

# Ozone Systems

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Installation & Operation Manual

**CD15nx • CD30nx**

Corona Discharge Ozone Generators

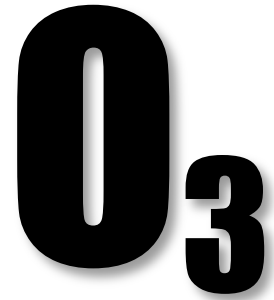


**ClearWater Tech, LLC.**

Integrated Ozone Systems

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# INTRODUCTION

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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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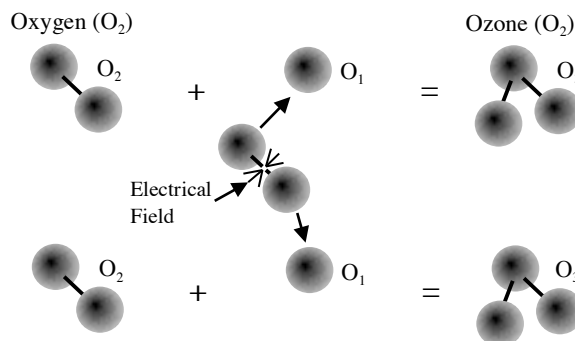
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# OVERVIEW

## How Ozone Is Generated

Ozone is generated by exposing oxygen molecules ( $O_2$ ) in an air stream to a controlled, high energy electrical field. As the air stream passes through the electrical field produced inside the ozone generator, some oxygen molecules are split, forming single oxygen atoms ( $O_1$ ). These oxygen atoms then recombine with other 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<sup>1</sup>. 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.

<sup>1</sup> Water Quality Association, "Ozone for POU, POE and Small Water System Water Treatment Applications," Lisle, IL, 1999

# Safety Information

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## Safety Warnings

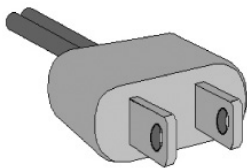
Two aspects of ClearWater Tech ozone generators represent potential dangers – ozone gas and high voltage electricity.

**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:

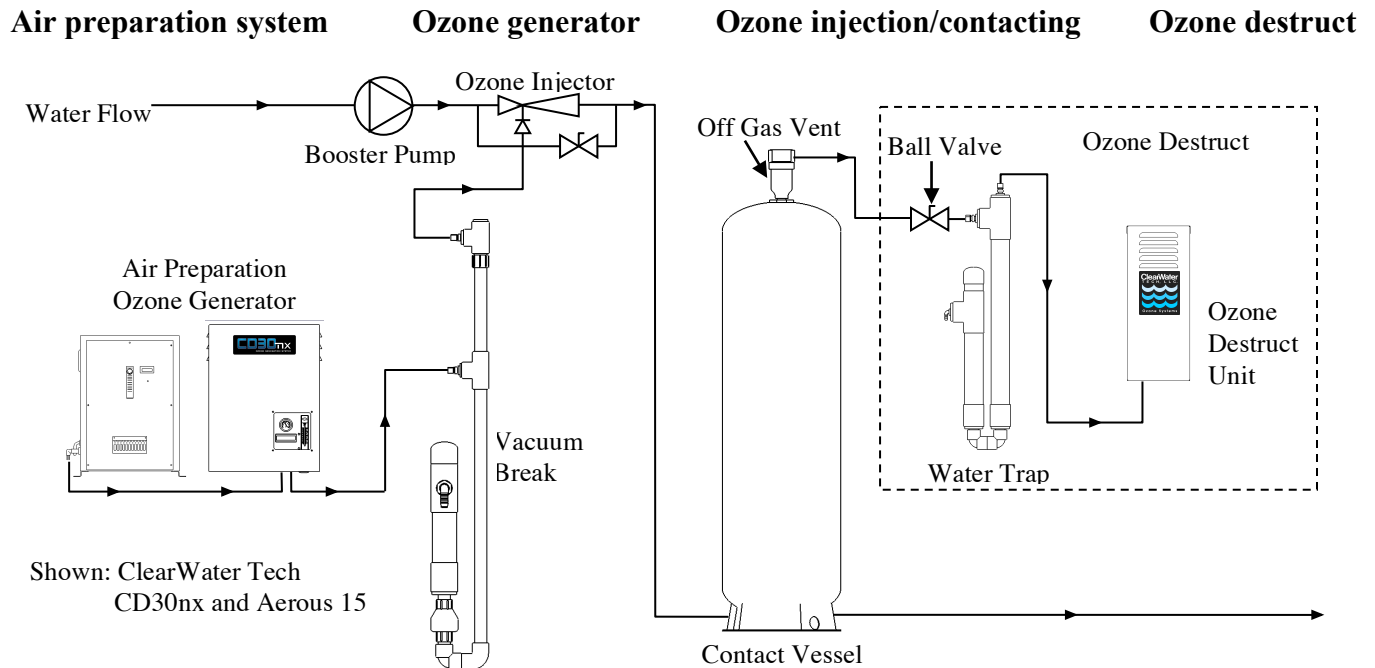
- 1. READ AND FOLLOW ALL INSTRUCTIONS.**
- 2. Connect to a grounded, grounding type receptacle only.**
- 3. Do not bury cord.**
- 4. Warning – To reduce the risk of electrical shock, replace damaged cord immediately.**
- 5. Install at least 5ft from tub water using nonmetallic plumbing. Install ozone generator no less than 1 ft above the maximum water level to prevent water from contacting electrical equipment. Install in accordance with the installation instructions.**
- 6. Warning: Short term inhalation of high concentration of ozone and long term inhalation of low concentrations of ozone can cause serious harmful physiological effects. Do not inhale gas produced by this device.**
- 7. Warning: For indoor use only. This unit is not intended for outdoor use.**
- 8. A wire connector is provided on this unit to connect a minimum 8 AWG (8.4 mm<sup>2</sup>) solid copper conductor between this unit and any metal equipment, metal enclosures of electrical equipment, metal water pipe, or conduit within 5 feet (1.5m) of the unit.**
- 9. All electrical connections should be made by a licensed, qualified electrician.**
- 10. Before attempting any electrical connections, be sure all power is off at the main circuit breaker.**
- 11. Install check valves and a vacuum break to prevent water from contacting the electrical equipment.**
- 12. 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.**
- 13. 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.**
- 14. SAVE THESE INSTRUCTIONS.**

# Theory of Operation/Product Description

ClearWater Tech ozone systems are designed for safe, effective use in a variety of water treatment applications. The CD15nx and CD30nx ozone generators may be part of a larger integrated ozone system. Such a system may include the following components required for reliable, efficient ozone production and can be divided into four general segments:

## 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.

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

## Ozone Generator

ClearWater Tech 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.

The CD15nx and CD30nx ozone systems are pressurized ozone generators, which means there is a needle valve between the ozone reaction chambers and the injector to allow the ozone reaction chambers to be pressurized. This adjustable needle valve is used to maintain optimum pneumatic parameters inside the ozone reaction chambers. These systems are also equipped with a pressure switch which prevents operation if the pressure within the reaction chambers drops below 6 pounds per square inch (PSI).

As the feed gas enters the fused, thermally protected reaction chambers inside the ozone generator, some of the oxygen molecules are split while passing through the high voltage electrical field (the “corona”), forming single oxygen atoms ( $O_1$ ). These oxygen atoms then recombine with other oxygen molecules in the air stream, forming ozone. The modular, multiple reaction chamber design allows the ozone generator to keep working even if one or more of the chambers requires service.

Depending on the application, the ClearWater Tech ozone generator may be interlocked with an ORP controller, PPM controller, pressure switch, timer or circulation pump. Other safety features are also built in, including thermal protection.

### Ozone Injection/Contacting

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

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

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

### Ozone Destruct

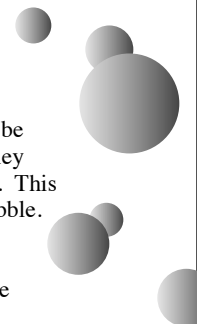
The ClearWater Tech off-gas destruct systems consists of two components: the ozone destruct unit (a heated chamber filled with manganese dioxide and copper oxide) and a water trap. Used in conjunction with a ClearWater Tech off-gas vent, the ozone destruct system is an effective way to vent the contact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

#### A Short Course in Fine Bubbles

**Lesson 1** – The large bubble (20mm) has a volume of 4.19 cm<sup>3</sup> and a surface area of 12.6 cm<sup>2</sup>.

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

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



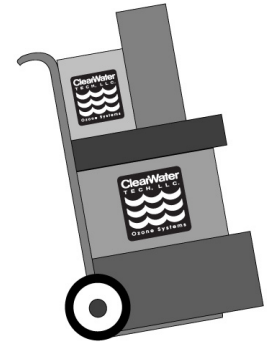


# Installation Procedures – Getting Started

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## Unpacking

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



## Equipment Placement

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

The air preparation system and ozone generator should be located as close as possible to the point of ozone injection. Ozone is an unstable gas and will begin reverting back to oxygen very quickly. To determine the most favorable ozone injection point, the following items should be considered:

- Located *downstream* of all other existing water system components.
- Located *upstream* of the residual sanitizer injection point (if so equipped).
- In a Sidestream plumbing configuration (see Figure 2) with recirculation, the pH adjustment chemical injection point must be located *downstream* of the residual sanitizer injection point (if so equipped).
- In a Full Flow plumbing configuration (see Figure 3) without recirculation, locate *downstream* of the pH adjustment chemical injection point.
- Adequate protection from weather, dust and excessive heat.

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

The equipment is heavy and requires proper support. Therefore, a clean, dry, level surface should be provided for the air preparation system and ozone generator. These components should be securely fastened to the surface using the mounting holes, tabs, and/or mounting bar provided. The mounting bar may be longer than necessary. This is to allow the mounting bar to be secured to studs. You may cut the mounting bar to a shorter length. Make sure suitable wall anchors are used to support the weight of the system.

The air preparation system and ozone generator are *not* designed to withstand outdoor elements, including direct contact with water and/or temperature extremes. Therefore, the equipment must be installed in an environment consistent with the following operating parameters:

- Ambient temperature range: 20°F (-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.**

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

# Installation Procedures – Plumbing



The ozone system should be plumbed using either a sidestream or full flow configuration. The sidestream loop method takes a *portion* of the water from the main flow (see Figure 2) 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 3). A booster pump may be necessary to maintain proper flow requirements. If employed, the booster pump is located *upstream* of the point at which the ozone injector manifold is installed.

