. To interface a control device to the external loop, cut one of the wires going to the vacuum switch. Connect the control device to each leg of the cut wire. **Note: External Loop control devices supplied by ClearWater Tech may come equipped with a two-position male connector ready to be plugged into the female two-position connector mounted to the chassis of the ozone generator.** If the control device used supplies an output voltage, a single pole single throw (SPST) normally-open relay may be used to create a dry contact

interface (see Figure 5, "External Loop Electrical Interface"). **Note: Attached to the white 18AWG external loop is a warning, "THIS CONNECTION IS A DRY CONTACT ONLY, DO NOT APPLY VOLTAGE".**

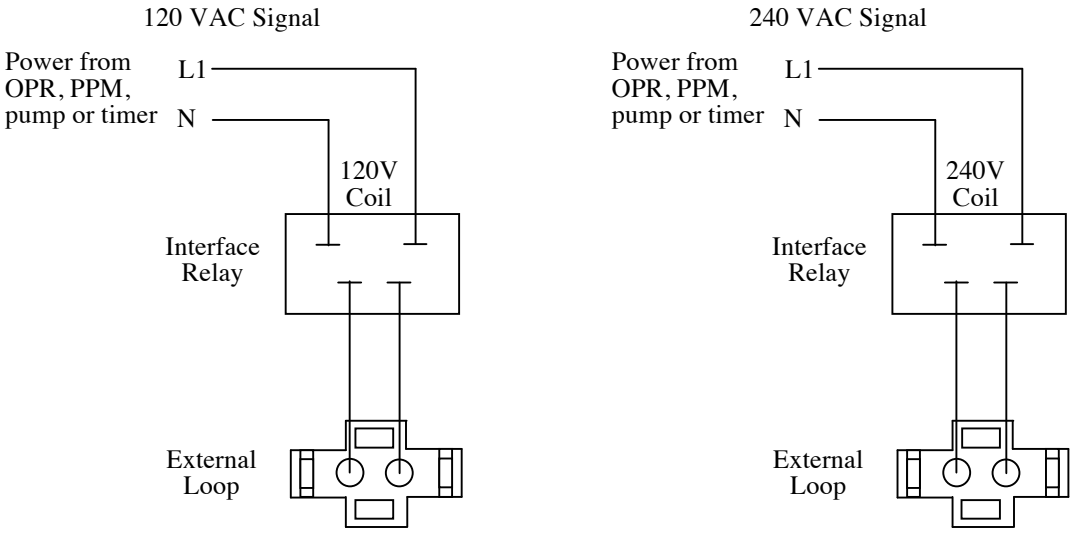
Step 4: Ozone Output Control – The HDO_3 Series systems are equipped with two options for controlling the ozone output, either a manual 0-100% ozone output control or a remote 4-20mA control input signal. The HDO_3 Series are factory set to be controlled by the dissolved ozone monitor through the 4-20mA input. See Appendix A for location.

- Manual Ozone Output Control - Turning the control knob counterclockwise will decrease the ozone output down to 0%, while turning the knob clockwise will increase the ozone output up to 100%. The "Ozone Output" is indicated by the LED(s) on the front cover of the ozone generator, see Appendix A.
- Remote 4-20mA Control: The ozone generator will automatically sense the 4-20mA input signal and override the setting of the manual ozone output control. Based on the 4-20mA signal, ozone output will increase or decrease, 4mA = 0% ozone output, 20mA = 100% ozone output. The "Ozone Output" is indicated by the LED(s) on the front cover of the ozone generator, see Appendix A. **Note: If the remote 4-20mA signal fails or is missing, the system will default to the manual ozone output setting. Check and adjust the manual ozone output control knob to avoid over-ozonation.** The ozone generator 4-20mA control leads of the HDO_3 system have been pre-wired at the factory to the dissolved ozone monitor/controller. The negative (-) input signal to the Purple wire of the ozone generator and the positive (+) input signal to the Orange wire of the ozone generator. **Note: The dissolved ozone monitor/controller has been pre-programmed at the factory to 20mA or 100% ozone output. Either re-programming the dissolved ozone monitor/controller or removing the 3-position 4-20mA control connector from the HDO_3 ozone generator can override this function.**

Step 5: Dissolved Ozone Monitor/Controller – The HDO_3 series systems are equipped with an integral dissolved ozone monitor/controller. This monitor/controller is equipped with alarm relays that can be used to interlock other devices based on dissolved ozone levels. Main power and the 4-20mA control interface to the ozone generator have been pre-wired at the factory. The unit has also been pre-programmed at the factory to supply a constant 20mA (100%) ozone output signal to the ozone generator. The dissolved ozone monitor/controller must be re-programmed for any other desired setting. See the dissolved ozone monitor/controller manual for function and electrical hook-ups.

External Loop Electrical Interface

Figure 5



Start-Up and 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 and vacuum or pressure levels are maintained at the HDO_3 system while the ozone injector is operating at a comparatively higher vacuum (measured in inches of mercury, or "in.Hg"). Also, maintaining the correct water flow and hydraulic pressures will ensure the highest possible level of dissolved ozone. The air from the air preparation system of the HDO_3-I and HDO_3-II flows toward the ozone generator under pressure, and from the ozone generator under vacuum (created by the ozone injector). The change from pressure to vacuum occurs at the SCFH meter of the air preparation system located on the bottom left side of the HDO_3 system. Where as, the air from the air preparation system of the HDO_3-III is flowing through the ozone generator under pressure, and from the ozone generator under a slight vacuum (created by the ozone injector). The change from pressure to vacuum occurs after the stainless steel "Ozone Injector–Vacuum Control" needle valve located on the control panel of the HDO_3-III..

HDO_3 Series – Dissolved Ozone Generation System

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

Step 1: Make sure all isolation valves in the ozone water system are open (Figures 3 and 4 show recommended isolation valve locations).

Step 2: The main power switch of the HDO_3 system, located on the Control Panel (see Appendix A), should be in the "OFF" position. Main power should be available to the HDO_3 system.

Step 3: Remove the Fill Port Cap of the vacuum break located on the backside of the HDO_3 system and fill the Riser Tube with clean water (no particulate matter) to the fill level, see Appendix A

Step 4: Re-install the Fill Port Cap, hand tight. **Note: Do not over tighten as damage to PVC fittings may occur.**

Step 5: Completely open the contact tank backpressure valve, located towards the bottom backside of the HDO_3 system (see Appendix A), by turning it counter-clockwise.

Step 6: Start-up hydraulics. Allow the water in the system to reach hydraulic equilibrium (contact vessel full, off-gas vent operating, etc.) and observe for plumbing leaks. If the inlet water supply is not under pressure be sure the HDO_3 booster pump is flooded with water so that the booster pump will prime. **Notes: Water flow must be established through the HDO_3 system booster pump before operation. If the inlet water supply to the HDO_3 system is not under pressure the system may not completely fill with water until the HDO_3 system is operational.**

Step 7: If the inlet water supply to the HDO_3 system is pressurized, using a water pressure regulator with a pounds per square inch (PSI) gauge, regulate the inlet water supply pressure to 20PSI maximum. **Note: Backpressure downstream of the HDO_3 system could affect this PSI reading.**

Step 8: Turn the main power switch of the HDO_3 to the "ON" position. The HDO_3 should energize giving power to the booster pump, oxygen concentrator, ozone generator and dissolved ozone monitor/controller.

Step 9: Check that the "Low Pressure – Side Water" and "High Pressure – Side Water" gauges match the normal operating parameters outlined in Figure 9. Note: It is typical for the "High Pressure - Side

Water" gauge to be about 40PSI greater than the "Low Pressure – Side Water" gauge. If the "Low Pressure – Side Water" is out of the appropriate range slowly adjust the contact tank backpressure valve until this pressure is within the parameters outlines in Figure 9.

Step 10: Adjust the oxygen concentrator flow meter located on the bottom left-hand side of the HDO_3 system. The HDO_3 system uses the flow gauge on the control panel to regulate oxygen output so the needle valve on the left hand side of the oxygen concentrator must be opened up as to not restrict oxygen output.

Step 11: Adjust the feed gas flow meter, located on the Control Panel (see Appendix A), of the HDO_3 system. See the "Feed Gas Flow Rate" line of the Operating Parameters chart Figure 9. **Note – The flow through this meter will not be at atmospheric pressure so the measured value located in the Operating Parameters chart has been pressure correct to the ideal pressure/vacuum. This means that the pressure/vacuum must be set correctly before the flow will be correct. Warning – If the flow from the oxygen concentrator is too high it can cause damage to the oxygen concentrator and eventually damage to the ozone generator.**

Step 12: For HDO_3-I and HDO_3-II systems, adjust the "Ozone Injector – Vacuum Control" knob, located on the Control Panel (see Appendix A), until the "Ozone Generator – Vacuum" gauge is correctly set according to the "Ozone Generator – Vacuum" line of the Operating Parameters chart Figure 9. Due to the vacuum switch installed, the "Ozone Generator – Vacuum" gauge must achieve -3inHg before ozone will begin production (once the External Loop is re-connected). **Note: Re-adjustment of the "Feed Gas Flow Rate" meter and the "Ozone Injector – Vacuum Control" knob in step 11 may be required to correctly set the normal operating parameters of both the feed gas flow rate and the ozone generator vacuum.**

For HDO_3-III – only: Adjust the "Ozone Injector – Vacuum Control" knob, located on the Control Panel (see Appendix A), until the "Ozone Generator – Pressure" gauge is correctly set according to the "Ozone Generator – Pressure " line of the Operative Parameters chart Figure 9 Due to the pressure switch installed, the PSI gauge must achieve a minimum of 9 PSI before ozone will begin production (once the External Loop is re-connected). **Note: Re-adjustment of the "Feed Gas Flow Rate" meter and the "Ozone Injector – Vacuum Control" knob in step 11 may be required to correctly set the normal operating parameters of both the feed gas flow rate and the ozone generator pressure. The ozone generator flow meter and pressure gauge on the front cover of the ozone generator will match the readings of the "Feed Gas Flow Rate" meter and the "Ozone Generator – Pressure" gauge.**

Step 13: The dissolved ozone monitor/controller should be registering 0.00PPM of dissolved ozone at this time. If it is not the dissolved ozone probe should be "Zeroed" or re-calibrated. Follow the calibration steps of the Quick Reference Guide located in Figure 10 or the "Calibration" section of the monitor/controller I/O Manual.

Step 14: Switch the ozone generator power switch to the "ON" position located on the bottom of the ozone generator, see Appendix A.

Step 15: Re-connect the External Loop dry contact that was removed before starting these start-up procedures. Production of ozone should now begin. **Note: If bubbles are observed in the vacuum break, do NOT re-connect the External Loop dry contact. See Troubleshooting Guide.**

Step 16: Approximately 20 seconds after the External Loop has been re-connected, the dissolved ozone monitor/controller should begin registering a steady increase in the dissolved ozone level. Adjust the dissolved ozone level by either, setting the dissolved ozone controller to a desired set point or remove the 4-20mA control 3-position connector (with orange and purple wires) from the bottom of the ozone

generator (see Appendix A), then adjust the "Manual Ozone Output Control" knob located at the bottom of the ozone generator (see Appendix A) to manually adjust ozone output.

Step 17: Perform a final check of all pneumatic connections from the air preparation system to the ozone injector manifold. Repair leaks as required. Check all system water connections. Repair leaks as required. **Note: The check valve at the ozone injector may make a humming noise. This is normal.**

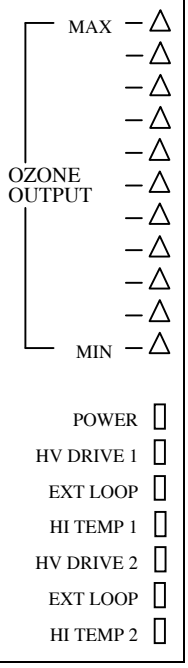
Step 18: Observe indicating LED(s), on the front cover of the HDO_3 systems ozone generator. See Figure 6, Figure 7, and Appendix A for proper function and location.

Step 19: Make final adjustments to the dissolved ozone monitor/controller. For information regarding the dissolved ozone monitor/controller use the Quick Reference Guide Figure 10 or see the monitor/controller I/O Manual.

HDO_3-I Ozone Generator LED Function

Figure 6

LED	Function	CD12
OZONE OUTPUT	The ten LEDs represent 0-100%, minimum to maximum ozone output. Each LED is equal to 10% output. These LEDs can be adjusted with the manual output control knob located at the bottom of the ozone generator or automatically with a remote 4-20mA control signal.	
POWER	Main Power is "ON" to the ozone generator, when LED is illuminated.	
HV DRIVE	Power is being sent to the high voltage drive board, when the LED is illuminated.	
EXT LOOP	The External Loop has continuity through it when the LED is *not* illuminated, which indicates ozone is being produced. The External Loop *does not* have continuity, when the LED is illuminated, which indicates no ozone production.	
HIGH TEMP	The High Temp LED will not be illuminated during normal operation. If the ozone generator's internal temperature is in excess of 150˚F the High Temp LED will illuminate, which will also discontinue ozone production.	



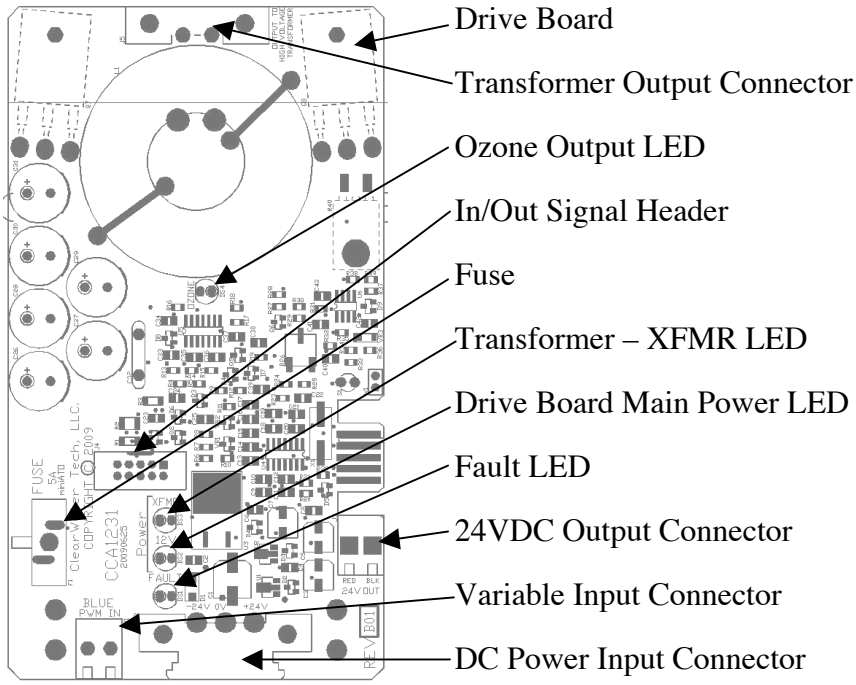
HDO_3-II and HDO_3-III - Ozone Generator Drive Board LED Function

Figure 7

LED	Function
12V MAIN POWER	When illuminated, this "Green" LED indicates that main power is supplied to the low voltage control circuitry.
XFMR POWER	When illuminated, this "Green" LED indicates that 48V Buss power is supplied to the drive module transformer (XFMR).
OZONE OUTPUT	The "Amber" ozone output LED will illuminate when ozone is being generated. The LED will also pulse as the output increases or decreases with either the Manual Ozone Output Control located on the bottom of the ozone generator (see Appendix A), or from a Remote 4-20mA signal (see "Installation Procedures – Electrical").
FAULT	When illuminated, this "Red" LED indicates that there is a fault with the drive module or the Ozone Reaction Chamber. If this LED is illuminated, refer to the Troubleshooting Guide. **Notes: If the drive module goes to a fault condition, the drive board will restart every 30 seconds. If the fault is not remedied the drive module will continue to go into a fault mode. When the drive module is in fault mode ozone will not be generated.**