## NOTES:

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

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

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

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

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

- Step 5:** Plumb from the injector manifold to the inlet side of the contact vessel. To reduce possible backpressure to the injector, minimize the number of elbows between the injector manifold and contact vessel. The contact vessel is a specified size, determined by water flow requirements. ClearWater Tech contact columns and the 30, 40, 80, and 120-gallon contact tanks have inlet *and* outlet fittings on the bottom of the vessel and are designated with arrows showing the direction of flow. **Note: The inlet and outlet arrows on the contact tanks are under the base of the tank.** The inlet on the 264, 463 and 850-gallon tanks is located at the top with the outlet at the bottom.
- Step 6:** Using a tee or plumbing saddle, plumb from the outlet of the contact vessel back into the main water line. For serviceability of the equipment in the side stream loop, be sure to install an isolation valve between the outlet fitting on the contact vessel and before returning to the main water line.
- Step 7:** Secure the booster pump and contact vessel to solid mounting surfaces using appropriate hardware and according to local codes. If installing a ClearWater Tech contact column, use a ClearWater Tech contact column mounting kit and install according to the instructions below. If installing a contact tank, secure to a solid horizontal surface using mounting flange or feet.
- Step 8:** Install the contact vessel venting system into the top of the vessel. If using the ClearWater Tech contact column, the vent kit supplied includes fittings, a control valve and Teflon® tubing. The contact tank venting system includes an air relief valve, fittings and a length of Teflon® tubing. Depending on conditions, the vented gas may be directed to an ozone destruct system, to atmosphere or to the low-pressure side of the water system. **Note: Do not direct the tubing to the suction side of any pump in the system.**

### Contact Column Installation (If so equipped)

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

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

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

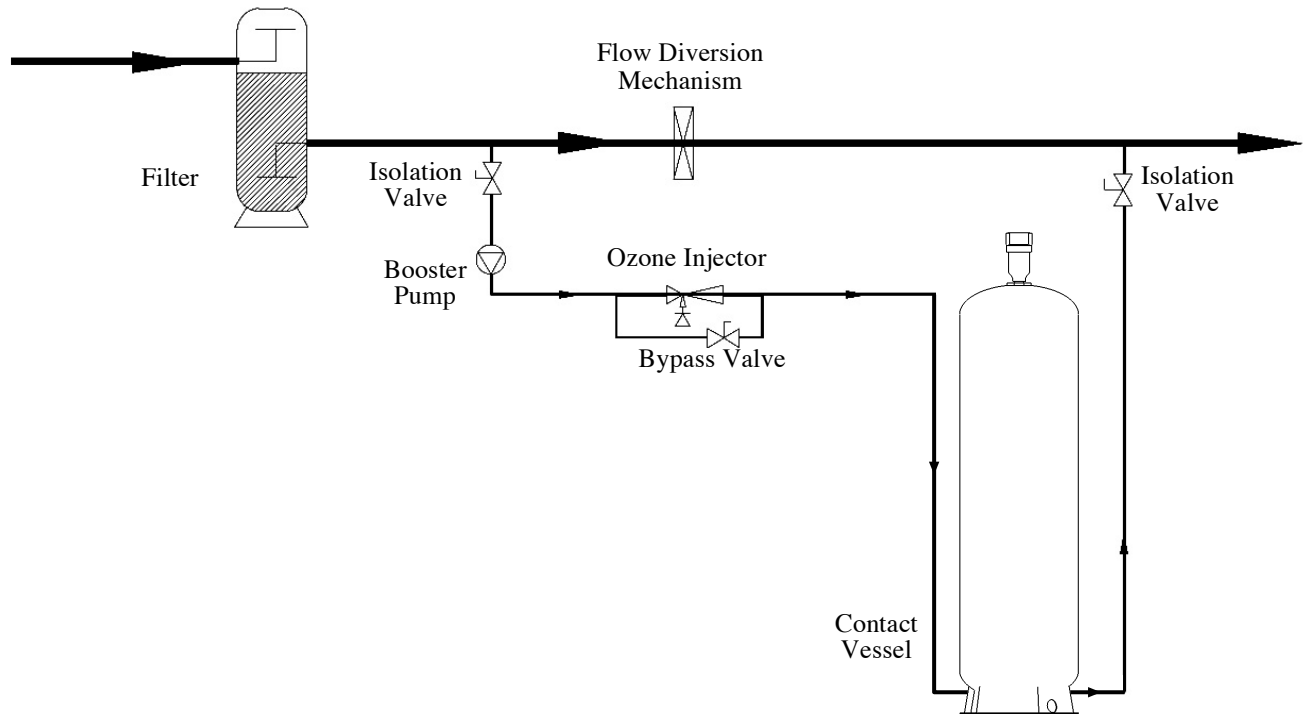
**Step 3:** Cut the unistrut bar to the desired length and attach it to the 'L' bracket using hardware provided.

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

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

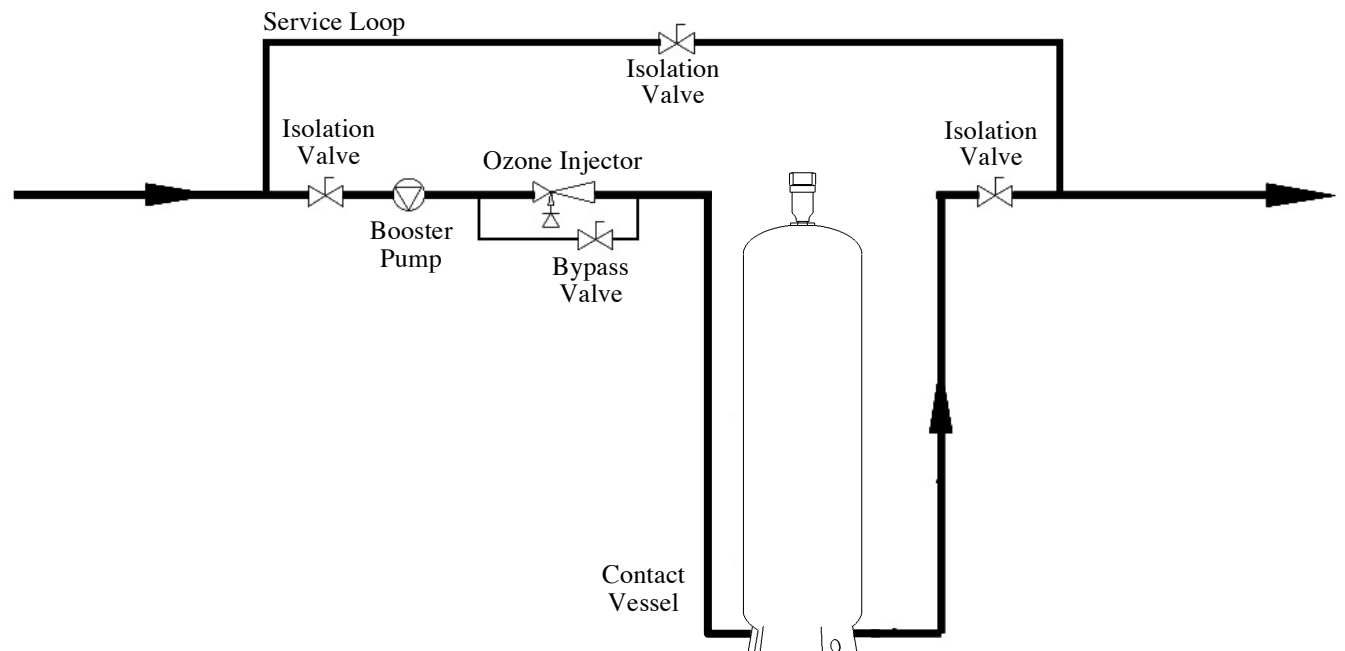
### Side stream Plumbing Installation Diagram

Figure 2



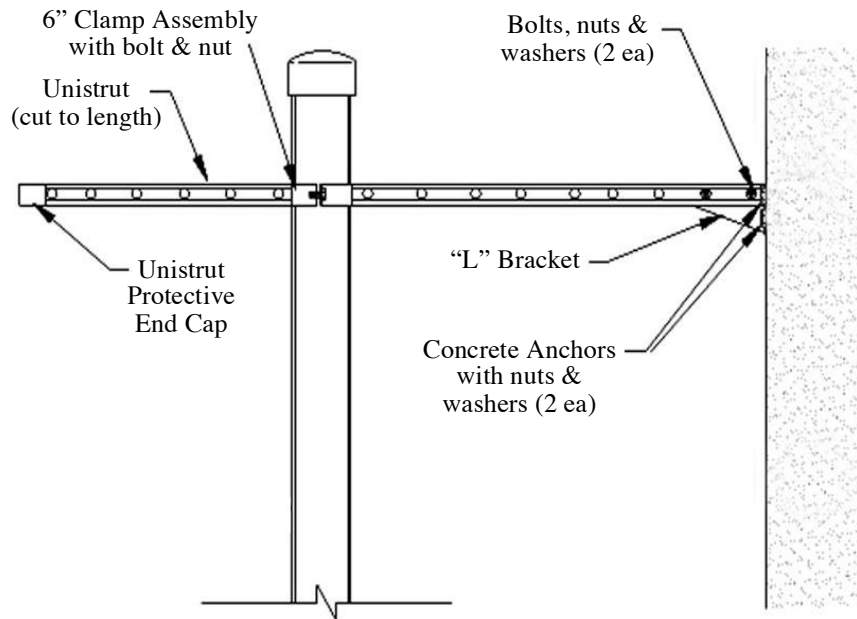
### Full Flow Plumbing Installation Diagram

Figure 3



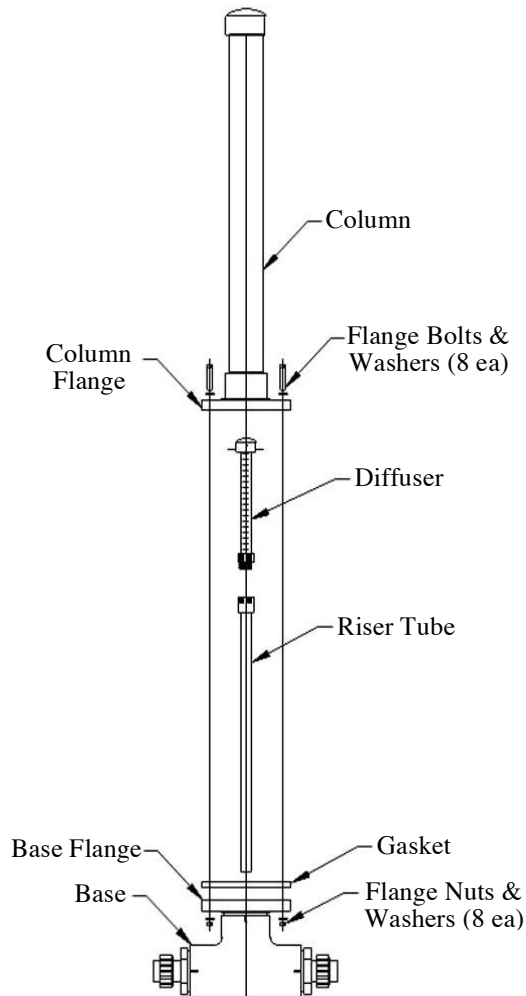
### Contact Column Installation Diagram

Figure 4

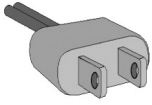


### Contact Column Exploded View

Figure 5



# Installation Procedures – Electrical



The CD15nx and CD30nx ozone generators are equipped with universal regulated power supplies that accept an input voltage from 90-250VAC at 47-63Hz, single phase (1Ø). ClearWater Tech has an assortment of IEC cords for various voltage requirements and outlet configurations, for use around the world. All possible pre-wiring has been completed at the factory. Logic schematics have been provided in the Appendix D.

**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 ozone generator to a true earth ground. Use solid copper bonding wire (usually #8 AWG) from the copper-bonding lug located on the bottom of the ozone generator to the grounding point.

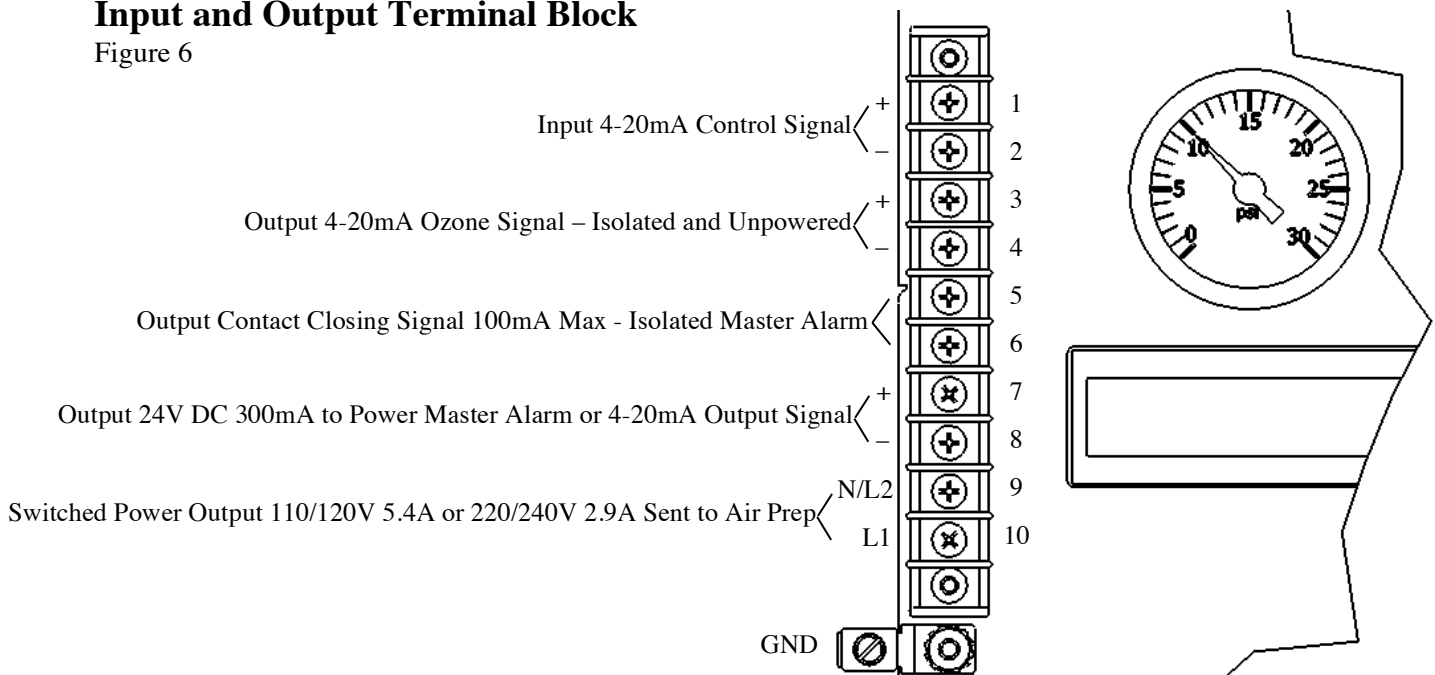
**Step 2: Main Power:** Plug the IEC end of the power cord into the power entry module located at the bottom of the ozone generator. The other end can be plugged into any main power source with input voltage from 90 to 250 VAC at 47 to 63 Hz, single phase. The power consumption of the unit is shown in the chart on the right. This current draw is for the base unit only. If the unit is being used to directly power the air preparation system the total power consumption will power consumption of the unit plus the power consumption of the air preparation system.

Power Consumption – Unit Only	
Input Voltage	90-250VAC 47-63Hz
CD15nx	1.6-0.8 Amps
CD30nx	2.8-1.4 Amps

**Step 3: Input and Output Terminal Block Connections:** Removing the cover reveals the terminal strip on the main control panel (see Appendix A). There are two knockouts provided in the bottom panel to allow for control and signal wires to come into the chassis and connect to this terminal strip. There is an electrical hook up schematic located below and inside the cover of the unit.

## Input and Output Terminal Block

Figure 6



**Input 4-20mA Control Signal** – A 4-20mA control signal to the ozone generator may be used to control the ozone generator output, terminals 1 and 2. Based on the 4-20mA signal, ozone output will increase or decrease: 4mA = 0% ozone output, 20mA = 100% ozone output. Connect the positive (+) 4-20mA input control signal, and negative (-) 4-20mA input control signal from the ozone generators terminal block to the 4-20mA controller according to the manual supplied with the controller. See the Ozone Generator Program Setup section for information on configuring the 4-20mA control.

**Output 4-20mA Ozone Signal** – An isolated 4-20mA signal proportional to the ozone output of the unit may be used to interface with an external monitoring device, terminals 3 and 4. The 4-20mA signal is not self powered, so the device receiving the signal must supply power to the 4-20mA circuit in the ozone generator. If the receiving 4-20mA circuit is also isolated and unpowered, 24VDC is provided on the terminal strip which can be used to power the system. See Figure 7 below an example of how to use the 24VDC terminals to power the 4-20mA circuit.

**Master Alarm** – This alarm signal is the closing of a solid state contact, terminals 5 and 6. When the system is operating normally the contact is open, if there is an alarm state, the contact will close. These contacts can be used as a switch to directly drive a load (warning light, warning sound device, etc.) if that load draws 100mA or less, and the peak voltage for the load is less than 100V. If more current or voltage is required for your system, an external relay can be selected with current and voltage ratings appropriate for your load, and the master alarm contacts can then be used to turn on the relay. See the Ozone Generator Program Setup section for information on the alarm states available.

**Output 24VDC 300mA** – 24VDC is provided if voltage is needed to energize the isolated Output 4-20mA Ozone Signal or the Master Alarm, terminals 7 and 8. The 24 volts is referenced to ground and the total current draw from this output must be less than 300mA.

**Output Switched Power** – This output can be used to power an air preparation system, terminals 9 and 10. This will allow the ozone unit to intelligently control the air preparation system and protect the overall ozone system. Once ozone is no longer called for, the CD30nx and CD15nx will continue to supply power to these terminals for a user defined amount of time, the default is 10 seconds. This extra time will flush the ozone out of the system to prevent ozone from being left in the chamber and defusing backwards, potentially harming non ozone resistant components on the oxygen side of the reaction chamber. The CD30nx and CD15nx will also not attempt to start the air preparation system for the first 15 seconds after the air preparation system has turned off. This will allow the air preparation system to decompress. Attempting to start a pressurized compressor can result in a stalled motor and current 3 to 4 times the rated value for the motor. The CD30nx and CD15nx either use the vacuum switch or the external loop as the air preparation signal. The default setting is the vacuum switch. Once the unit senses at least -3inHg on the outlet side, it will turn on the air preparation system. Ozone production will begin once the air preparation system has built adequate pressure in the reaction chambers. If some other control mechanism is desire to turn on the air preparation system (external controller, pump signal, ext.) the air preparation system can be controlled by the external loop instead of the vacuum switch. See the Ozone Generator Program Setup section for information on setting how the air preparation system is controlled. If the ozone system is powered with 110/120VAC the voltage at these terminals will be 110/120VAC and the current draw for should not exceed 5.4A. If the ozone system is powered with 220/240VAC the voltage at these terminals will be 220/240VAC and the current draw should not exceed 2.9A.

**Step 4: 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, when this loop has lost continuity the following will occur:

- Ozone production will stop and the ozone output will drop to 0%.
- The display will indicate that the “Ext Loop” is causing ozone output to be 0%.
- If the unit has been setup to use the external loop as the control signal for the air preparation system, (see the Ozone Generator Program Setup section for information on setting how the air preparation is controlled) the power to the switched power output terminals will remain on for a few seconds (see the Ozone Generator Program Setup section for information on setting how long these terminals remain on). If the air preparation system is connected to these terminals the ozone will be purged from the chamber and delivery lines. After a few seconds power at these terminals will be switched off.

**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 the following will occur:

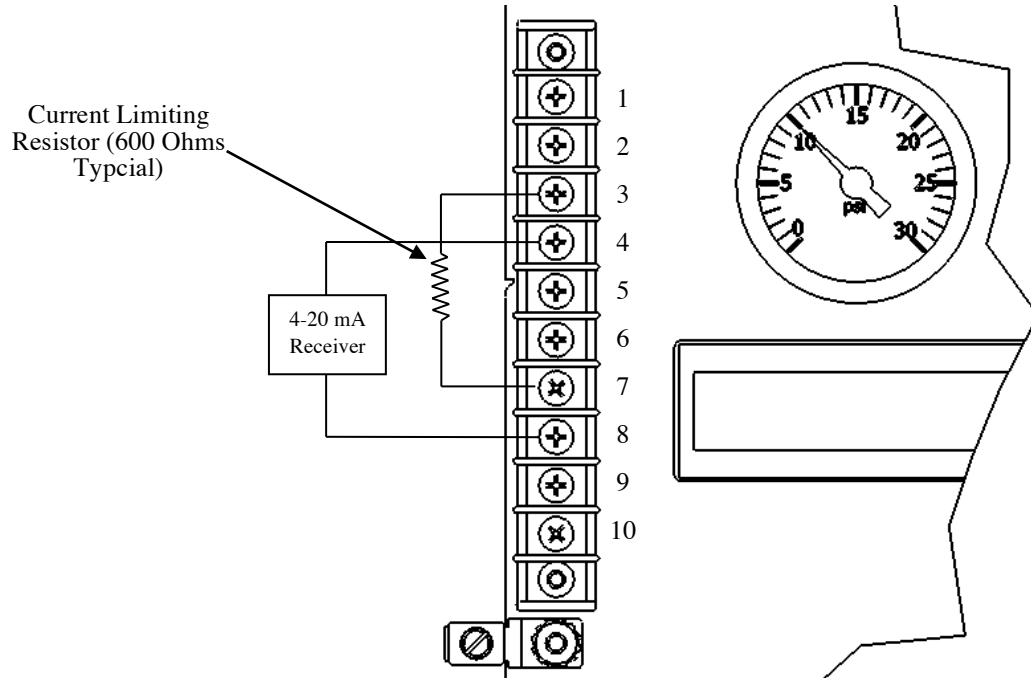
- Ozone production will continue.
- If the unit has been setup to use the external loop as the control signal for the air preparation system, (see the Ozone Generator Program Setup section for information on setting how the air preparation is controlled) the power to the switched power output terminals will remain on.

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 the white 18AWG wire in half. Connect the control device to each leg of the external loop. 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 8 below. **Note:** Attached to the white 18 AWG external loop is a warning, “THIS CONNECTION IS A DRY CONTACT ONLY, DO NOT APPLY VOLTAGE”.