HDO_3-II and HDO_3-III – Drive Board

Figure 8



Pneumatic Operating Parameters

Figure 9

HDO_3-I	Operating Range	Optimum
Feed Gas Flow Rate in SCFH	6-8 SCFH	8 SCFH
Feed Gas Flow Rate in CFH (corrected for Vacuum, this is what the meter will read)	6.6-8.7 CFH	8.7 CFH
Ozone Generator – Vacuum	-3 to -8 in Hg	-5 in Hg
Ozone Injector – Vacuum	-5 to -25 in Hg	-15 in Hg
High Pressure – Side Water Water Supply Inlet: Pressurized (Non-Pressurized[1])	55-65 (35-45) PSI	60 (40) PSI
Low Pressure – Side Water Water Supply Inlet: Pressurized (Non-Pressurized[1])	15-25 (0-5) PSI	20 (5) PSI

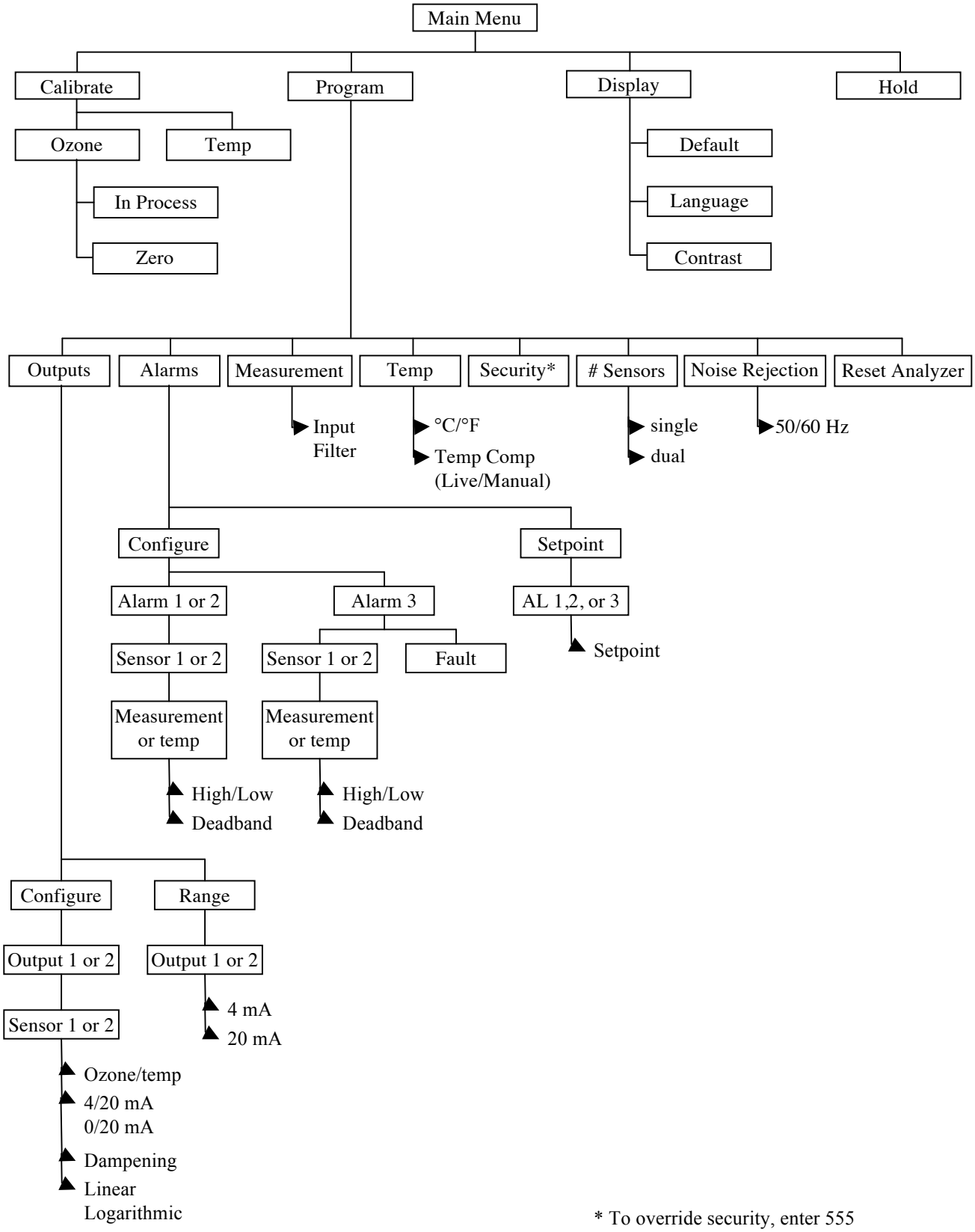
HDO_3-II	Operating Range	Optimum
Feed Gas Flow Rate in SCFH	10-15 SCFH	15 SCFH
Feed Gas Flow Rate in CFH (corrected for Vacuum, this is what the meter will read)	10.9-16.4 CFH	16.4 CFH
Ozone Generator – Vacuum	-3 to -8 in Hg	-5 in Hg
Ozone Injector – Vacuum	-5 to -25 in Hg	-15 in Hg
High Pressure – Side Water Water Supply Inlet: Pressurized (Non-Pressurized[1])	55-65 (35-45) PSI	60 (40) PSI
Low Pressure – Side Water Water Supply Inlet: Pressurized (Non-Pressurized[1])	15-25 (0-5) PSI	20 (5) PSI

HDO_3-III	Operating Range	Optimum
Feed Gas Flow Rate in SCFH	10-12 SCFH	12 SCFH
Feed Gas Flow Rate in CFH (corrected for Vacuum, this is what the meter will read)	7.7-9.2 CFH	9.2 CFH
Ozone Generator – Pressuure (Control Panel and Ozone Generator)	9 to 12 PSI	10 PSI
Ozone Injector – Vacuum	-5 to -25 in Hg	-15 in Hg
High Pressure – Side Water Water Supply Inlet: Pressurized (Non-Pressurized[1])	55-65 (35-45) PSI	60 (40) PSI
Low Pressure – Side Water Water Supply Inlet: Pressurized (Non-Pressurized[1])	15-25 (0-5) PSI	20 (5) PSI

1 – The pressure range is based on possible head pressure and may vary by installation

Quick Reference Guide – Rosemont Dissolved Ozone Monitor/Controller

Figure 10



* To override security, enter 555

Maintenance

Maintenance of the HDO_3 dissolved 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" section before attempting any maintenance procedure that requires the use of tools and/or shutting down the ozone system.**

Daily Procedures

Control Panel

- Gauges and Meters: Observe normal operating parameters of all gauges and meters. Make sure they are within the ranges shown on the "Pneumatic Operating Parameters" chart Figure 9. Adjust if necessary by following the steps outlined in the "Start-Up & Calibration" section.
- Dissolved Ozone Monitor/Controller: Observe the LCD display for normal function and accurate anticipated dissolved ozone results. If an alarm signal is displayed see the troubleshooting section of the monitor/controller's I/O Manual.

Ozone Generator

- Indicating Lights – **HDO_3-I Only:** Check the indicator lights on the ozone generator. See Figure 6 for Ozone Generator LED Display function.
- Indicating Lights – **HDO_3-II and HDO_3-III Only:** Check for illumination of the drive module "Ozone Output" LED (for LED location, see Appendix A). If the Ozone Output LED is not illuminated, observe the complete operating function of the drive module LED's. Before checking drive module LED function (see Figure 7 for LED location and function), remove the ozone generator cover and depress the cover safety switch located on the ozone generator chassis (see Appendix A). **CAUTION: Depressing overrides the cover safety switch. The ozone generator will remain energized with the cover removed. Do not touch anything inside the ozone generator while this switch is activated! Please consult your ClearWater Tech dealer before attempting this procedure.**
- Air Flow - **HDO_3-III Only:** Check the CFH gauge on the front cover of the ozone generator. Make sure air flow is within the range shown on the "Feed Gas Flow Rate" line of the "Operating Parameters" chart (see Figure 9). Adjust if necessary by following the steps outlined in the "Start-Up & Calibration" section.

- Pressure – **HDO_3-III Only:** Check the pressure gauge located on the front cover ozone generator. Make sure pressure is within the range shown on the "Ozone Generator Pressure" line of the "Operating Parameters" chart (see Figure 9).

Vacuum Break

- Water Level: check the Vacuum Break water level. Fill as required by removing the threaded cap on top of the fill port and fill water into the fill port up to the fill level, (see Appendix A).

Ozone Injector

- 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. If water is observed in the delivery line near the check valve assembly, the check valve has failed. See Troubleshooting Guide.

Monthly Procedures

Air Preparation System

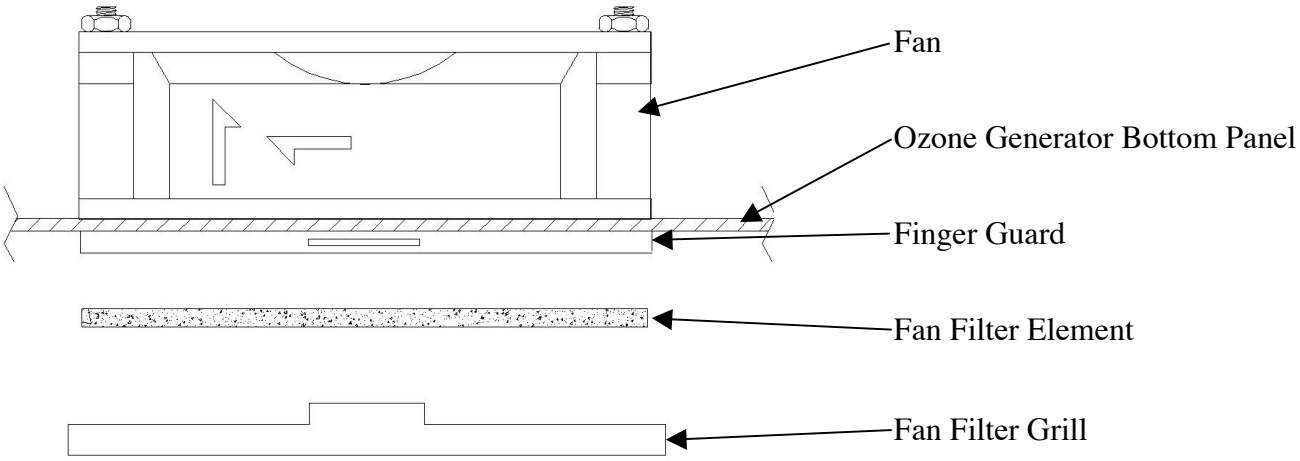
- Cooling Fan Operation: Check for air flow leaving the air preparation system through the louvers on the back of the unit. If there is not air flow refer to the Troubleshooting Guide.

Ozone Generator

- Cooling Fan Operation: check to make sure the cooling fan(s) (mounted on the bottom panel of the ozone generator) are operating. If not, refer to the Troubleshooting Guide.
- Cooling Fan Filters: Check the cooling fan filter element(s) (mounted on the fan assembly located at the bottom panel of the ozone generator) and clean as required. Operating conditions in the equipment area will dictate the frequency required for this procedure. Remove the filter element and clean with soap and water, drying them completely before re-installing, (see Figure 11).

Ozone Generator Cooling Fan Assembly

Figure 11



System Shutdown Procedures

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

Step 1: Turn the HDO_3 system main power switch to the "OFF" position.

Step 2: Turn off main power to all other peripheral equipment, such as a main water supply pump.

Step 3: Turn the main power service disconnect or breaker to the "OFF" position.

Step 4: Check main power with a multi-meter to be sure all power is disconnected.

Step 5: Close the water supply isolation valves at the inlet and outlet of the HDO_3 system.

Semi-Annual Procedures

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

Air Preparation System

- Air Inlet Filter: Replace the air compressor inlet filter on the air preparation system module (see Appendix A). **Note: Manufacturers' recommended replacement interval is 4,000 hours of operation. Operating conditions in the equipment area will dictate the required frequency of this procedure.**

Annual Procedures

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

Air Preparation System

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

Ozone Generators

- Cooling Fan Filters: Clean or replace the cooling fan filter elements as required. **Note: Operating conditions in the equipment area will dictate the required frequency of this procedure.**
- Inline Filter: Replace the inline particulate filter.
- Reaction Chambers: Remove and disassemble the reaction chambers according to the steps outlined below (see Figure 12-14). Check the chamber interior and dielectric tube for oil, dirt or moisture. **Note: Disassembly and service of the reaction chamber(s) is a technical, delicate and critical procedure. Please consult your ClearWater Tech dealer before attempting this procedure.**

Reaction Chamber Removal and Disassembly **HDO_3-I Only**

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

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

Step 2: Disconnect tubing connections from the fittings on both ends of the reaction chamber.

Step 3: Disconnect the high voltage lead from the reaction chambers.

Step 4: Remove the nuts holding the reaction chamber to the chassis.

Step 5: Remove reaction chambers from ozone generator.

Step 6: Remove retaining screws and washers from the two end caps (3 each) of both reaction chambers.

Step 7: Using a gentle back-and-forth twisting motion, remove the non-high voltage end cap (the one without the high voltage attachment screw) from the heat sink/cathode assembly. **Note: Orientation of the end cap on the heat sink/cathode assembly.**

Step 8: Remove the high voltage end cap and dielectric from the heat sink/cathode assembly. **Note: Orientation of the end cap on the heat sink/cathode assembly.** Remove end cap and contact brush from dielectric glass anode.

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

Step 10: Inspect the dielectric, end caps and cathode for breakage, corrosion or debris. Clean and/or replace parts as necessary. Re-assemble the reaction chamber per the instructions below.

Reaction Chamber Removal and Disassembly **HDO_3-II and HDO_3-III Only**

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

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

Step 2: Disconnect tubing connections from the fittings on both ends of the reaction chamber.

Step 3: Disconnect the high voltage lead from the drive transformer.

Step 4: Remove the nuts holding the reaction chamber to the chassis.

Step 5: Remove reaction chambers from ozone generator.

Step 6: Remove retaining screws and washers from the two end caps (4 each) of both reaction chambers.

Step 7: Using a gentle back-and-forth twisting motion, remove the non-high voltage end cap (the one without the white power lead attached) from the heat sink/cathode assembly. **Note: Orientation of the end cap on the heat sink/cathode assembly. The stainless steel clamp on the HDO_3-III reaction chamber end-caps must not be removed.**

Step 8: Remove the high voltage end cap and dielectric from the heat sink/cathode assembly. **Note: Orientation of the end cap on the heat sink/cathode assembly. The stainless steel clamp on the HDO_3-III reaction chamber end-caps must not be removed.** Remove end cap and contact brush from dielectric glass anode.

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

Step 10: Inspect the dielectric, end caps and cathode for breakage, corrosion or debris. Clean and/or replace parts as necessary. Re-assemble the reaction chamber per the instructions below.

Reaction Chamber Assembly and Re-installation **HDO_3-I Only**

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

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

Step 3: Using a gentle twisting motion, press the non-high voltage end cap onto the heat sink/cathode assembly until flush with the heat sink cooling fins. **Note: Orientation of end cap on the heat sink/cathode assembly.**

Step 4: Slide the three end cap retaining screws with washers 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: Slide the dielectric into the heat sink/cathode assembly. Seat the dielectric into the O-rings of the non-high voltage end cap by applying pressure with a gentle twisting motion. (There must not be any dirt, debris, oils or fingerprints on the dielectric upon re-installation).

Step 6: *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 flat against the dielectric glass. 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. **Note: Orientation of the end cap on the heat sink/cathode assembly.**

Step 7: Slide the three end cap retaining screws with washers 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 8: Re-install complete reaction chamber assembly into the ozone generator, reconnect the high voltage lead(s) and tubing connections to both end caps. Follow steps outlined in Chapter 7 - "Start-Up and Calibration" to re-start the ozone system.

Reaction Chamber Assembly and Re-installation **HDO_3-II and HDO_3-III Only**

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

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

Step 3: Using a gentle twisting motion, press the non-high voltage end cap onto the heat sink/cathode assembly until flush with the heat sink cooling fins. **Note: Orientation of the end cap on the heat sink/cathode assembly.**

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

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

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

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

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, reconnect the high voltage lead(s) and tubing connections to both end caps. Follow steps outlined in Chapter 7 - "Start-Up and Calibration" to re-start the ozone system.