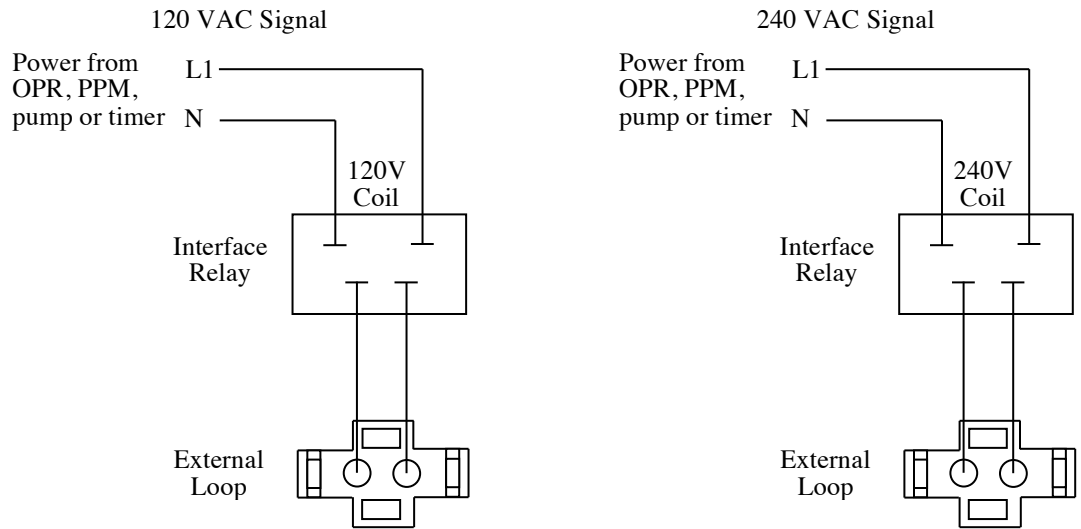
### Typical 4-20mA Output Signal Connection Using Provided 24VDC Terminals

Figure 7



### External Loop Electrical Interface

Figure 8

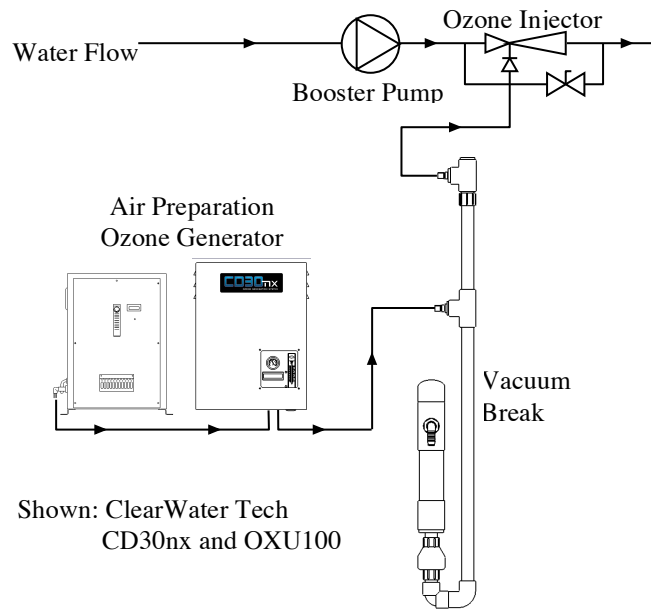


# Installation Procedures – Pneumatic

This section outlines the steps required to complete the ozone system pneumatic hook-ups. The system components include the air preparation system, ozone generator, vacuum break, and ozone injector manifold (see Figure 9). The air preparation system provides the ozone generator with a source of dry, oil-free oxygen-enriched air (90% +/- 3% oxygen purity at -60°F dew point). The air is drawn from the ozone generator (where ozone is produced from the oxygen in the air stream) and through the vacuum break by the suction created at the ozone injector manifold.

## Typical Pneumatic Hookup

Figure 9

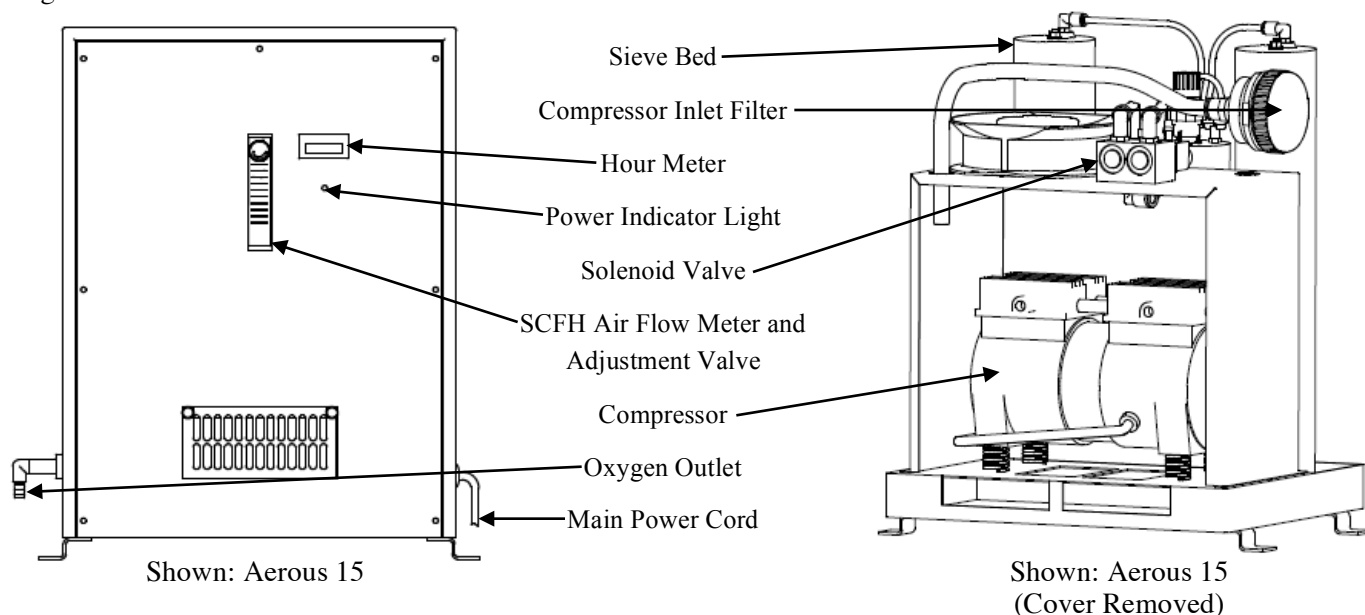


## Hook-Up: Air preparation system-to-ozone generator

- Step 1:** Setup the air preparation following the instructions provided with the air preparation system. Using the graphs found in Figure 12, determine how much air flow is necessary to achieve the ozone output desired for the application. Make sure the air preparation system you select can deliver that amount of air flow at a pressure of 10 psi without over drawing the sieve beds. **Warning: Make sure to read and follow the operating instructions of the air preparation system as damage could occur to the air preparation system if the flow rate is too high.**
- Step 2:** Teflon® tape and attach brass barb provided to the PSA oxygen concentrator outlet (if so required). A typical oxygen concentrator system is shown below in Figure 10 as a reference.
- Step 3:** Using a suitable length of 3/8" braided tubing provided, attach one end of the tubing to the oxygen concentrator system to one end of the indicator cartridge. Secure the tubing to the brass fittings with the hose clamps provided.
- Step 4:** Using a suitable length of 3/8" braided tubing, attach tubing to the barb located on the oxygen concentrator, then attach the other end of the tubing to the brass barb located at the bottom of the ozone generator. Secure the tubing to the fittings with the hose clamps provided.

## Typical Oxygen Concentrator Detail

Figure 10



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

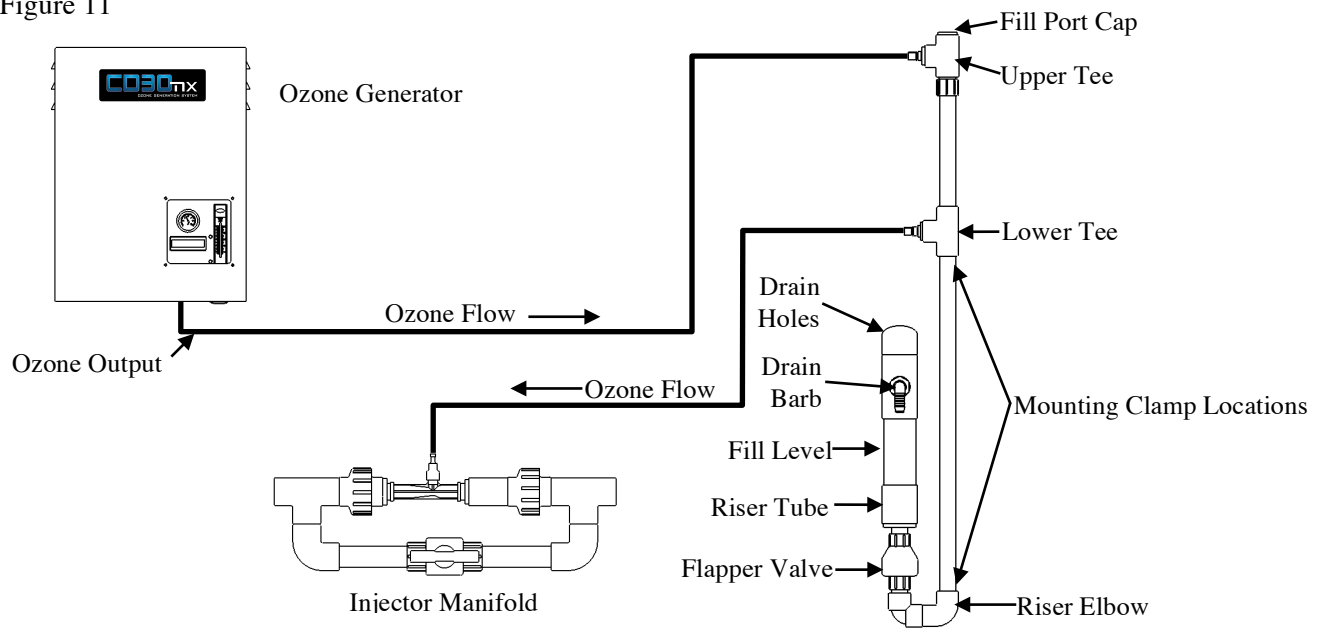
The ClearWater Tech vacuum break provides a positive atmospheric “break” between the ozone injector manifold and the ozone generator, preventing water from flowing back into the ozone generator should the venturi check valve fail. Under normal operating conditions, the vacuum break's flapper valve (see Figure 11) is closed, allowing the vacuum created by the venturi to draw the output gas from the ozone generator. If the check valve at the venturi begins to leak or fails completely, vacuum is interrupted and water will flow toward the ozone generator. With the vacuum break properly installed between the venturi and the ozone generator, the water will flow down the riser tube (away from the ozone generator) and out to drain, protecting the ozone generator from potential water damage.