Vacuum Break

- Cleaning: Remove the vacuum break fill port cap and flush vacuum break with water to remove any debris that may have accumulated. As required disassemble vacuum break and clean the seat of the flapper valve with a soft clothe. Re-assemble vacuum break and fill water into the vacuum break up to fill level, see Appendix A.

Injector Manifold

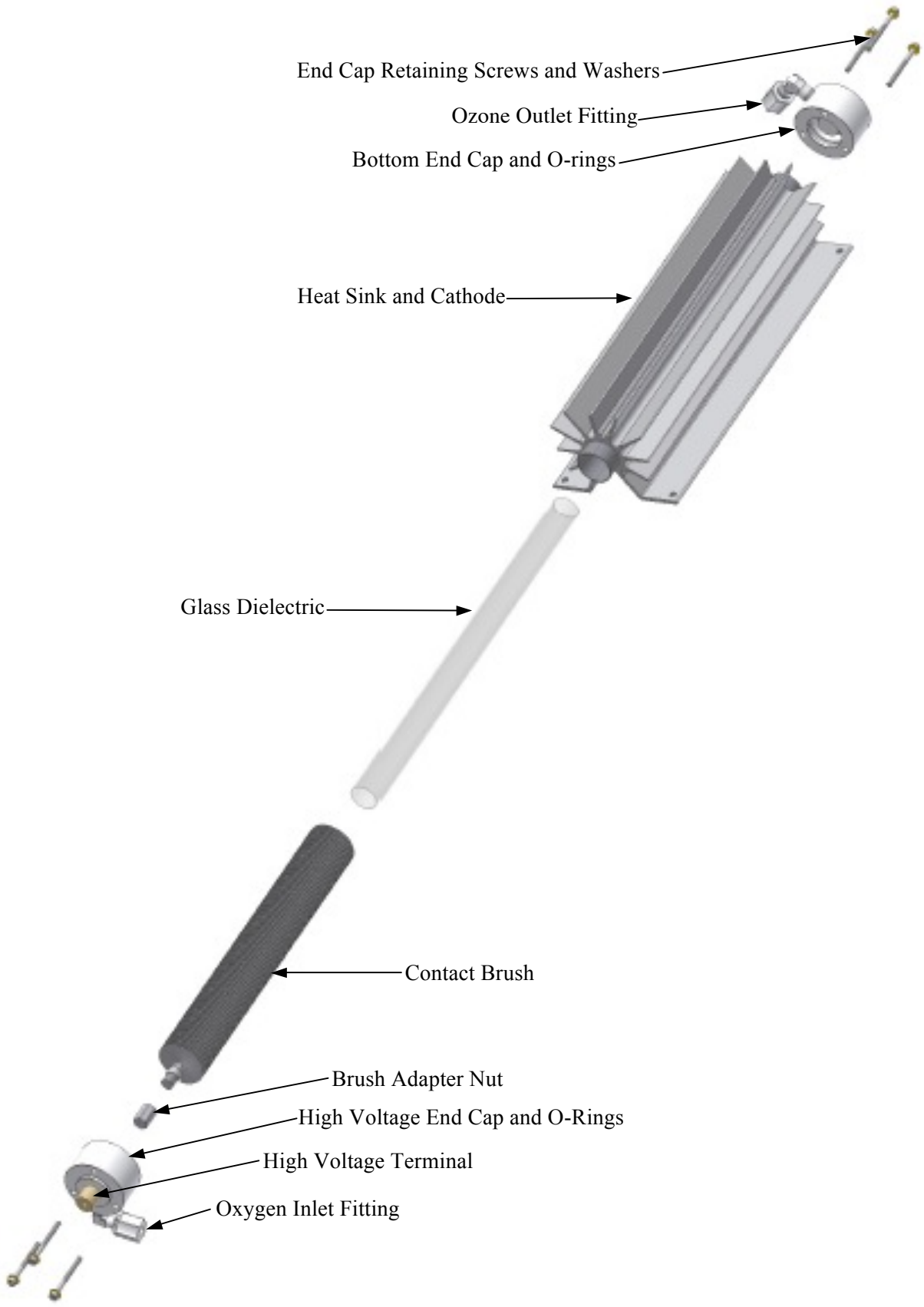
- Check Valve: Replace the check valve located at the ozone injector. **Note: Because the system is in the shutdown mode, no vacuum is present at the injector. Therefore, some water may be flowing from the injector port during this procedure.**

Contact Tank

- Off-Gas Vent: Remove the off-gas vent from the contact tank located on the backside of the HDO_3 system. Disassemble the off-gas vent by un-threading the bowl of the vent from the housing. Thoroughly rinse the internal components and clean the valve seat..

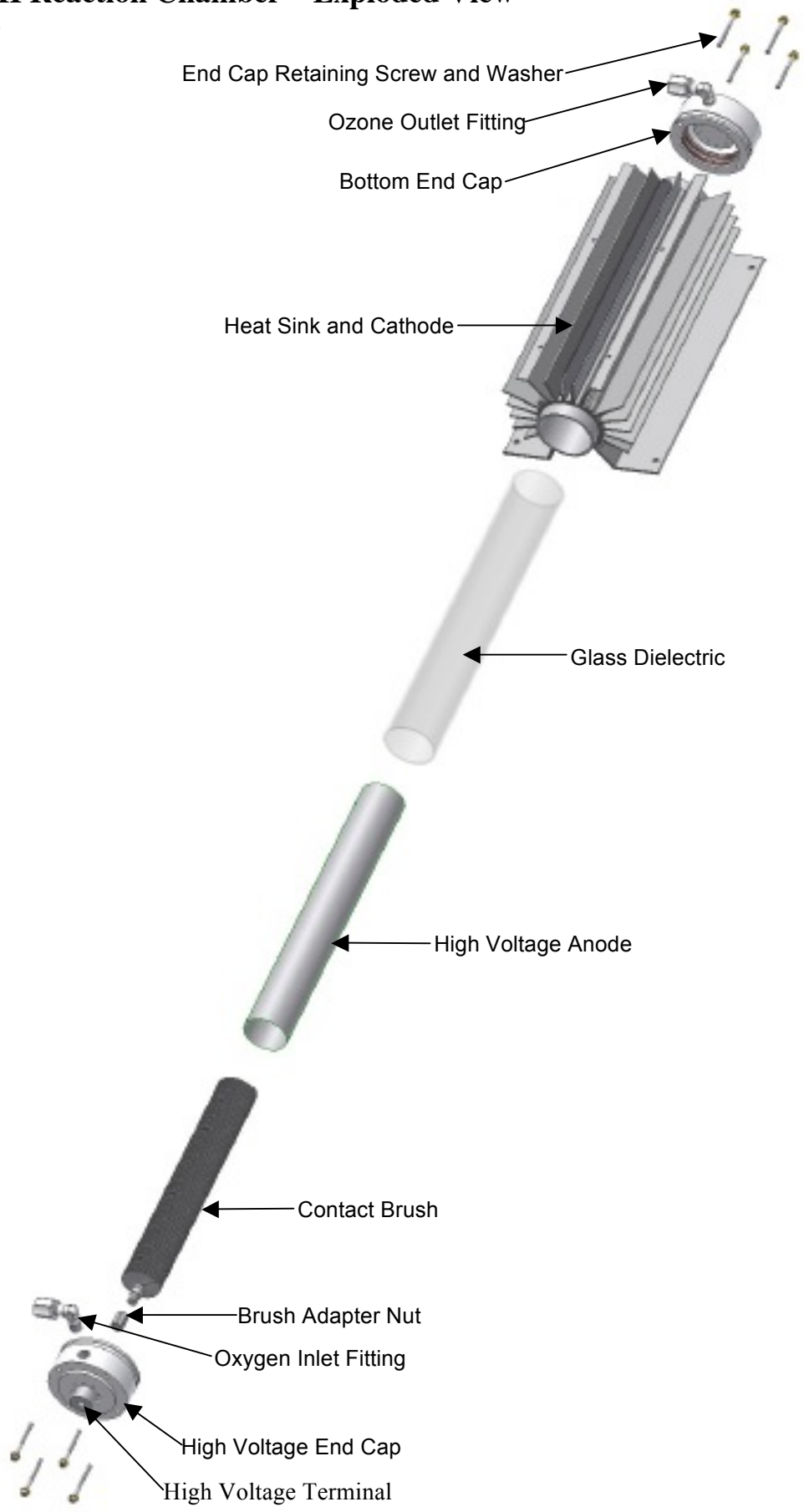
HDO_3-I Reaction Chamber – Exploded View

Figure 12



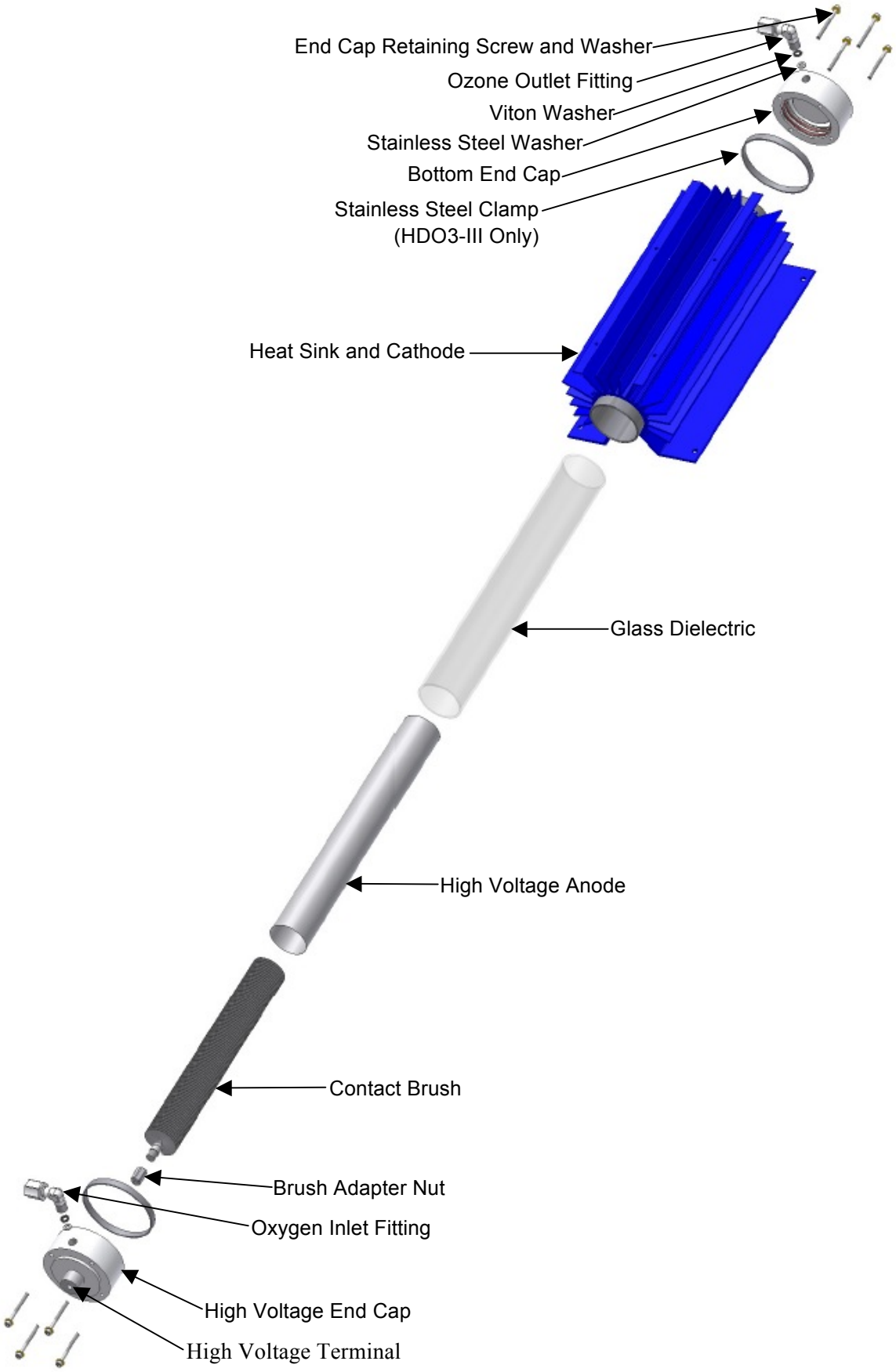
HDO_3-II Reaction Chamber – Exploded View

Figure 13



HDO_3-III Reaction Chamber – Exploded View

Figure 14



Troubleshooting

Air Preparation

Problem/Symptom	Possible Cause	Solution
Unit not operating	• No power to HDO_3 system • Incorrect wiring to the HDO_3 system • Main Power switch is in the "OFF" position • Compressor not functioning	• Check main power to system • See "Installation Procedures – Electrical" • Turn Main Power switch to the "ON" position • Rebuild or replace as required
Low air flow or no air flow (air preparation flow meter, bottom left-hand side of system)	• Flow meter out of adjustment • Fouled compressor inlet filter • Compressor not functioning • Air leak	• Adjust flow meter, see "Start-Up and Calibration – Step 10" • Replace inlet filter • Rebuild or replace as required • Check & tighten fittings
Compressor pressure relief valve making noise	• Pressure relief valve not operating • Pinched tubing • Compressor not functioning • Sieve bed (ATF) not operating	• Replace pressure relief valve • Replace tubing • Rebuild or replace as required • Repare or replace ATF as required
Fan not operating (bottom right-hand side of the system)	• Debris caught in fan • Fan inoperable	• Remove debris • Replace fan

Control Panel and Ozone Generator – HDO_3-I

Problem/Symptom	Possible Cause	Solution
'Feed Gas Flow Rate' meter out of adjustment (Control Panel)	• No feed gas flow rate • High feed gas flow rate • Low feed gas flow rate	• Air preparation system not operating correctly. See air preparation section above. • Make adjustments with the 'Feed gas Flow Rate' needle valve and the 'Ozone Injector – Vacuum Control' knob • 'High Pressure-Side Water' and 'Low Pressure – Side Water' gauges have equalized. Excessive backpressure downstream of the ozone injector or HDO_3 system.
'Ozone Generator – Vacuum' or 'Ozone Injector – Vacuum' not within operating parameters (Control Panel). Vacuum too high	• High vacuum	• Slightly open the 'Ozone Injector-Vacuum Control' knob, then adjust the 'Feed Gas Flow Rate' meter
'Ozone Generator – Vacuum' not within Operating parameters (Control Panel). Low vacuum	• Low vacuum • Defective injector check valve • No water in vacuum break • Off-gas vent restricted • Defective O-ring seals in reaction chambers • Loose internal fittings • Defective dielectrics	• Slightly close the 'Ozone Injector-Vacuum Control' knob, then adjust the 'Feed Gas Flow Rate' meter • Replace injector check valve • Fill vacuum break with water, see 'Start Up & Calibration' • Clean Off-gas Vent • Check and replace as required • Check all fittings tighten as required • Check and replace as required

Control Panel and Ozone Generator – HDO_3-I - Continued

Problem/Symptom	Possible Cause	Solution
'Ozone Injector – Vacuum' not within Operating parameters (Control Panel). Low vacuum	• Low vacuum	• Slightly close the 'Ozone Injector-Vacuum Control' knob, then adjust the 'Feed Gas Flow Rate' meter
	• Defective injector check valve	• Replace injector check valve
	• No water in vacuum break	• Fill vacuum break with water, see 'Start Up & Calibration'
	• Off-gas vent restricted	• Clean Off-gas Vent
'High Pressure – Side Water' gauge not within operating parameters (Control Panel)	High Pressure	
	• Inlet water supply pressure regulator out of adjustment or inoperable	• Adjust or repair as required
	• Contact tank back pressure downstream of the HDO_3 system	• Open the back pressure valve slightly
	Low Pressure	
	• HDO_3 system booster pump inoperable or debris in booster pump impeller	• Remove or clean as required
	• Contact tank backpressure valve is open	• Close the back pressure valve slightly
'Low Pressure – Side Water' gauge not within operating parameters (Control Panel)	High Pressure	
	• Inlet water supply pressure regulator out of adjustment or inoperable	• Adjust or repair as required
	• Contact tank back pressure valve is closed	• Open the back pressure valve slightly
	• Excessive back pressure down stream of the HDO_3 system	• Remove backpressure downstream
	Low Pressure	
	• Contact tank backpressure valve is open	• Close the back pressure valve slightly
Dissolved Ozone Monitor/Controller not operating	• See the monitor/controller I/O manual	
LED display is not illuminated	• No power to the HDO_3 System	• Check main power to the system
	• Ozone generator main power switch is in the "Off" position	• Switch to the "ON" position
	• Blown fuse(s)	• Replace fuse(s)
	• Incorrect wiring	• See 'Installation Procedures' – Electrical
	• LED display board ribbon cable is disconnected from the output control board	• Connect ribbon cable (be sure all of the pins are properly inserted into the output control board)
'Main Power' LED is not illuminated, but all other LED's are illuminated	• LED display board is inoperable	• Replace LED display board
Circuit breaker trips	• Incorrect wiring to HDO_3 System	• See 'Installation Procedures' – Electrical
	• Circuit breaker amperage does not match system draw	• Replace with correct circuit breaker. See 'Installation Procedures' – Electrical
	• Unit flooded with water	• Access damage, correct cause and rebuild as required

Control Panel and Ozone Generator – HDO_3-I - Continued

Problem/Symptom	Possible Cause	Solution
Receive an electrical shock upon touching the unit	• Incorrect wiring • Unit not grounded • Unit flooded with water	• See 'Installation Procedures' – Electrical • Ground unit according to local codes • Assess damage, correct cause and rebuild as required
'HV Drive' LED is not illuminated	• No Power to the high voltage drive board	• Check board to be sure it is attached securely to the mother board • Bad high voltage drive board, replace as required
'EXT Loop' LED is illuminated	• The external loop does not have continuity	• See Figure 5 for function
'Ozone Output' LED's are not illuminated	• The manual ozone output potentiometer is set to 0% • Insufficient vacuum to ozone generator • Remote 4-20mA controller is sending a 4mA signal, which limits output to 0%	• See 'Installation Procedures' – Electrical • Adjust vacuum, see 'Start-Up & Calibration' • No solution required, controller will adjust LED's automatically
'Ozone Output' LED's are not responding to the remote 4-20mA control signal	• The remote 4-20mA control signal is not sensed by the 4-20mA control circuit	• Check for loose wires or connections See 'Installation Procedures' – Electrical • Check the 4-20mA 3-position connector to the ozone generator, see Appendix A, for location • Check the dissolved ozone controller operation
Fan not operating	• Fan obstructed • Main mother board not operating • Fan inoperable	• Remove obstruction • Check main power, check fuses. Repair or replace as required • Replace fan
Unit flooded with water	• Defective check valve • Vacuum break flapper valve stuck • Hydraulics out of adjustment	• Assess damage, repair as required, replace check valve • See 'Maintenance Procedure' – Annual • See 'Start-Up & Calibration'
Ozone smell detected from or near ozone generator	• Insufficient vacuum at venturi • Loose internal fittings • Defective O-ring seals in reaction chamber • Defective dielectrics	• See 'Start-Up & Calibration' • Check all fittings, tighten as required • Check & replace as required • Check & replace as required

Control Panel and Ozone Generator – HDO_3-II and HDO_3-III

Problem/Symptom	Possible Cause	Solution
'Feed Gas Flow Rate' meter out of adjustment (Control Panel)	• No feed gas flow rate • High feed gas flow rate • Low feed gas flow rate	• Air preparation system not operating correctly. See air preparation section above. • Make adjustments with the 'Feed gas Flow Rate' needle valve and the 'Ozone Injector – Vacuum Control' knob • 'High Pressure-Side Water' and 'Low Pressure – Side Water' gauges have equalized. Excessive backpressure downstream of the ozone injector or HDO_3 system. • HDO_3-III only: 'Ozone Generator – Pressure' gauge is too high. Slightly open the 'Ozone Injector – Vacuum Control' knob, then adjust the 'Feed Gas Flow Rate' meter
'Ozone Generator – Vacuum' not within Operating parameters (Control Panel, HDO_3-II only)	High Pressure	• Slightly open the 'Ozone Injector-Vacuum Control' knob, then adjust the 'Feed Gas Flow Rate' meter
	Low Pressure	• Slightly close the 'Ozone Injector – Vacuum Control' knob, then adjust the 'Feed Gas Flow Rate' meter
	• Defective injector check valve	• Replace injector check valve
	• No water in vacuum break	• Fill vacuum break with water, see 'Start Up & Calibration'
	• Off-gas vent restricted	• Clean Off-gas Vent
	• Defective o-ring seals in reaction chamber	• Check and replace as required
	• Loose internal fittings	• Check all fittings tighten as required
	• Defective dielectrics	• Check and replace as required
'Ozone Generator – Pressure' not within Operating parameters (Control Panel, HDO_3-III only)	High Pressure	• Slightly open the 'Ozone Injector-Vacuum Control' knob, then adjust the 'Feed Gas Flow Rate' meter
	Low Pressure	• Slightly close the 'Ozone Injector – Vacuum Control' knob, then adjust the 'Feed Gas Flow Rate' meter
	• Defective o-ring seals in reaction chamber	• Check and replace as required
	• Loose internal fittings	• Check all fittings tighten as required
	• Defective dielectrics	• Check and replace as required

Control Panel and Ozone Generator – HDO_3-II and HDO_3-III - Continued

'Ozone Injector – Vacuum' not within Operating parameters (Control Panel)	High Pressure	• Slightly open the 'Ozone Injector-Vacuum Control' knob, then adjust the 'Feed Gas Flow Rate' meter
	Low Pressure	• Slightly close the 'Ozone Injector – Vacuum Control' knob, then adjust the 'Feed Gas Flow Rate' meter
	• Defective injector check valve	• Replace injector check valve
	• No water in vacuum break	• Fill vacuum break with water, see 'Start Up & Calibration'
	• Off-gas vent restricted	• Clean Off-gas Vent
'High Pressure – Side Water' gauge not within operating parameters (Control Panel)	High Pressure	
	• Inlet water supply pressure regulator out of adjustment or inoperable	• Adjust or repair as required
	• Contact tank back pressure valve is closed	• Open the back pressure valve slightly
	• Excessive backpressure down stream of the HDO_3 system	• Remove backpressure downstream
	Low Pressure	
	• HDO_3 system booster pump inoperable or debris in booster pump impeller	• Remove or clean as required
	• Contact tank backpressure valve is open	• Close the back pressure valve slightly
'Low Pressure – Side Water' gauge not within operating parameters (Control Panel)	High Pressure	
	• Inlet water supply pressure regulator out of adjustment or inoperable	• Adjust or repair as required
	• Contact tank back pressure valve is closed	• Open the back pressure valve slightly
	• Excessive back pressure down stream of the HDO_3 system	• Remove backpressure downstream
	Low Pressure	
	• Contact tank backpressure valve is open	• Close the back pressure valve slightly
Dissolved Ozone Monitor/Controller not operating	• See the monitor/controller I/O manual	
Ozone Generator "Main Power" light is not illuminated or System is not "ON" (Located under the ozone generator)	• No power to the HDO_3 System	• Check main power to system. See 'Installation Procedures' – Electrical
	• Switch is in the "OFF" position	• Turn switch to the "ON" position
	• Blew a fuse	• Replace fuse
Circuit breaker trips	• Incorrect wiring to HDO_3 System	• See 'Installation Procedures' – Electrical
	• Circuit breaker amperage does not match system draw	• Replace with correct circuit breaker. See 'Installation Procedures' – Electrical
	• Unit flooded with water	• Access damage, correct cause and rebuild as required
Receive an electrical shock upon touching the unit	• Incorrect wiring	• See 'Installation Procedures' – Electrical
	• Unit not grounded	• Ground unit according to local codes
	• Unit flooded with water	• Assess damage, correct cause and rebuild as required

Control Panel and Ozone Generator – HDO_3-II and HDO_3-III - Continued

12V Main Power, "Green" LED not illuminated	• No power to drive module from power supply	• Check main power to unit • Test voltage from power supply to drive module, see Appendix E
Transformer (XFMR) Power, "Green" LED not illuminated	• If drive board "Main Power" LED is not illuminated, the "XFMR Power" LED will not illuminate • Blown drive board "on board" fuse • Drive board is in "Fault" mode	• Test voltage from power supply to drive module, see Appendix E • Replace "on board" fuse • See Troubleshooting, "Fault" LED
Ozone Output, "Amber" LED not illuminated	• If the Transformer (XFMR) Power LED is not illuminated, the "Ozone Output" LED will not illuminate • The Manual Ozone Output potentiometer is turned down to 0% • Remote4-20mA Controller is sending a 4mA signal, which limits output to 0% • Drive board is in "Fault" mode	• Check all wires and connectors • See 'Installation Procedures' – Electrical • No solution required, controller will adjust LED automatically • See Troubleshooting, "Fault" LED
The "Ozone Output" LED not responding to the remote 4-20mA control signal	• The remote 4-20mA control signal is not sensed by the 4-20mA control board	• Check for loose wires or connections • See 'Installation Procedures' – Electrical • Check 4-20mA controller operation
System Fault – Single Flash The drive board can not get enough power into the reaction chamber.	• Loose wire harness connection from the drive board to the drive transformer • Drive board incorrectly characterized the system on startup • Loose or disconnected High Voltage Lead to transformer • Excessive dirt or debris in ozone reaction chamber • Water in ozone reaction chamber • Broken dielectric • Failed drive board • Failed drive transformer	• Check all wires and connectors • With pressure and flow at normal operating conditions, restart the ozone generator. • Attach High Voltage Lead to transformer • Clean the dielectric and replace O-rings • Clean the dielectric and replace O-rings • Replace dielectric • Replace drive board • Replace drive transformer
System Fault – Double Flash The drive board's feedback had a series of sudden dips indicative of unusual arcing occurring somewhere in the system.	• Loose wire harness connection from the drive board to the drive transformer • Loose or disconnected High Voltage Lead to transformer • Excessive dirt or debris in ozone reaction chamber • Water in ozone reaction chamber • Broken dielectric • Failed drive board • Failed drive transformer	• Check all wires and connectors • Attach High Voltage Lead to transformer • Clean the dielectric and replace O-rings • Clean the dielectric and replace O-rings • Replace dielectric • Replace drive board • Replace drive transformer

Control Panel and Ozone Generator – HDO_3-II and HDO_3-III - Continued

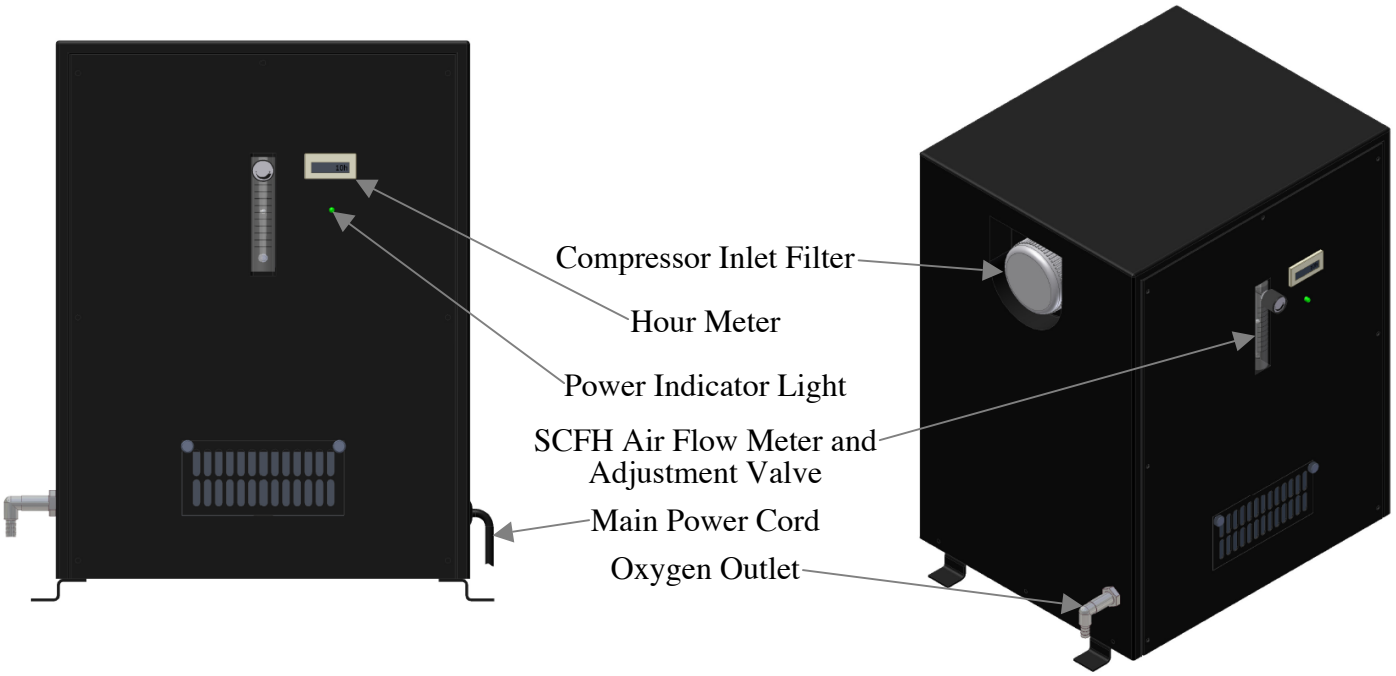
System Fault – Triple Flash The thermal switch on the board has closed indicating that it was exposed to temperatures exceeding 140F.	• Unit is overheating	• Check fan for proper operation and clean fan filter • Check operating temperature • See "Installation Procedures – Getting Started, Equipment Placement"
Fan not operating	• Fan obstructed • Power supplies not operating • Fan inoperable	• Remove obstruction • Check main power, check fuses. Repair or replace as required • Replace fan
Unit flooded with water	• Defective check valve • Vacuum break flapper valve stuck • Hydraulics out of adjustment	• Assess damage, repair as required, replace check valve • See 'Maintenance Procedure' – Annual • See 'Start-Up & Calibration'
Ozone smell detected from or near ozone generator	• Insufficient vacuum at venturi • Loose internal fittings • Defective O-ring seals in reaction chamber • Defective dielectrics	• See 'Start-Up & Calibration' • Check all fittings, tighten as required • Check & replace as required • Check & replace as required