- Step 1:** Select a suitable vertical surface that is accessible and in close proximity to both the ozone generator and the ozone injector manifold.
- Step 2:** Install the two Clic® mounting clamps provided onto the vertical surface so that the vacuum break is in a vertical position and the drain holes are below the level of the ozone generators ozone outlet fitting. One clamp should be located so it fits around the Riser Tube Elbow, and the other so it fits around the bottom of the Lower Tee (see Figure 11).
- Step 3:** Remove the Fill Port Cap located on top of the Riser Tube and fill the Riser Tube with clean water (no particulate matter) until "Fill Level" line indicated in Figure 11.
- Step 4:** Re-install the Fill Port Cap, using pliers or a wrench to tighten. Note: Do not over tighten as damage to PVC fittings may occur.
- Step 6:** Connect one end of a suitable length of Teflon® ozone delivery line to the ozone generator's ozone outlet fitting (see Appendix, Section A). Attach the other end of the Teflon® delivery line to the fitting threaded into the Upper Tee. As an additional backflow prevention measure, loop this length of tubing as high as is practical between the two connection points.
- Step 7:** Connect one end of a second length of Teflon® delivery line to the fitting threaded into the Lower Tee. The other end of the delivery line will be attached to the fitting located on top of the check valve assembly, in step 6 of the “Start-up and Calibration Procedures.”

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

### Vacuum Break Detail

Figure 11



# 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 is maintained at the ozone generator while the system is operating under pressure. Air from the air preparation system is flowing through the ozone generator under pressure, and from the ozone generator under a slight vacuum (created by the ozone injector manifold). The change from pressure to vacuum occurs after the stainless steel ozone outlet needle valve on the ozone generator.

## Air Preparation System, Ozone Generator & Ozone Injector

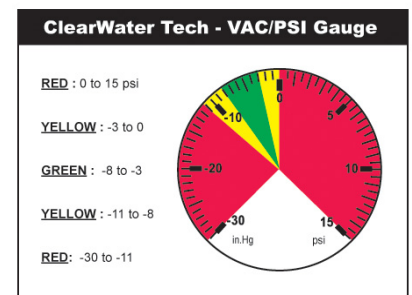
**Warning:** *Disconnect the External Loop dry contact from the ozone generator while performing all start-up procedures. Failure to do so may result in ozone escaping to atmosphere.*

**Step 1:** Make sure all isolation valves in the ozone water system are open (Figures 2 or 3 show recommended isolation valve locations).

**Step 2:** Start-up hydraulics. Allow the water system to reach hydraulic equilibrium (contact vessel full, off-gas vent operating, etc.) and observe for plumbing leaks. **Note: Water flow must be established through the main water pump and the ozone system booster pump (if so equipped).**

**Step 3:** Close the ball valve on the injector manifold about half way.

**Step 4:** Using your thumb, check for the presence of vacuum (suction) at the ozone injection manifold check valve assembly or use a ClearWater Tech vacuum test assembly to check vacuum at the injector port. If no suction is present, continue to close the ball valve on the injector manifold until vacuum is detected. If using the vacuum test assembly, check the VAC/PSI gauge for vacuum. If the needle is in the red zone on the pressure (PSI) side of the gauge, gradually close the ball valve on the injector manifold until the needle moves into the green zone. If the needle is in the red zone on the vacuum (in.Hg) side of the gauge, gradually open the ball valve on the injector manifold until the needle moves into the green zone. While vacuum is in the green zone you must be able to achieve proper SCFH (Standard Cubic Feet per Hour) of air flow (see the “Pneumatic Operating Parameters” chart for venturi SCFH required, Figure 13).



**Step 5:** Make sure electrical power is on to all ozone system electrical components. The main power switch of the air preparation system must be in the “ON” position (if so equipped, see Figure 10). Setup the air preparation following the instructions provided with the air preparation system. Using the graph found in Figure 12, determine how much air flow is necessary to achieve the ozone output desired for the application. Make sure the air preparation system you select can deliver that amount of air flow at a pressure of 10 psi without over drawing the sieve beds. **Warning: Make sure to read and follow the operating instructions of the air preparation system as damage could occur to the air preparation system if the flow rate is too high.**

**Step 6:** Connect the Teflon® ozone delivery line from the vacuum break to the ozone inlet fitting located at the ozone injection manifold check valve assembly. **Note: If the oxygen concentrator is wired to the ozone generators switched power output (terminals 9 and 10), the oxygen concentrator will not**

**have power until this connection is made and vacuum is present.** See the Ozone Generator Program Setup section for more information on configuring how the CD30nx and CD15nx control the air preparation system.

- Step 7:** Using the stainless steel ozone outlet needle valve located at the bottom the ozone generator (see Appendix A), adjust the backpressure of the ozone reaction chambers to 10 PSI. Check the PSI gauge on the front panel of the ozone generator, which measures this backpressure. If there is insufficient backpressure the needle valve may be closed slightly; similarly, if there is too much backpressure the valve may be opened slightly. **Note: The lock nut on the needle valve must be loosened prior to adjustment and tightened after adjustment. Due to the pressure switch installed, the PSI gauge must achieve 6 PSI before ozone will begin production.**
- Step 8:** The CFH gauge on the front panel of the ozone generator monitoring the flow of pressurized gas. Since it is under pressure it will indicate a flow rate lower than the expected unpressurized SCFH value. See the graph in Figure 12 to see the relationship between SCFH and CFH at 10 psi. **Warning: Make sure to read and follow the operating instructions of the air preparation system as damage could occur to the air preparation system if the flow rate is too high.**
- Step 9:** Perform a final check of all air connections from the air preparation system to the ozone injector manifold. Repair leaks as required. Check all system water connections, including the ozone injector manifold, vacuum break and contact vessel. Repair leaks as required. **Note: The check valve at the ozone injector manifold may make a humming noise. This is normal.**
- Step 10:** Reconnect the External Loop connector to the ozone generator.
- Step 11:** See “Ozone Generator Program Setup” for instruction on how to setup the control program and adjust ozone output.

## Ozone System Power Up

When the ozone system is powered up with the external loop connected to the ozone generator, the manual ozone control allowing ozone production, back pressure of at least 6 PSI present, and vacuum from the injector of at least -3 inHg, the unit will begin generating ozone. The drive board’s Self-Resonating Technology (SRT) will begin by characterizing the drive system at the temperature, pressures, and flows the reaction chamber is currently experiencing. You will hear and audible sweep of the drive frequency from high to low as the drive board maps the resonant point of the system. For best results bring the pressure and flow through the system up to normal operation before powering up the ozone generator.

## Vacuum Break

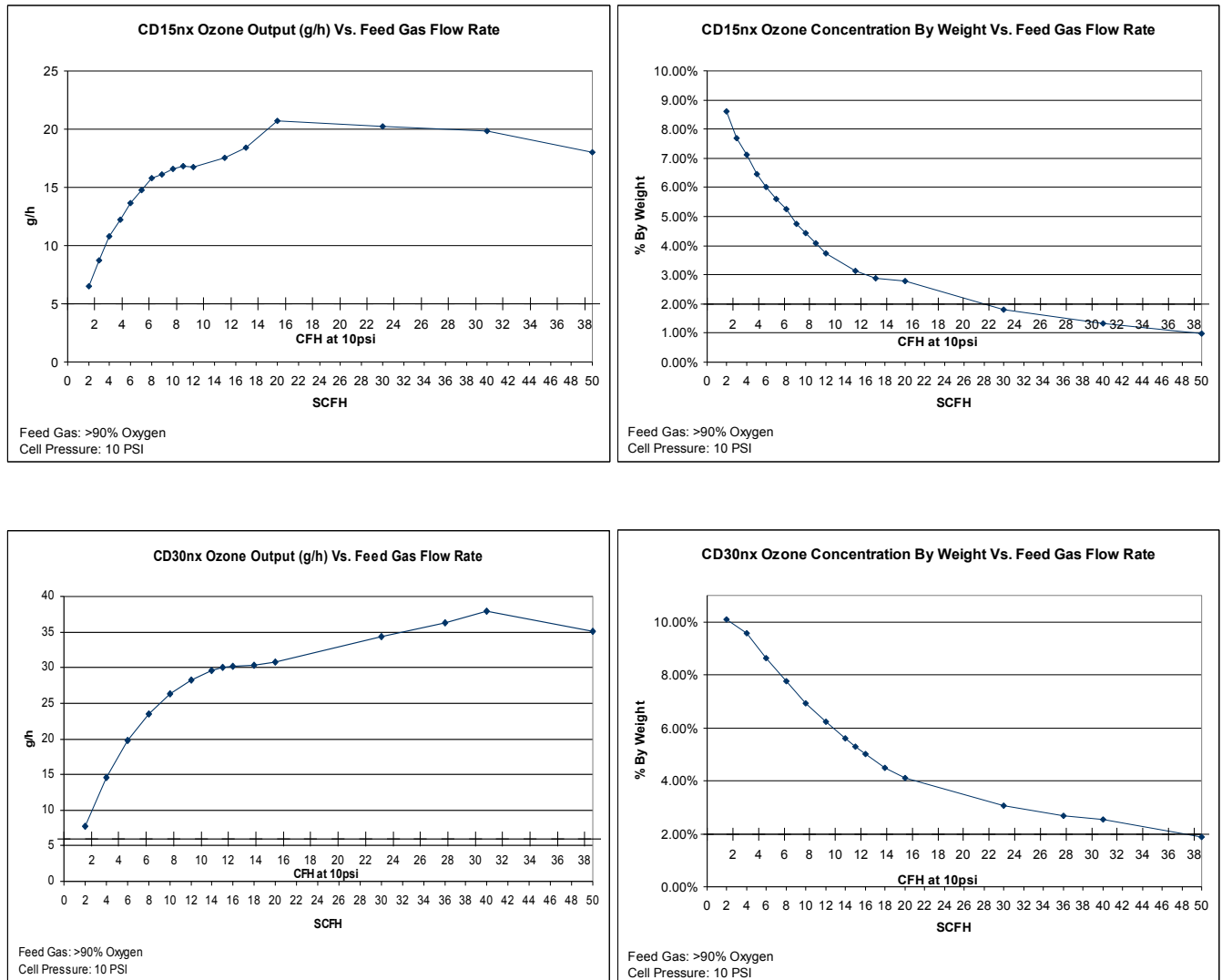
Check the water level in the vacuum break, making sure it is above the flapper valve (see Figure 11). If water is not pressing downward on the flapper valve it will open, causing a loss of vacuum. A loss of vacuum means ozone cannot flow from the vacuum break, which in turn can cause an ozone leak. **Note: If the vacuum break must be refilled with water disconnect the External Loop from the ozone generator and disconnect the Teflon® ozone delivery line from the ozone inlet fitting of the vacuum break. Once the vacuum break is filled, reconnect the ozone delivery line first, then reconnect the External Loop.**

## Ozone Destruct System

Adjust the small ball valve at the tee of the water trap (see Figure 1) so that only a small amount of water is “spitting” into the trap. This will indicate that the contact vessel is full and only a very small amount of water is allowed to escape.