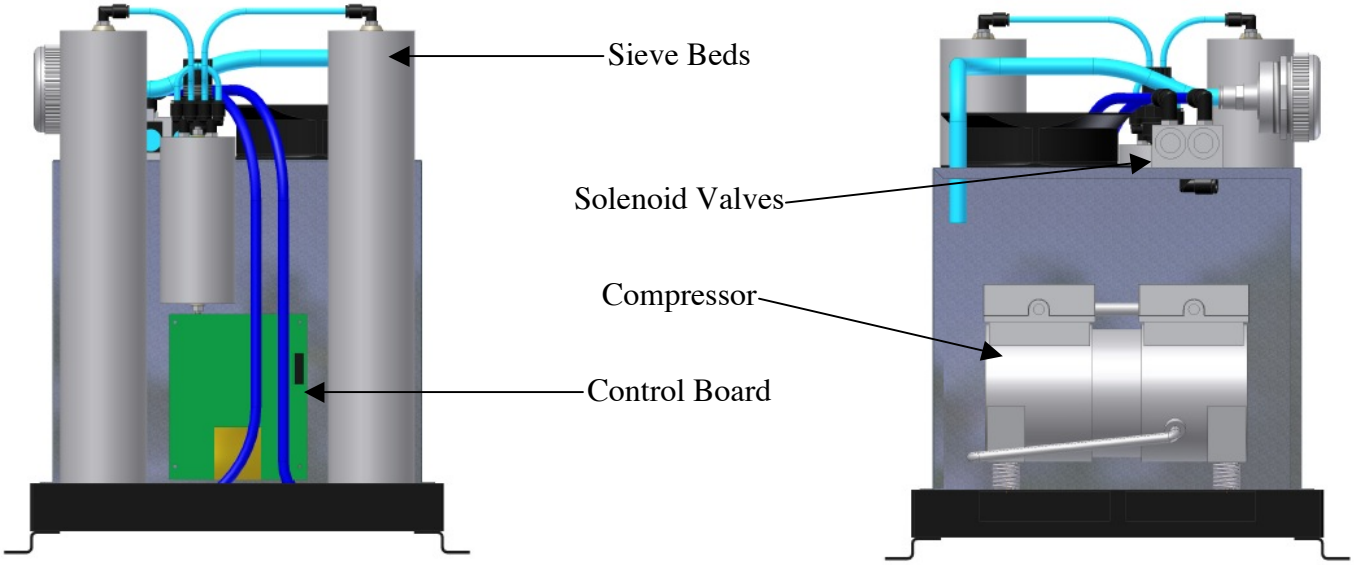
Ozone Injection/Contacting/Vacuum Break

Problem/Symptom	Possible Cause	Solution
Water backflow past injector check valve	• Defective injector check valve	• Replace injector check valve
Water bubbling in vacuum break	• Insufficient 'Ozone Injector – Vacuum' • Debris on seat of vacuum break flapper valve	• See "Start-Up and Calibration" • Clean seat of flapper. See "Maintenance Procedures – Annual"
No vacuum at venture inlet port of ozone injector	• Low gpm water flow through ozone injector • Back pressure in hydraulic line • Booster pump not functioning properly	• Check for obstruction upstream • Check for obstructions downstream of ozone injector • Check booster pump (contact dealer)
Ozone smell detected in or around vacuum break or ozone injector	• Insufficient vacuum at venturi • Loose fittings • Broken fittings	• See 'Start-Up & Calibration' • Check all fittings, tighten as required
Outlet water Supply Pressure Relief Valve is relieving water	• 'Low Pressure – Side Water' gauge is in excess of 55 PSI. Inlet water supply pressure is high • Excessive back pressure downstream of HDO_3 system	• Reduce inlet water supply pressure to no more than 20 PSI • Pressure downstream of the HDO_3 system must not exceed inlet water supply pressure or 20 PSI

Appendix A – Specifications

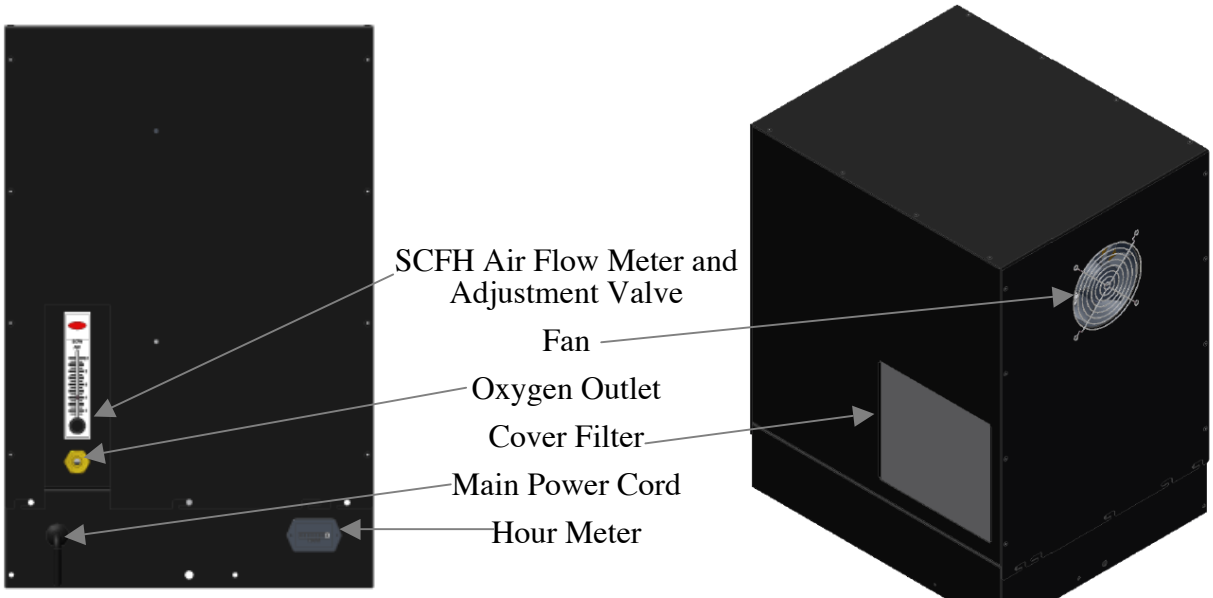
Air Preparation System (Aerous 15 Shown)

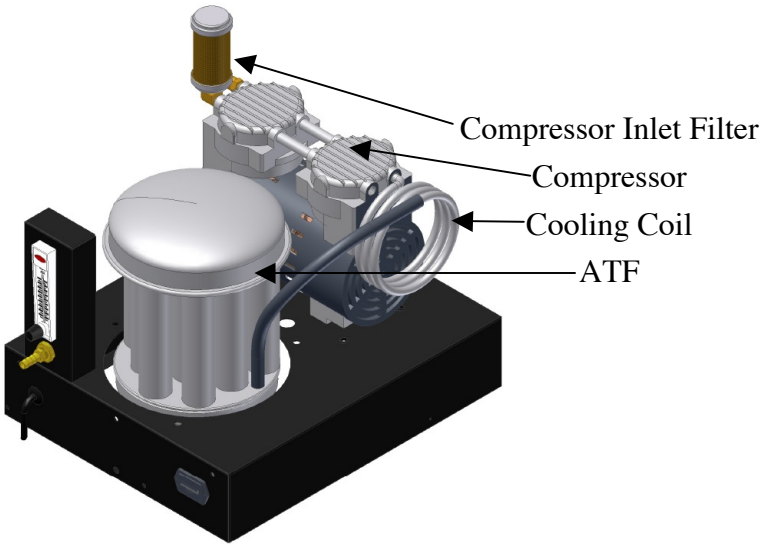




Air Prep System	Oxygen Output/SCFH
HDO_3-I (Aerous 8)	90% (+/-3%) @ 8 scfh, 10 PSI
HDO_3-II and HDO_3-III (Aerous 15)	90% (+/-3%) @ 15 scfh, 10 PSI

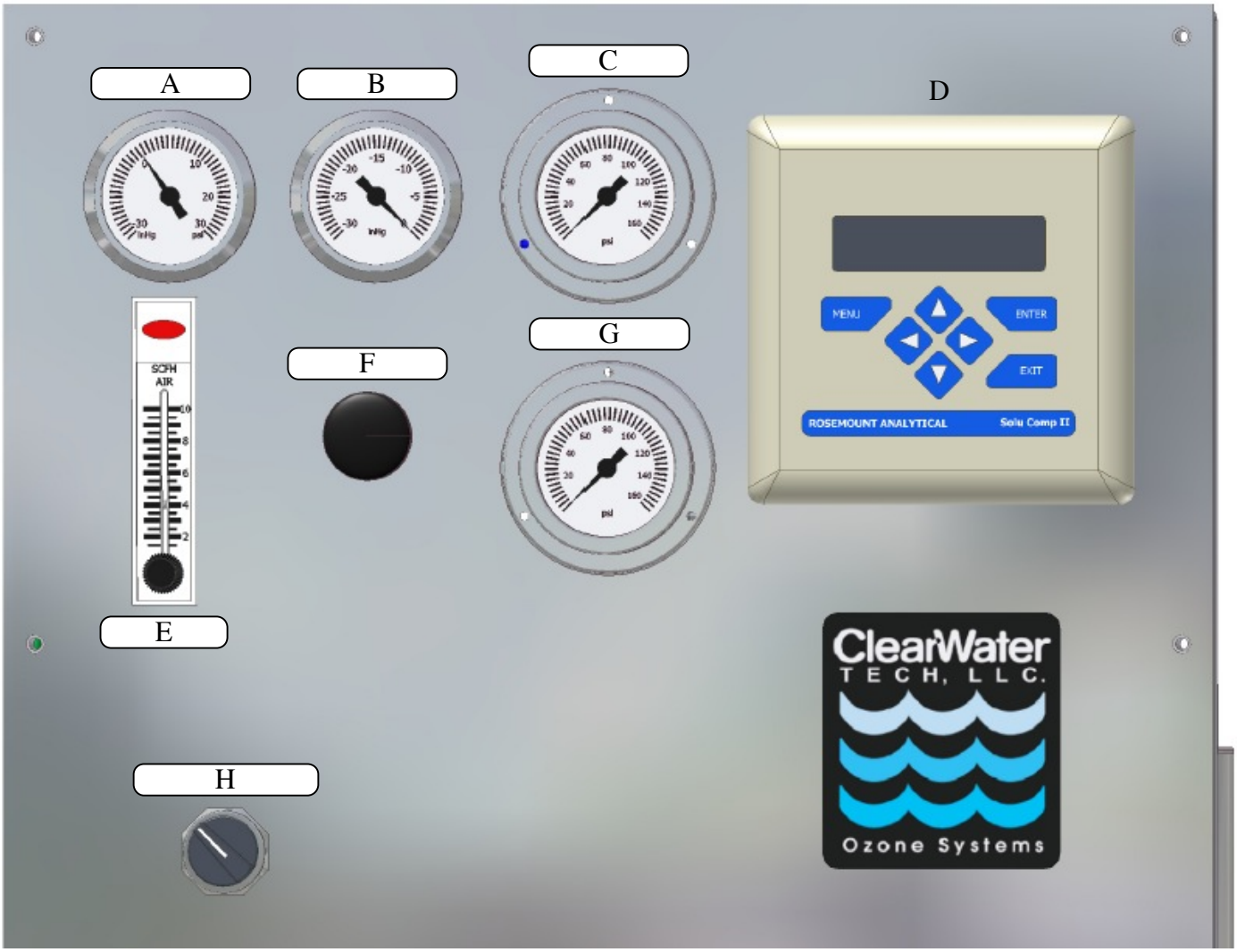
Air Preparation System (Workhorse 12C Shown)





Air Prep System	Oxygen Output/SCFH
HDO_3 – I (Workhorse 8C)	90% (+/-3%) @ 8 scfh, 5PSI
HDO_3 – II (Workhorse 15C)	90% (+/-3%) @ 15 scfh, 5PSI
HDO_3 – III (Workhorse 12C)	90% (+/-3%) @ 12 scfh, 12PSI

Control Panel



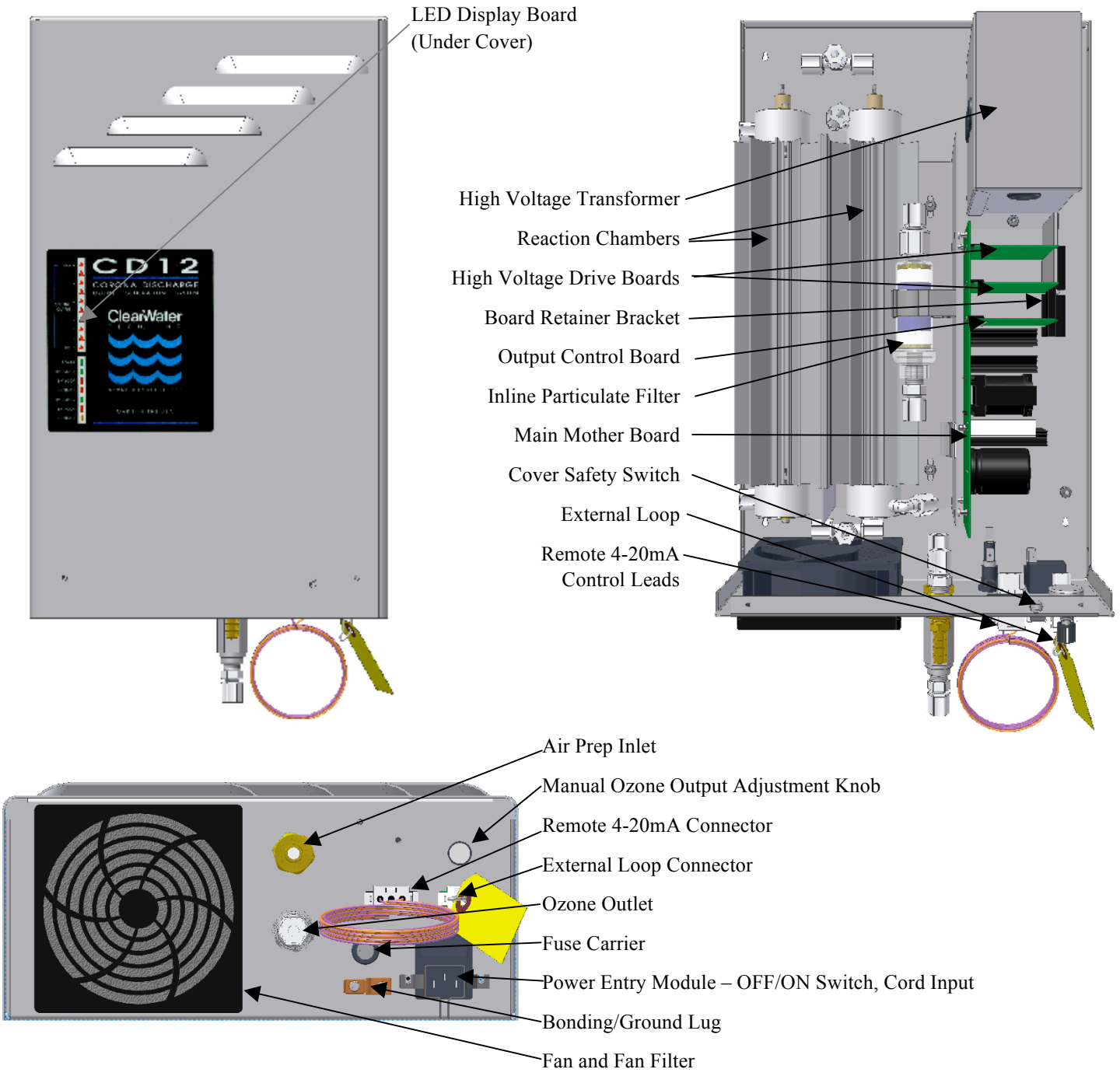
HDO_3-I	HDO_3-II	HDO_3-III
A – Ozone Generator – Vacuum	A – Ozone Generator – Vacuum	A – Ozone Generator – Pressure
B – Ozone Injector – Vacuum	B – Ozone Injector – Vacuum	B – Ozone Injector – Vacuum
C – High Pressure – Side Water	C – High Pressure – Side Water	C – High Pressure – Side Water
D – Dissolved Ozone Monitor/Controller	D – Dissolved Ozone Monitor/Controller	D – Dissolved Ozone Monitor/Controller
E – Feed Gas Flow Rate	E – Feed Gas Flow Rate	E – Feed Gas Flow Rate
F – Ozone Injector – Vacuum Control	F – Ozone Injector – Vacuum Control	F – Ozone Injector – Vacuum Control
G – Low Pressure – Side Water	G – Low Pressure – Side Water	G – Low Pressure – Side Water
H – Main Power Switch – OFF/ON	H – Main Power Switch – OFF/ON	H – Main Power Switch – OFF/ON