### Ozone Output Charts

Figure 12



### Pneumatic Operating Parameters

Figure 13

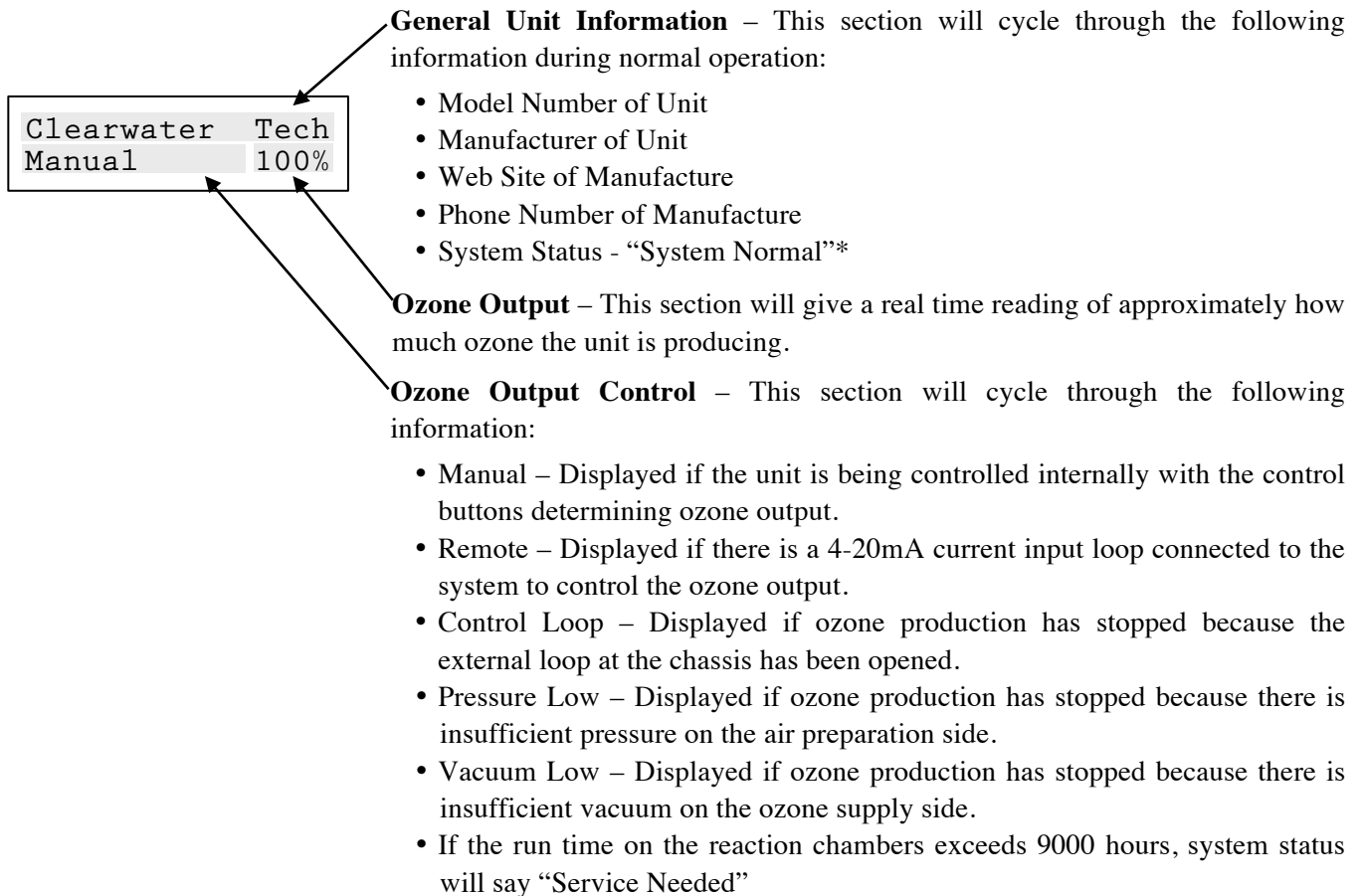
Operating Parameter	CD15nx		CD30nx	
	Range	Rated	Range	Rated
Air Preparation System Air Flow	0-20 SCFH	7 SCFH	0-40 SCFH	14 SCFH
Ozone Generator Air Flow (Gauge on Front Cover)	0-15.4 CFH	5.4 CFH	0-30.8 CFH	10.8 CFH
PSI Gauge (Gauge on Front Cover)	6-11 PSI	10 PSI	6-11 PSI	10 PSI
Injector Manifold Air Flow	0-20 SCFH	7 SCFH	0-40 SCFH	14 SCFH
Injector Manifold Vacuum	-3 to -8 inHg	-5 inHg	-3 to -8 inHg	-5 inHg

# Ozone Generator Program Setup

The CD15nx and CD30nx are equipped with a sophisticated System Information and Diagnostics (S.I.D.) control board, which monitors the ozone drive systems, inlet and outlet pressure, and remote 4-20mA control signal, allows the operator flexibility in how the system is configured, and provides output signals which can be used to monitor the system remotely. This section provides an overview of the control system.

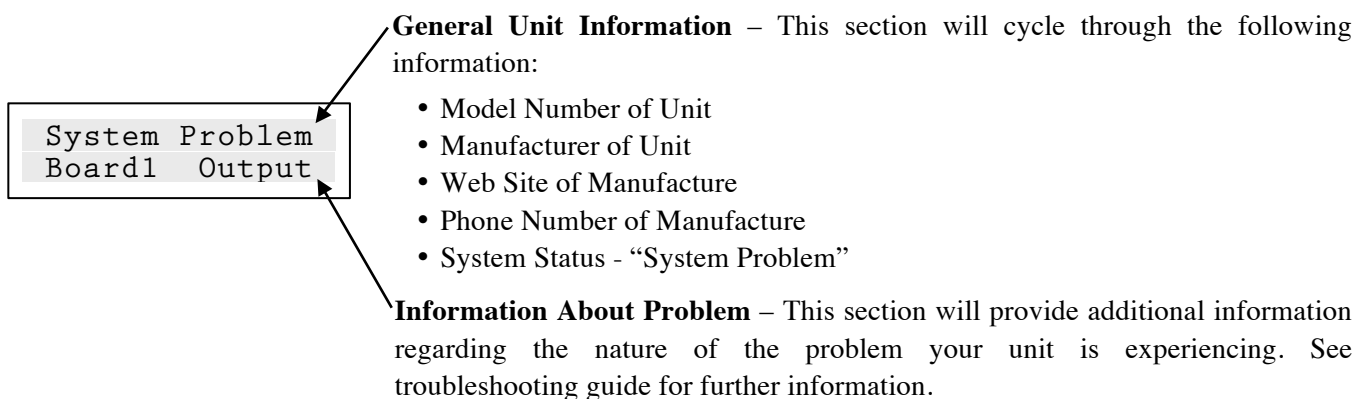
## Main Screen – System Normal

This is the main screen that the unit will return to if neither the left side control button or right side control button is pressed for a period of time. See Appendix A for the location of the control buttons.



## Main Screen – System Problem

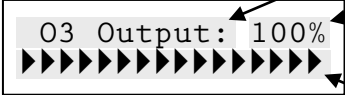
This is how the main screen will appear if there is a problem with the system.





## Ozone Output Screen

When either of the control buttons are pushed individually the screen will automatically go to this the output screen, to see actual and desired ozone output. Pushing or holding down the left side control button will decrease the ozone output. Pushing or holding down the right side control button will increase the ozone output.



**Screen Title**

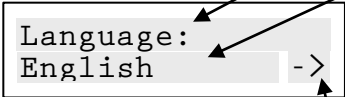
**Actual Ozone Output** – This section will give a real time reading of approximately how much ozone the unit is producing.

**Desired Ozone Output** – This section shows manual control set point. No triangles on the display represents 0% ozone output, 16 triangles on the display represents 100% ozone output.

## Setup Screen

When both buttons are pushed simultaneously the unit will enter setup mode. The unit will automatically exit the setup mode if buttons are not pushed within 20 seconds. The setup mode will progress through 7 screens each allowing a different aspect of the system to be configured. For each item to be configured, the option that is displayed is the option that is selected and being used by the system.

### Setup Screen 1 – Language



**Screen Title**

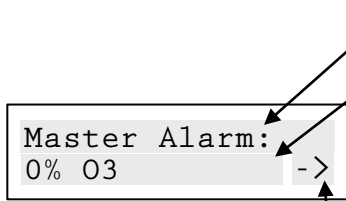
**Current Language Selected** – Pushing the left side control button will cycle the language through the following options:

- English
- Spanish
- French

Note: The language that is displayed is the language being used by the system. To change the language, push the left side control button until the desired language is shown, then push the right side control button to move to the next screen in the setup mode.

**Next Setup Screen** – Pushing the right side control button will move to the next screen in the setup mode.

**Setup Screen 2 – Master Alarm**



**Screen Title**

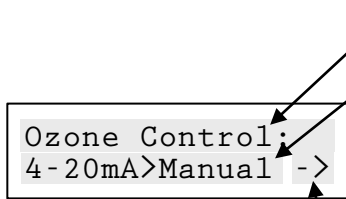
**Master Alarm Current Configuration** – Pushing the left side control button will cycle through the following options of what initiates the master alarm:

- 0% O3 – Master alarm will trip when the actual ozone output is 0% for any reason: Loss of pressure, loss of vacuum, loss of external loop, manual control changed to 0%, remote 4-20mA current loop control signal changed to 4mA, or a system problem.
- <100% O3 – Master alarm will trip when the actual ozone output is less than 100% for any reason: Loss of pressure, loss of vacuum, loss of external loop, manual control changed something other than 100%, remote 4-20mA current loop control signal changed something less than 20mA, or a system problem.
- O3<>Control – Master alarm will trip when the actual ozone output is not equal to the control set point for any reason. The control set point is the amount of ozone being produced set by the manual control or the 4-20mA current loop control signal. In this mode, a loss of pressure, loss of vacuum, loss of external loop, or a system problem will initiate the master alarm.
- O3<>Cont+Ext – Master alarm will trip when the actual ozone output is not equal to the control set point for any reason not including pulling the external loop. The control set point is the amount of ozone being produced set by the manual control or the 4-20mA current loop control signal. In this mode, a loss of pressure, loss of vacuum, or a system problem will initiate the master alarm. The external loop can be used in this mode as a control method without initiating a master alarm.

Note: The configuration that is displayed is the configuration being used by the system. To change the configuration, push the left side control button until the desired configuration is shown, then push the right side control button to move to the next screen in the setup mode.

**Next Setup Screen** – Pushing the right side control button will move to the next screen in the setup mode.

### Setup Screen 3 – Ozone Control



**Screen Title**

**Current Ozone Control Method** – Pushing the left side control button will cycle through the following options of how the system controls the ozone output:

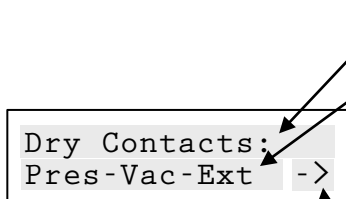
- 4-20mA>Manual – In this mode the 4-20mA current loop input signal, if provided, will override the manual control automatically. The manual control will only be used if a 4-20mA current loop input signal is not present.
- Manual Only – In this mode the 4-20mA current loop is ignored if present, only the manual control is used.
- 4-20mA Only – In this mode the manual control is ignored, and only the 4-20mA current loop is used to control the unit. If a 4-20mA current loop input signal is not present, the ozone output will be 0%.

Note: The configuration that is displayed is the configuration being used by the system. To change the configuration, push the left side control button until the desired configuration is shown, then push the right side control button to move to the next screen in the setup mode.

**Next Setup Screen** – Pushing the right side control button will move to the next screen in the setup mode.

### Setup Screen 4 – Dry Contact

Dependent upon the application in which the ozone generator is being used, it may be necessary to bypass various safety and/or interface components. This screen will allow for the user to disable or enable the systems pressure (Pres) or vacuum (Vac) switches which control ozone production. **Warning: The pressure switch and/or vacuum switch should only be disabled if instructed to do so. Disabling these switches could cause ozone to be released to the atmosphere around the ozone generator.**



**Screen Title**

**Dry Contacts Used to Shut Down System** – Pushing the left side control button will cycle through the following contact options the system uses to shut down ozone production:

- Pres-Vac-Ext – In this mode the pressure switch, vacuum switch, and external loop (located on the chassis) will be used to shut down ozone production.
- Pres-Ext – In this mode the pressure switch and the external loop (located on the chassis) will be used to shut down ozone production.
- Vac-Ext – In this mode the vacuum switch and the external loop (located on the chassis) will be used to shut down ozone production.
- Ext – In this mode only the external loop (located on the chassis) will be used to shut down ozone production.

Note: The configuration that is displayed is the configuration being used by the system. To change the configuration, push the left side control button until the desired configuration is shown, then push the right side control button to move to the next screen in the setup mode.

**Next Setup Screen** – Pushing the right side control button will move to the next screen in the setup mode.

### Setup Screen 5 – Air Preparation Control

Your ozone system is equipped to control the air prep system using the Switched Power Output on the terminal strip (terminals 9 and 10). This screen will allow you to configure what trigger the CD30nx or CD15nx uses to turn on the air preparation system.

**Screen Title**

**Air Preparation Trigger Current Configuration** – Pushing the left side control will cycle through the following triggers to turn on the air preparation system.

- Vacuum Switch – The system will turn the air preparation system on once it senses a vacuum on the ozone outlet of -3 inHg or more. This will allow the ozone system and air preparation system to turn on automatically once there is enough flow through the injector to produce vacuum.
- Ext – The system will turn the air preparation system on when the external loop is present. If the application does not involve vacuum, or the vacuum produced is low/unstable this configuration will allow an external control device, interfaced with the external loop, to control the ozone system and air preparation system.

Note: The configuration that is displayed is the configuration being used by the system. To change the configuration, push the left side control button until the desired configuration is shown, then push the right side control button to move to the next screen in the setup mode.

**Next Setup Screen** – Pushing the right side control button will move to the next screen in the setup mode.

### Setup Screen 6 – Air Preparation Delay

One of the main advantages of having the CD15nx or CD30nx control the air preparation system is to provide an “off-delay” function allowing the air preparation system’s flow and pressure to flush the ozone out of the reaction chamber(s) when ozone production has stopped. This setup screen will allow you to set the duration that the air preparation system remains “on” once ozone production has stopped.

**Screen Title**

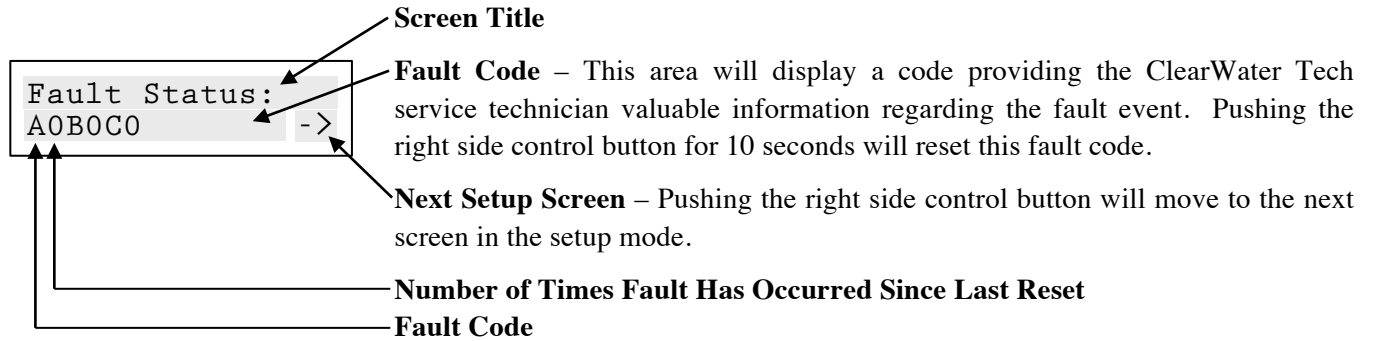
**Delay Time** – Pushing the left side control button increase the off delay time, in seconds. The off delay is the amount of time the air preparation system remains “on” once ozone production has stopped. Once the delay time reaches 60 seconds it will return to 0 seconds.

Note: The number of seconds that are displayed is the number of seconds the system will use for the “off-delay” of the air preparation system. To change the delay, push/hold down the left side control button until the desired number of seconds is shown (you must go all the way up to 60 to get back to 0 if you desire a value less than the value currently shown). Once the value shown is the value you want, push the right side control button to move to the next screen in the setup mode.

**Next Setup Screen** – Pushing the right side control button will move to the next screen in the setup mode.

### Setup Screen 7 – Fault Information

This screen will assist the ClearWater Tech service technician with diagnosing the system in the event that it experiences a fault condition.



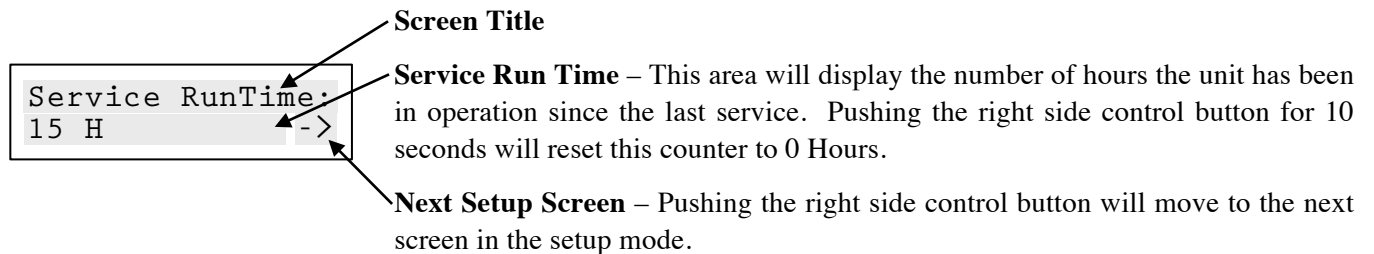
### Fault Status Codes

Figure 14

Code	Description
A	Drive 1 can not get enough power into the reaction chamber.
B	Drive 1 is sensing a series of sudden dips in the power into the chamber indicative of unusual arching occurring somewhere in the system.
C	Drive 1 thermal switch is sensing temperatures exceeding 140F.
D	Drive 2 can not get enough power into the reaction chamber.
E	Drive 2 is sensing a series of sudden dips in the power into the chamber indicative of unusual arching occurring somewhere in the system.
F	Drive 2 thermal switch is sensing temperatures exceeding 140F.

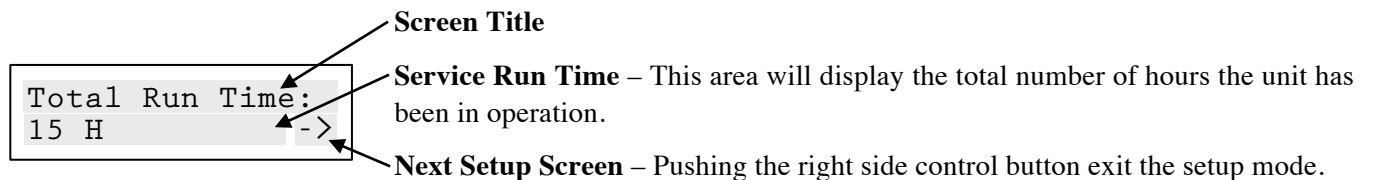
### Setup Screen 8 – Service Run Time

This screen shows the number of hours the unit has been in operation since the last service. When a complete annual service has been provided the “Service Run Time” should be reset.



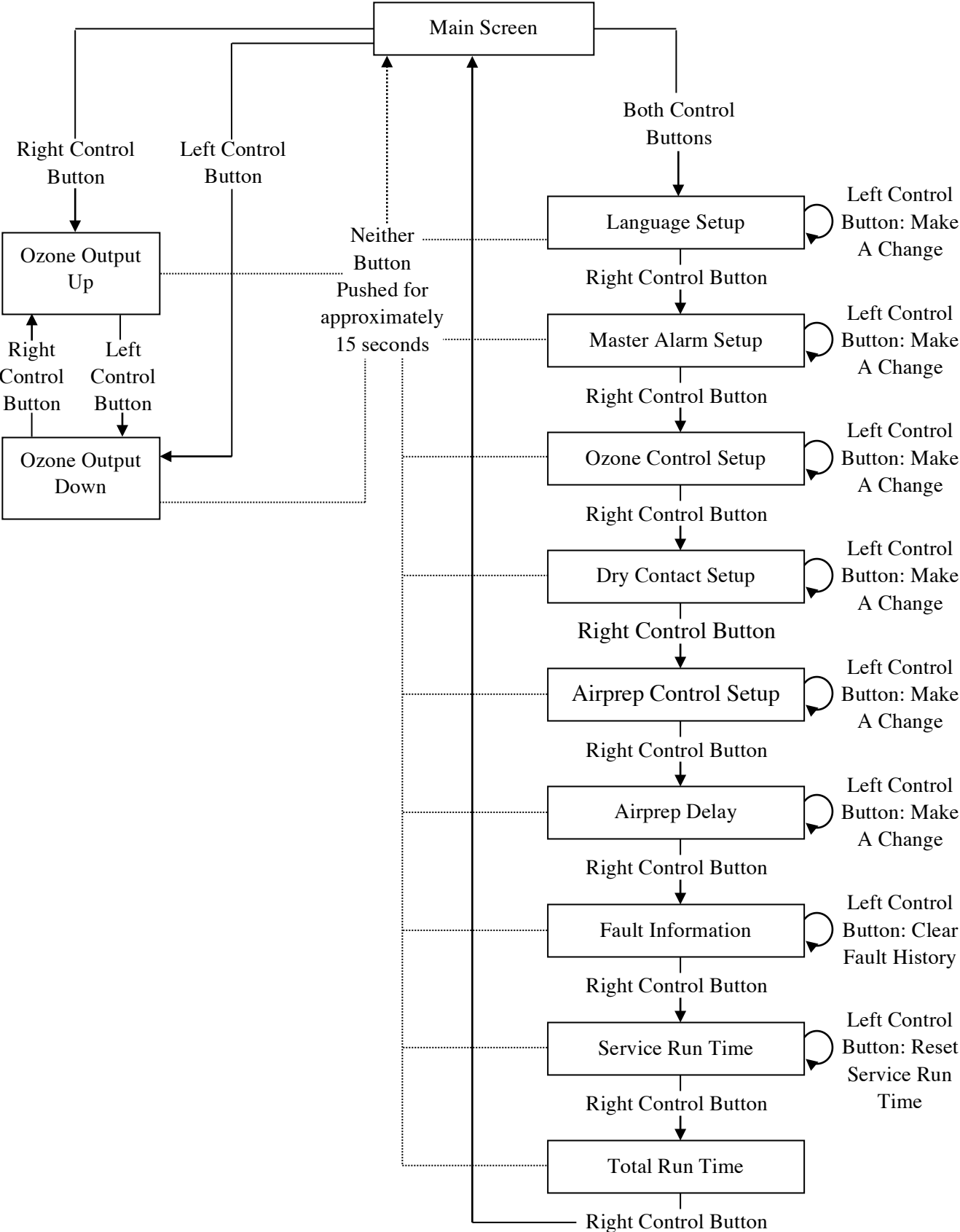
### Setup Screen 9 – Total Run Time

This screen shows the total number of hours the unit has been in operation. This hour counter can not be reset.