HDO_3-I

Shown: HDO3-I with Areous Oxygen Generator

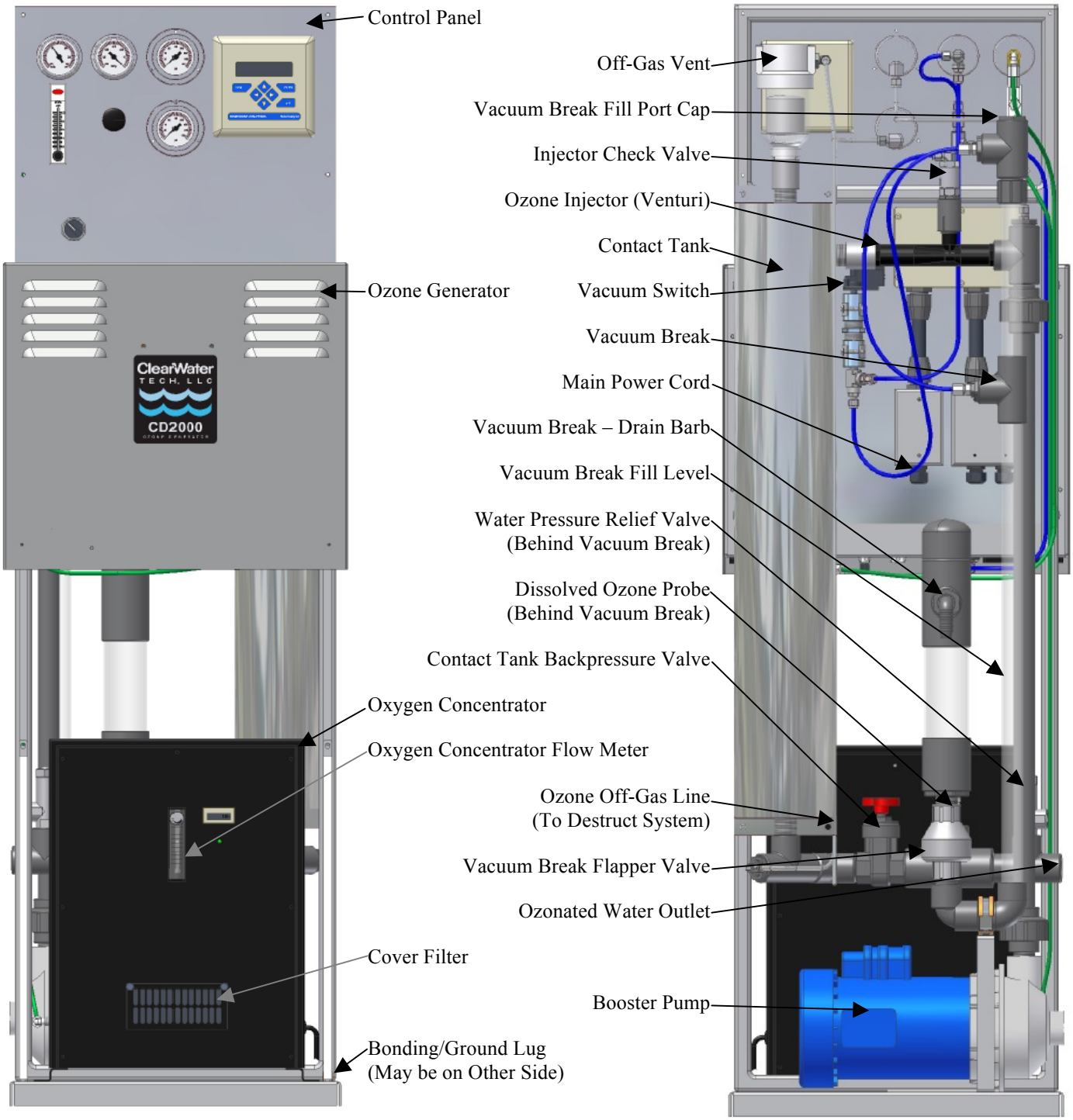
Ozone Generator	Specifications	Ozone Output
HDO_3-I	66” h x 20” w x 29” d, 280 lbs	8g/h @ 3%

HDO_3-I – Ozone Generator



Shown: ClearWater Tech CD12 Ozone Generator

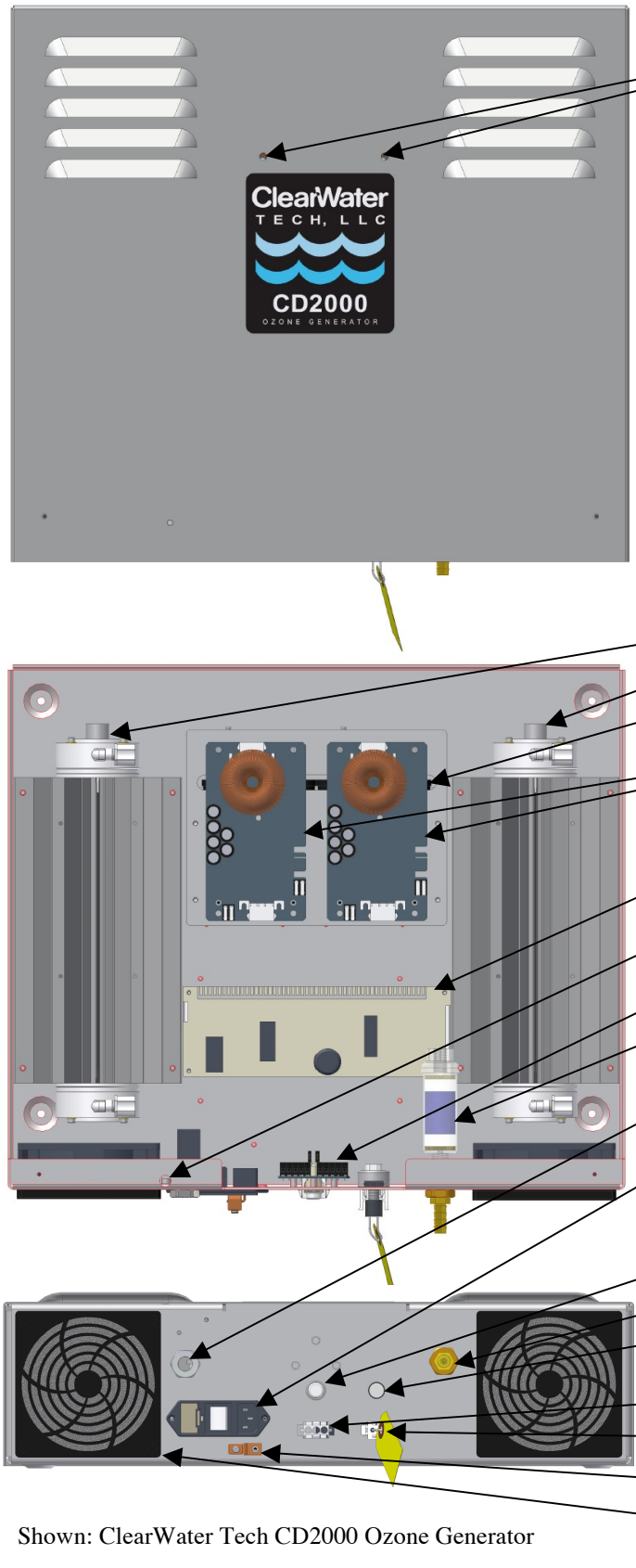
HDO_3-II



Shown: HDO3-II with Areous Oxygen Generator

Ozone Generator	Specifications	Ozone Output
HDO_3-II	66” h x 20” w x 29” d, 300 lbs	20g/h @ 4%

HDO_3-II – Ozone Generator



Ozone Output LED's

Reaction Chambers

Drive Transformer – XFRM (under boards)

Drive Boards

Power Supply

Cover Saftey Switch

4-20mA Control Board

Inline Particulate Filter

Ozone Outlet

Main Power Module
Switch – OFF/ON
Cord Connection
Fuse Carriers

Main Power Light

Air Prep Inlet

Manual Ozone Output Adjustment Knob

Remote 4-20mA Connector

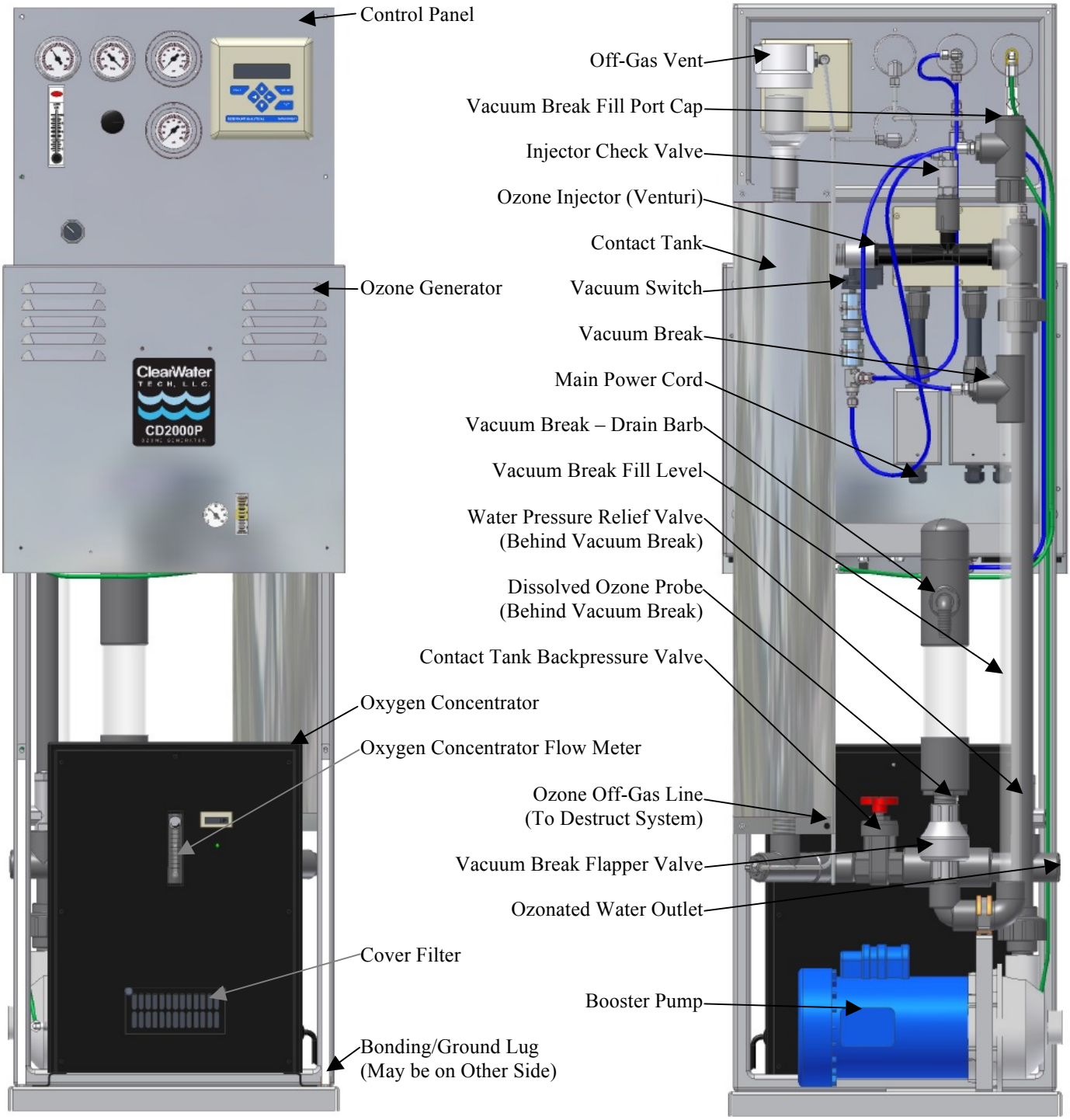
External Loop Connector

Bonding/Ground Lug

Fan and Fan Filter

Shown: ClearWater Tech CD2000 Ozone Generator

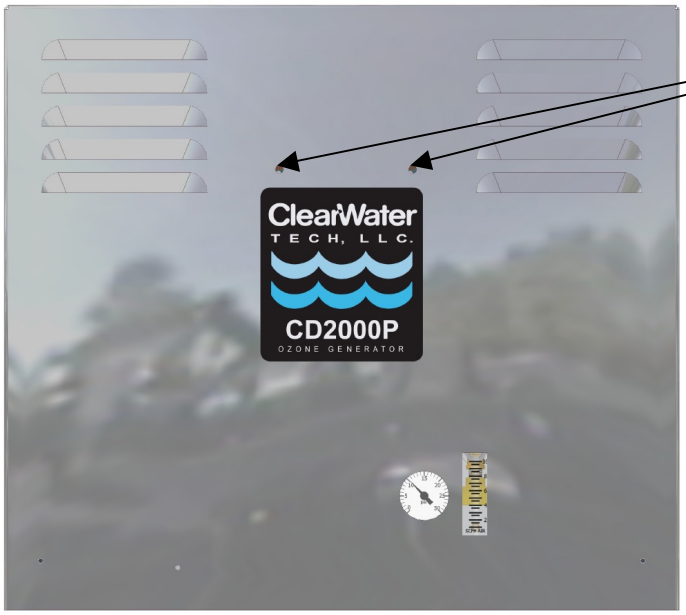
HDO_3-III



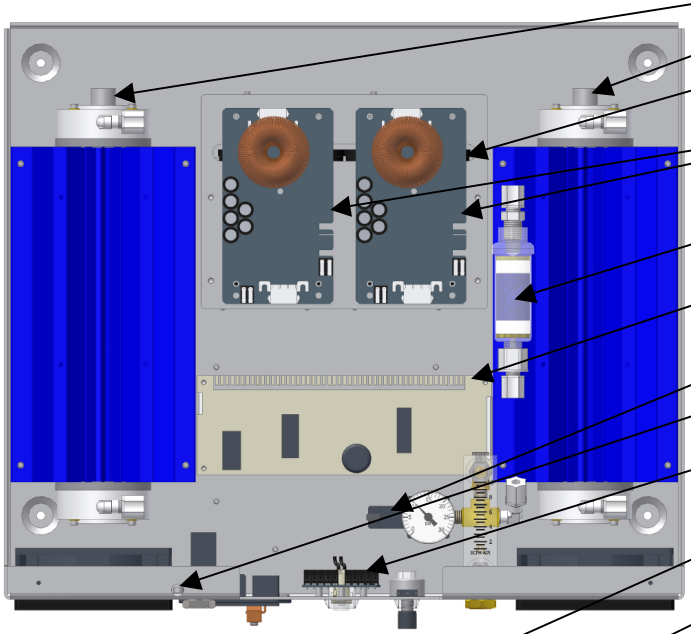
Shown: HDO3-II with Areous Oxygen Generator

Ozone Generator	Specifications	Ozone Output
HDO_3-III	66” h x 20” w x 29” d, 300 lbs	27g/h @ 6%

HDO_3-III – Ozone Generator



Ozone Output LED's



Reaction Chambers

Drive Transformer – XFRM (under boards)

Drive Boards

Inline Particulate Filter

Power Supply

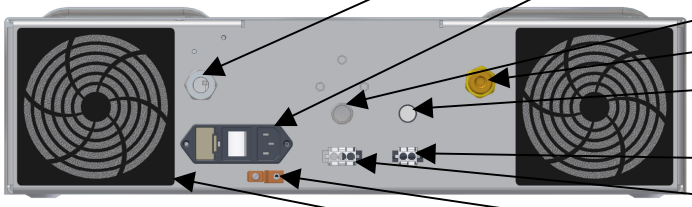
Pressure Switch

Cover Saftey Switch

4-20mA Control Board

Ozone Outlet

Main Power Module
- Switch – OFF/ON
- Cord Connection
- Fuse Carriers



Main Power Light

Air Prep Inlet

Manual Ozone Output Adjustment Knob

External Loop Connector

Remote 4-20mA Connector

Bonding/Ground Lug

Fan and Fan Filter

Shown: ClearWater Tech CD2000P Ozone Generator

Appendix B – Parts List

SeaQual Air Preparation System

Description	Part Number
Compressor Inlet Filter	OXS350
Compressor Rebuild Kit	OXS356
Pressure Relief Valve HDO_3-I, HDO_3-II	OXS360
Pressure Relief Valve HDO_3-III	OXS361
Compressor Vibration Mount	OXS365
Cooling Fan – 120VAC 60Hz	FA41
Cooling Fan – 240VAC 60Hz	FA42

Aerous Air Preparation System

Description	HDO_3-I Part Number	HDO_3-II and HDO_3-III Part Number
Control PCB 120 VAC 60Hz	OXU372	OXU377
Control PCB 220/240 VAC 50/60Hz	OXU386	OXU378
Solenoid Valve Assembly	OXU379	OXU379
Compressor 120VAC 60Hz	OXU373	OXU340
Compressor 220/240 VAC 50/60Hz	OXU374	OXU345
Encloser Filter	OXU350	OXU351
Inlet Filter Package	OXU371	OXU371
Maintenance Kit	ASP70A	ASP75A
Rebuild Kit	ASP71A	ASP76A

Ozone Generator

Description	Part Number
Reaction Chamber – Complete HDO_3-I	RCC17
Reaction Chamber – Complete HDO_3-II	RCC7
Reaction Chamber – Complete HDO_3-III	RCC9
Dielectric Anode 1” – HDO_3-I	RCC76
Dielectric Anode 2” – HDO_3-II	RCC73
Dielectric Anode 2” – HDO_3-III	RCC71
Non-High Voltage End Cap – HDO_3-I	RCC57
High Voltage End Cap – HDO_3-I	RCC53
Non-High Voltage End Cap – HDO_3-II	RCC107
High Voltage End Cap – HDO_3-II	RCC102
Non-High Voltage End Cap – HDO_3-III	Contact Dealer
High Voltage End Cap – HDO_3-III	Contact Dealer

O-ring Set – HDO_3-I	ORS50
O-ring Set – HDO_3-II	ORS30
O-Ring Set – HDO_3-III	ORS40
Mother Board – HDO_3-I	CCA1325
Output Control Board – HDO_3-I	ELPC5031
High Voltage Drive Board – HDO_3-I	ELPC5040
High Voltage Drive Board – HDO_3-I	ELPC5042
LED Display Board – HDO_3-I	ELPC5052
Complete Board Set – HDO_3-I	ELPC5062
High Voltage Transformer – HDO_3-I	ELTR105
Power Supply – 48VDC, 300W – HDO_3-II, HDO_3-III	PSR822
Drive Module Transformer – HDO_3-II, HDO_3-III	HVT275
Drive Module Board – HDO_3-II, HDO_3-III	CCA1232
4-20mA Control Board – HDO_3-II, HDO_3-III	ELPC5430
Cooling Fan – 24VDC	FA46
Cooling Fan Filter	FA40
Inline Particulate Filter	FLT34
Pressure Switch	PS20SA
Vacuum Switch	SWT90SA
Fuse, Bussmann MDL-5 – 5 amp, 250VAC Slow Blow, Main Power	FUS20
Fuse, Littlefuse 239003 – 3amp, 250VAC Slow Blow, Mother Board – HDO_3-I	FUS15
Fuse, Littelfuse Minifuse 297005 – 5 amp, 32VAC, Drive Board, HDO_3-II. HDO_3-III	FUS75

Rosemont and Booster Pump

Description	Part Number
Dissolved Ozone Sensor Solution	CMT521
Dissolved Ozone Membrane	CMT522
Booster Pump Rebuild Cit	PRK10

Appendix C – Maintenance Kit

ASPHD10A – Maintenance Kit – HDO_3-I, Sequal Air Prep		
Part Number	**Quantity**	**Description**
OXS350	1	Oxygen Concentrator – Replacement Compressor Inlet Filter
OXS356	1	Oxygen Concentrator – Compressor Rebuild Kit
OXS360	1	Oxygen Concentrator – Compressor Pressure Relief Valve
OXS370	1	Oxygen Concentrator – Cover Filter
FA40	1	Filter – Cooling Fan Filter
FLT34	1	Filter – Inline Particulate Filter
ORG40	4	O-Ring – 1" CD Reaction Chamber, Small
ORG80	4	O-Ring – 1" CD Reaction Chamber, Large
FUS20	5	Fuse, Bussmann MDL-5 – 5 amp, 250VAC Slow Blow, Main Power
FUS15	1	Fuse, Littlefuse 239003 – 3 amp, 250VAC Slow Blow, Mother Board

ASPHD20A – Maintenance Kit – HDO_3-II, Sequal Air Prep		
Part Number	**Quantity**	**Description**
OXS350	1	Oxygen Concentrator – Replacement Compressor Inlet Filter
OXS356	1	Oxygen Concentrator – Compressor Rebuild Kit
OXS360	1	Oxygen Concentrator – Compressor Pressure Relief Valve
OXS370	1	Oxygen Concentrator – Cover Filter
FA40	1	Filter – Cooling Fan Filter
FLT34	1	Filter – Inline Particulate Filter
ORG10	4	O-Ring – 2" CD Reaction Chamber, Small
ORG110	4	O-Ring – 2" CD Reaction Chamber, Large
FUS20	5	Fuse, Bussmann MDL-5 – 5 amp, 250VAC Slow Blow, Main Power
FUS75	2	Fuse, Littelfuse Minifuse 297005 – 5 amp, 32VAC, Drive Board

ASPHD30A – Maintenance Kit – HDO_3-III, Sequal Air Prep		
Part Number	**Quantity**	**Description**
OXS350	1	Oxygen Concentrator – Replacement Compressor Inlet Filter
OXS356	1	Oxygen Concentrator – Compressor Rebuild Kit
OXS361	1	Oxygen Concentrator – Compressor Pressure Relief Valve
OXS370	1	Oxygen Concentrator – Cover Filter
FA40	1	Filter – Cooling Fan Filter
FLT34	1	Filter – Inline Particulate Filter
ORG120	4	O-Ring – 2" CD Reaction Chamber, Pressurized End Cap, Small
ORG110	4	O-Ring – 2" CD Reaction Chamber, Large
HSW100	4	Sealing Washer - Viton
HWW9004	4	Hardware Washer - #6, Flat, S.S.
FUS20	5	Fuse, Bussmann MDL-5 – 5 amp, 250VAC Slow Blow, Main Power
FUS75	2	Fuse, Littelfuse Minifuse 297005 – 5 amp, 32VAC, Drive Board

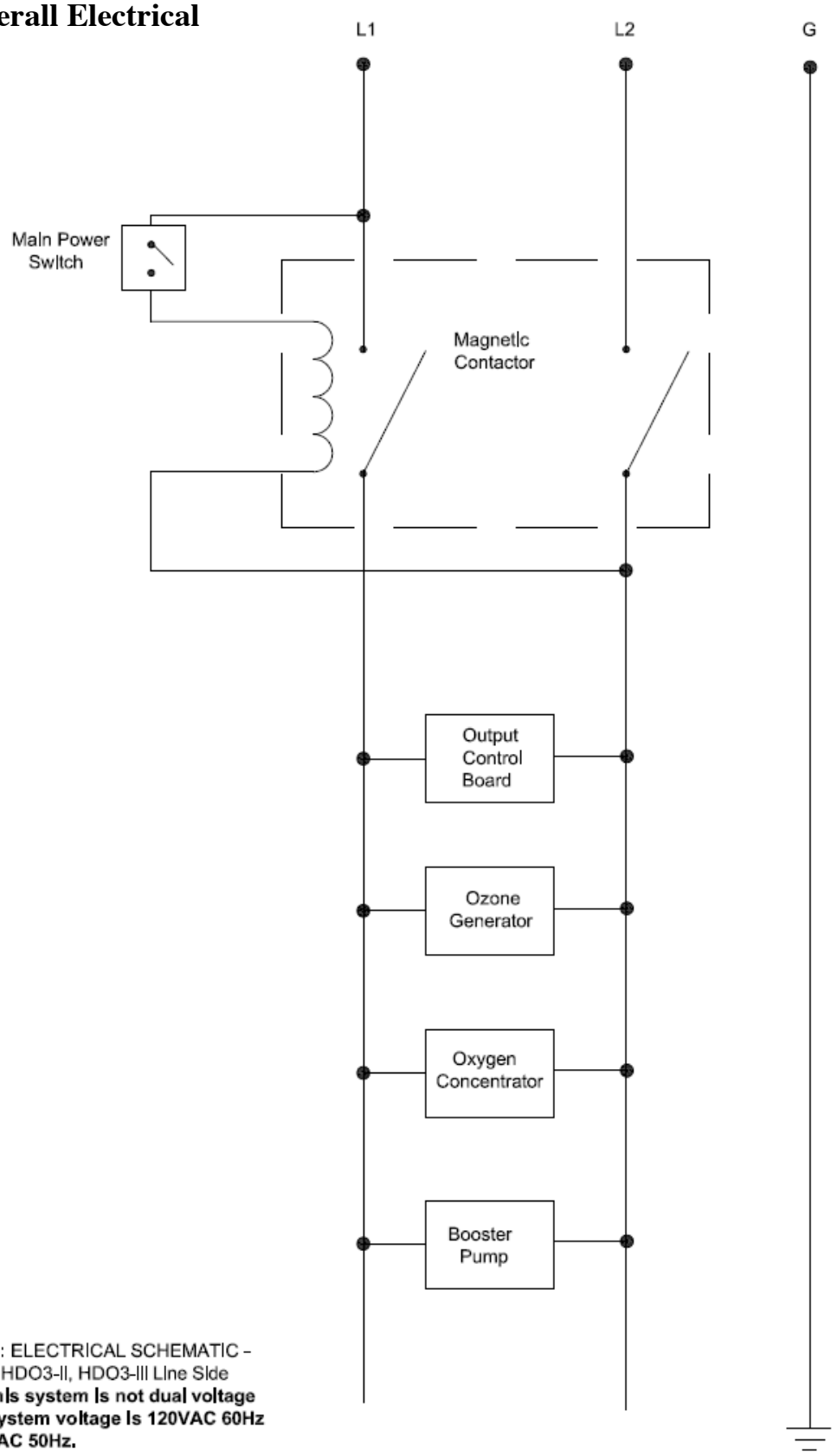
ASPHD10B – Maintenance Kit – HDO_3-I, Aerous Air Prep		
Part Number	**Quantity**	**Description**
OXU350	1	Oxygen Concentrator – Replacement Enclosure Filter
OXU371	1	Oxygen Concentrator – Replacement Compressor Inlet Filter
FA40	1	Filter – Cooling Fan Filter
FLT34	1	Filter – Inline Particulate Filter
ORG40	4	O-Ring – 1" CD Reaction Chamber, Small
ORG80	4	O-Ring – 1" CD Reaction Chamber, Large
FUS20	5	Fuse, Bussmann MDL-5 – 5 amp, 250VAC Slow Blow, Main Power
FUS15	1	Fuse, Littlefuse 239003 – 3 amp, 250VAC Slow Blow, Mother Board

ASPHD20B – Maintenance Kit – HDO_3-II, Aerous Air Prep		
Part Number	**Quantity**	**Description**
OXU351	1	Oxygen Concentrator – Replacement Enclosure Filter
OXU371	1	Oxygen Concentrator – Replacement Compressor Inlet Filter
FA40	1	Filter – Cooling Fan Filter
FLT34	1	Filter – Inline Particulate Filter
ORG10	4	O-Ring – 2" CD Reaction Chamber, Small
ORG110	4	O-Ring – 2" CD Reaction Chamber, Large
FUS20	5	Fuse, Bussmann MDL-5 – 5 amp, 250VAC Slow Blow, Main Power
FUS75	2	Fuse, Littelfuse Minifuse 297005 – 5 amp, 32VAC, Drive Board

ASPHD30B – Maintenance Kit – HDO_3-III, Aerous Air Prep		
Part Number	**Quantity**	**Description**
OXU351	1	Oxygen Concentrator – Replacement Enclosure Filter
OXU371	1	Oxygen Concentrator – Replacement Compressor Inlet Filter
FA40	1	Filter – Cooling Fan Filter
FLT34	1	Filter – Inline Particulate Filter
ORG120	4	O-Ring – 2" CD Reaction Chamber, Pressurized End Cap, Small
ORG110	4	O-Ring – 2" CD Reaction Chamber, Large
HSW100	4	Sealing Washer - Viton
HWW9004	4	Hardware Washer - #6, Flat, S.S.
FUS20	5	Fuse, Bussmann MDL-5 – 5 amp, 250VAC Slow Blow, Main Power
FUS75	2	Fuse, Littelfuse Minifuse 297005 – 5 amp, 32VAC, Drive Board

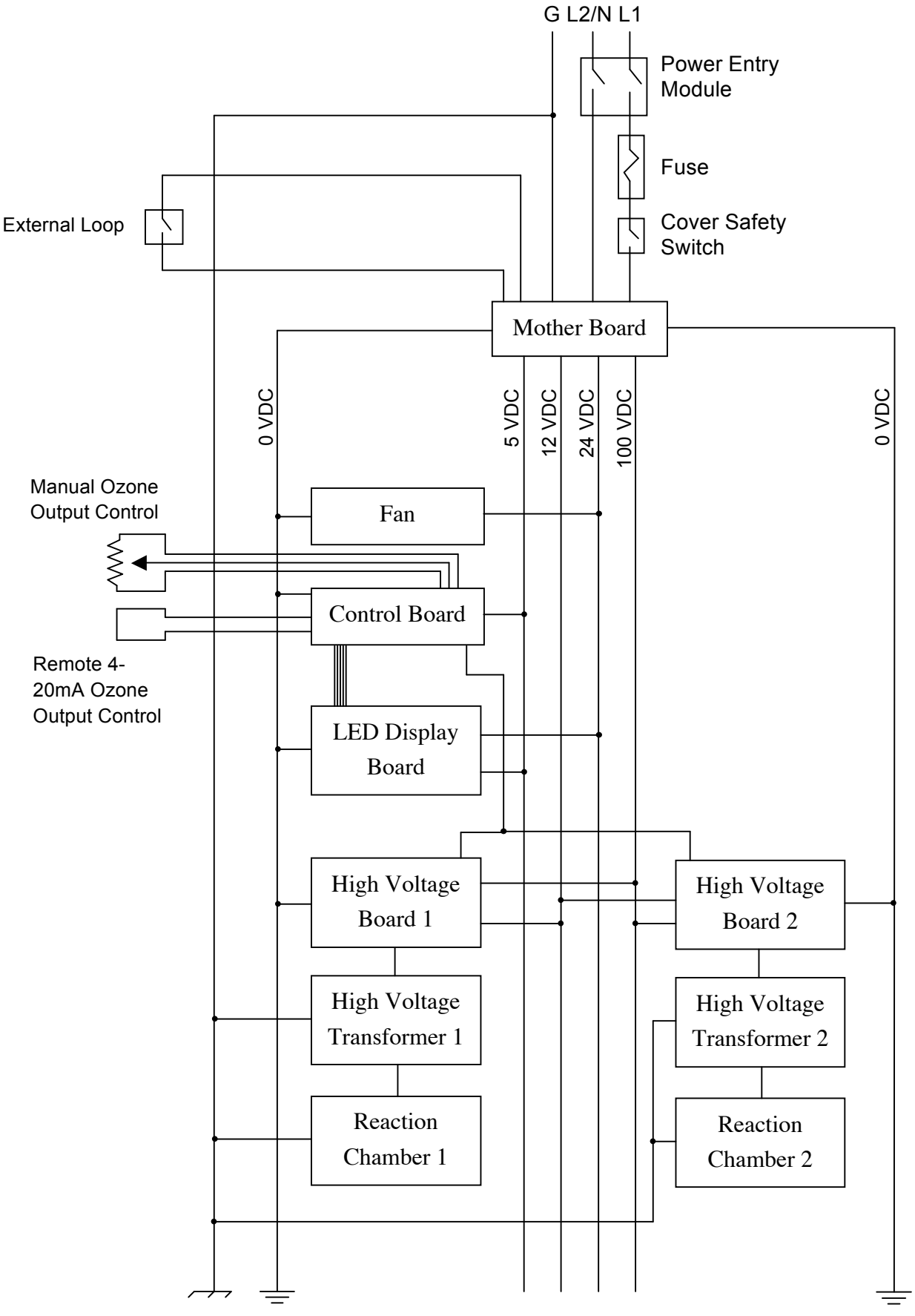
Appendix D – Logic Schematics

HDO_3 – Overall Electrical

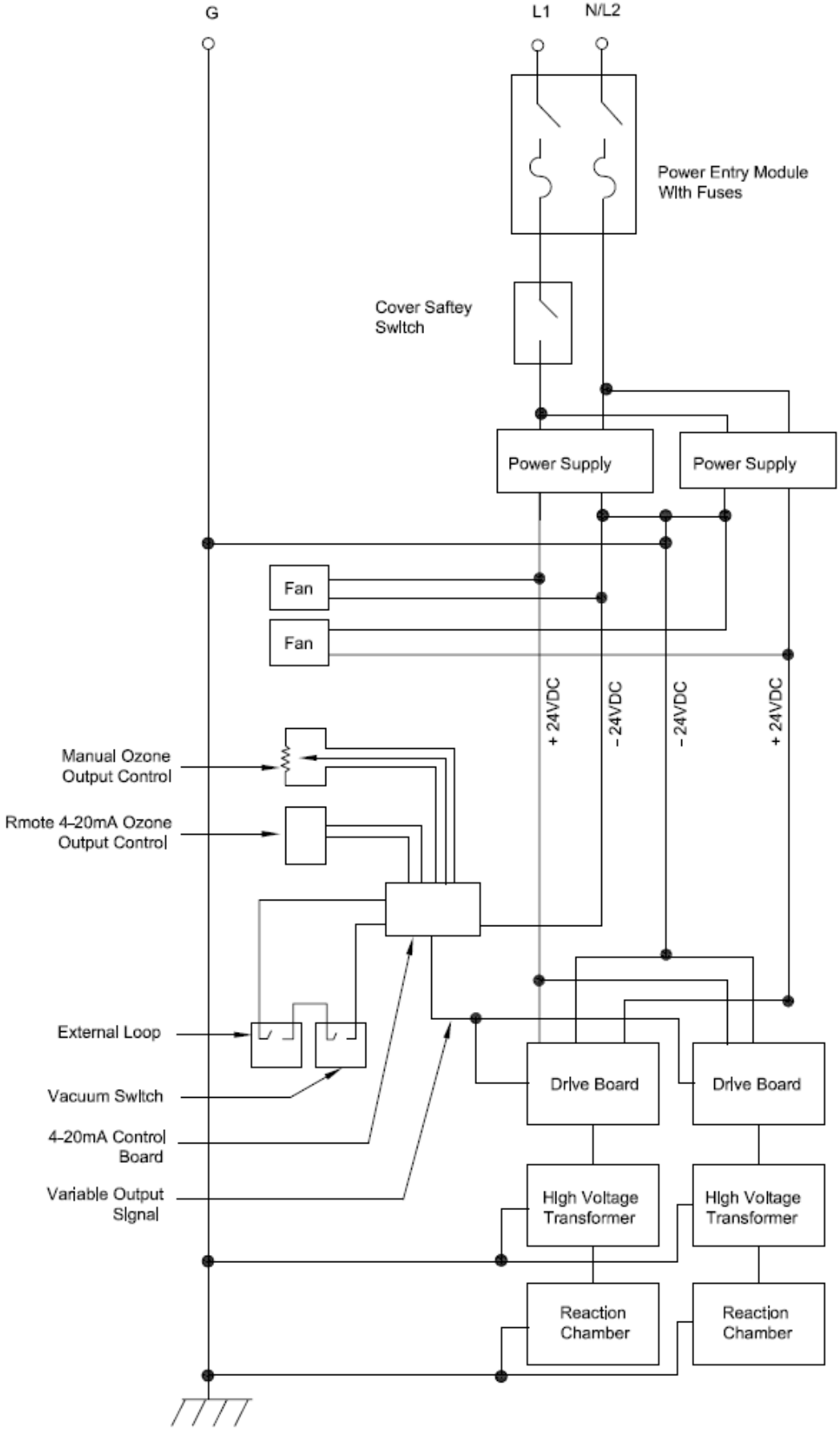


SHOWN: ELECTRICAL SCHEMATIC – HDO3-I, HDO3-II, HDO3-III Line Side
Note: This system is not dual voltage rated, System voltage is 120VAC 60Hz or 220VAC 50Hz.

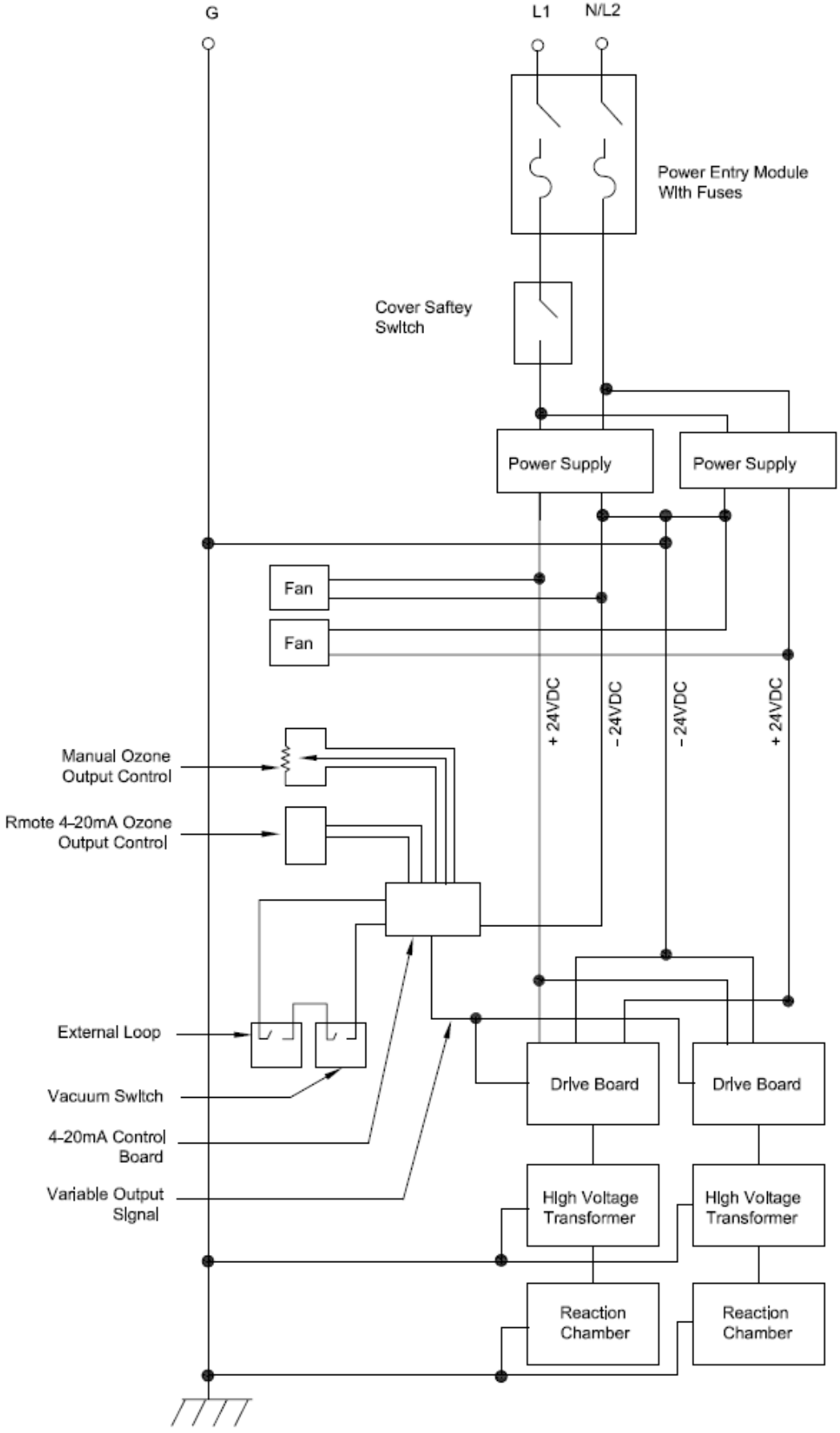
HDO_3-I – Ozone Generator – CD12



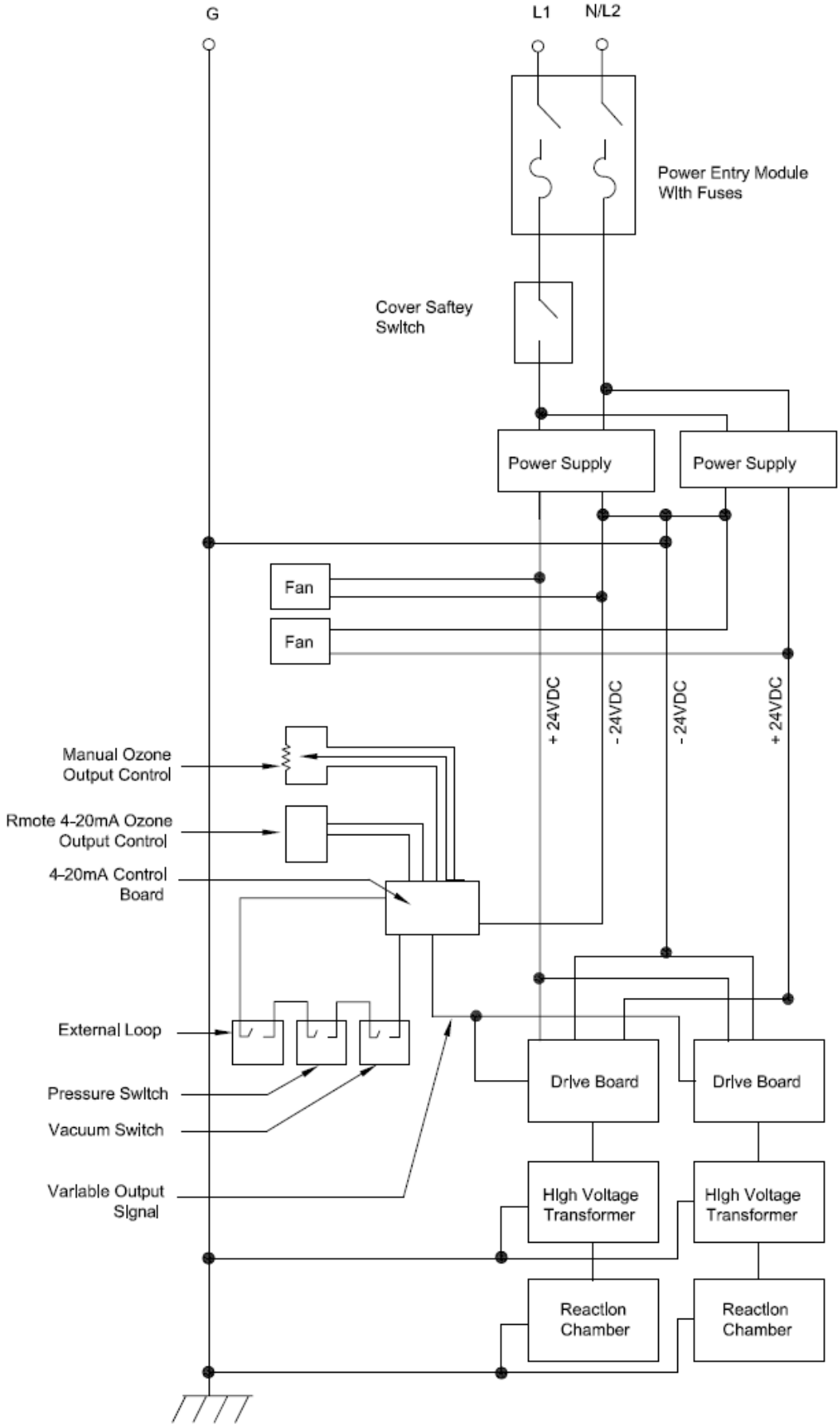
HDO_3-II – Ozone Generator – CD2000



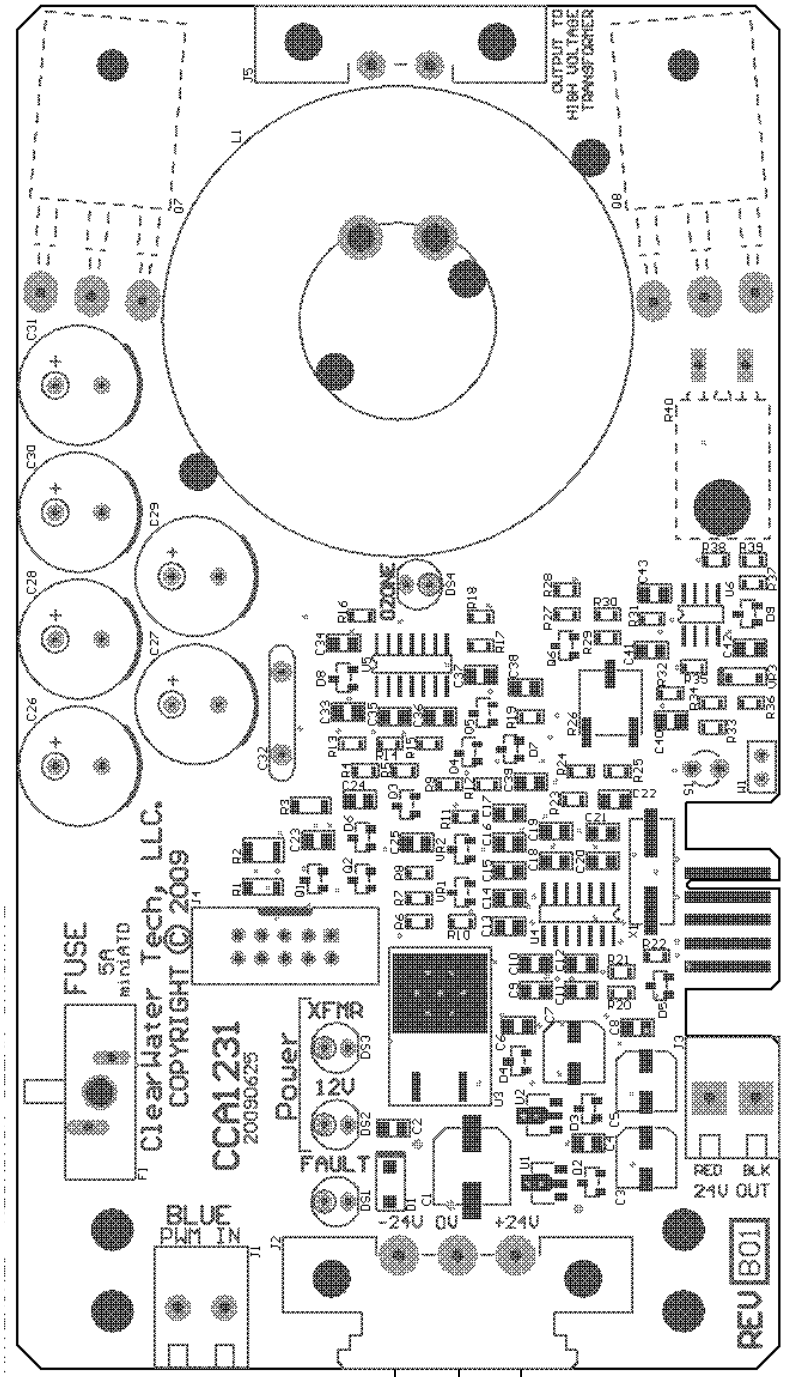
HDO_3-II – Ozone Generator – CD2000

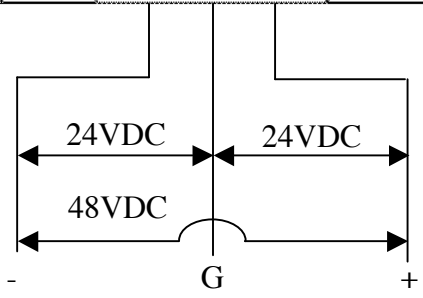


HDO_3-III – Ozone Generator – CD2000P



Appendix E – Drive Module Input Voltages





Appendix F – Warranty Information

ClearWater Tech, LLC. Limited One-Year Warranty

Summary of the Warranty

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

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

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

Items Excluded from the Warranty

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

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

Obtaining Service Under the Warranty

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

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

Exclusive Warranty

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

Disclaimer of Incidental and Consequential Damages

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

Legal Remedies of Purchaser

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

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