# Program Screen Guide

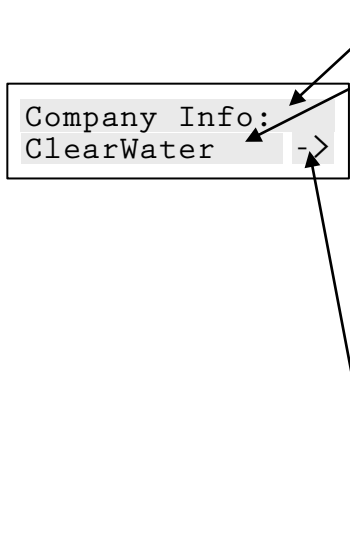
Figure 15



## Company Selection Screen

This screen will allow the company information displayed on the main screen to be modified. To access this screen, hold down the left hand control button while powering up the unit. Once an X appears on the left hand side of the display screen, release the left hand control button. Once an X appears on the right hand side of the screen push the left hand control button again. When prompted with “Please Release Buttons”, release the left hand control button.

### Setup Screen 1 – Company Selection



**Screen Title**

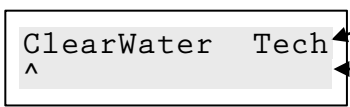
**Current Company Info** – Pushing the left side control button will cycle through the following options:

- ClearWater – With this selected, the main menu will display the ClearWater name, phone number, and web page.
- None – With this selected, the main menu will not display the company name, phone number, or web page.
- Custom – With this selected, the user can input their own company name, phone number, and web page which will then be cycled through in the main menu.

Note: The configuration that is displayed is the configuration being used by the system. To change the configuration, push the left side control button until the desired configuration is shown, then push the right side control button.

**Next Setup Screen** – Pushing the right side control button will exit this setup mode unless “Custom” is selected. If “Custom” is selected the unit will continue to the next screen allowing the user to enter the company name.

### Setup Screen 2 – Custom Company Name Input



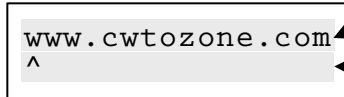
**Current Company Name (16 Characters Max)**

**Cursor** – This indicates which character is currently selected for adjustment.

Pushing the left side control button will cycle through the character options beginning with the character shown. When the cycle reaches the end of the available characters it will begin again at the beginning of the list. A blank space is one of the available characters for shorter company names.

Pushing the right side control button will move the cursor one position to the right. If the cursor is already at the right hand side of the screen, pushing the right side control button will move the user to the next screen to input the company web site.

### Setup Screen 3 – Custom Company Web Site Input



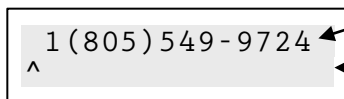
**Current Company Web Site (16 Characters Max)**

**Cursor** – This indicates which character is currently selected for adjustment.

Pushing the left side control button will cycle through the character options beginning with the character shown. When the cycle reaches the end of the available characters it will begin again at the beginning of the list.

Pushing the right side button control will move the cursor one position to the right. If the cursor is already at the right hand side of the screen, pushing the right side control button will move the user to the next screen to input the company phone number.

### Setup Screen 4 – Custom Company Phone Number Input



**Current Company Phone Number (16 Characters Max)**

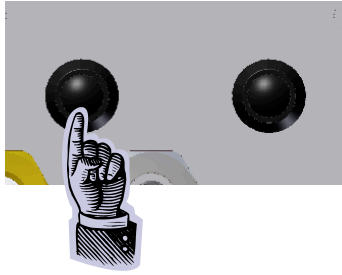
**Cursor** – This indicates which character is currently selected for adjustment.

Pushing the left side control button will cycle through the character options beginning with the character shown. When the cycle reaches the end of the available characters it will begin again at the beginning of the list.

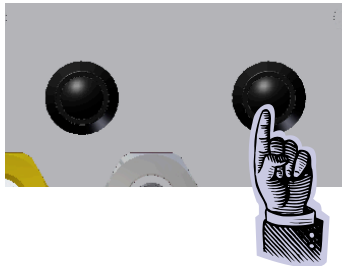
Pushing the right side control button will move the cursor one position to the right. If the cursor is already at the right hand side of the screen, pushing the right side control button will exit this setup mode.



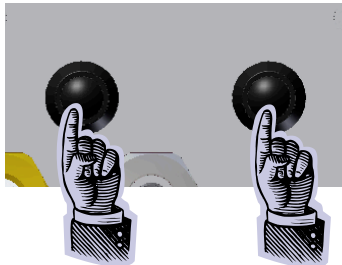
## Menu Navigation



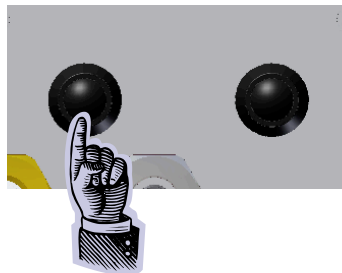
Pushing the left side control button will decrease the ozone output if the unit is under manual control



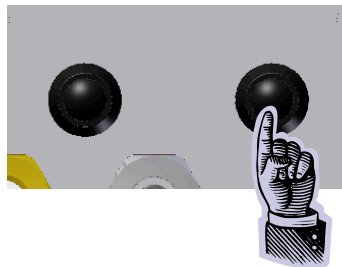
Pushing the right side control button will increase the ozone output if the unit is under manual control



Pushing both buttons (the left side control button and the right side control button) at the same time will take you to the setup screen



In the setup screen, pushing the left side control button cycle through the different options on the particular screen you are on.

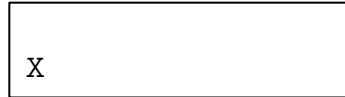
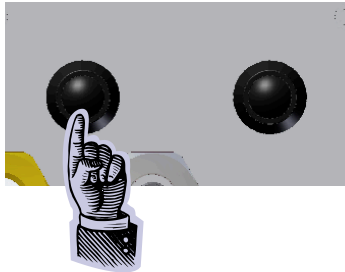


In the setup screen, pushing the right side control button will move you to the next item that can be configured

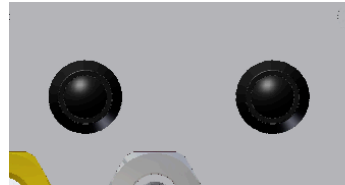
### Entering The Company Selection Screen



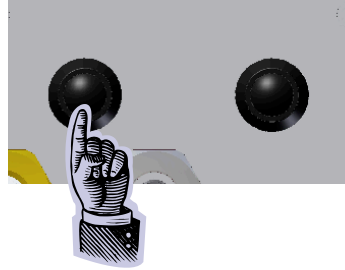
Push down the left side control button while powering up the unit.



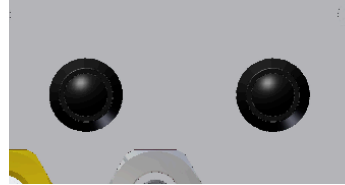
When an X appears on the left hand side, release the left side control button.



When an X appears on the right hand side, push the left side control button again.



When prompted, release the left hand an X appears on the left hand side, release the left side control button.



# Maintenance

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

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

## NOTES:

- **The ozone generator warranty states that it “does not extend to any product or part which has been damaged or rendered defective as a result of use of parts not sold by ClearWater Tech, or service or unit modification not authorized by ClearWater Tech” Please contact your ClearWater Tech dealer if you have any questions about any maintenance procedure before you begin that procedure.**
- **CAUTION:** Observe all common safety practices and review the “Safety Warnings and Instructions” section before attempting any maintenance procedure that requires the use of tools and/or shutting down the ozone system.

## Daily Procedures

### Air Preparation System

- Power Switch: Check the power switch on the air preparation system (see Figure 10), if so equipped.
- Indicator Cartridge: Inspect the air preparation system indicator cartridge. A change in the blue crystals to a light pink or white color indicates the presence of moisture in the feed gas coming from the air preparation system. If such a change is observed, refer to the Troubleshooting Guide.
- Air Flow: Check the air flow gauge on the air preparation system (see Figure 10). Make sure the air flow is within the acceptable SCFH range for the unit at 10psi. See the Ozone Output Chart in Figure 12 to convert CFH at 10psi to SCFH. **Warning: Make sure to read and follow the operating instructions of the air preparation system as damage could occur to the air preparation system if the flow rate is too high.**

### Ozone Generator

- Information Display: Take a look at the information display to verify the system is “Normal” and has no problems. Check the ozone level to make sure it remains at the correct set point, if a 4-20mA remote control signal is being used, make sure the information display indicates it is under “Remote” control. See the “Ozone Generator Program Setup” section for additional information related to the messages that will appear on the screen and their description.
- Air Flow: Check the air flow gauge located on the front control panel. Compare the CFH flow on the flow gauge to the Ozone Output Chart in Figure 12 or the Pneumatic Operating Parameter in Figure 13 to insure the proper output is being achieved. **Warning: Make sure to read and follow the operating instructions of the air preparation system as damage could occur to the air preparation system if the flow rate is too high**
- Pressure: Check the PSI gauge located on the front control panel. Make sure pressure is within the range shown on control panel. Adjust if necessary by following steps outlined in the “Start-Up & Calibration” section.

### Vacuum Break

- **Water Level:** Check the water level in the vacuum break. Make sure it is above the flapper valve in the overflow tube. Fill as required by removing the threaded fitting on top of the riser tube until water is up to the 'Fill Level' in the overflow tube (see Figure 11).

### Injection Manifold

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

## Monthly Procedures

### Air Preparation System

- **Cooling Fan Operation:** Check to make sure the cooling fan mounted on the side panel of the air preparation system is operating (if so equipped). If not, refer to the Troubleshooting Guide.
- **Cover Filter:** Check the cover filter element mounted on the side of the air preparation system 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.

### Ozone Generator

- **Drive Module Operation:** The Drive Module is made up of two components: the drive board and the drive transformer. With the ozone generator cover removed, check for illumination of the drive module "Ozone Output" LED(s) (for LED locations, see Figure 16); if not illuminated see Troubleshooting Guide. This procedure is to observe the complete operating function of the drive module(s). First use the control buttons (see Appendix A) to enter the setup menu and check the Fault Information. See the "Ozone Generator Program Setup" section for assistance in navigating the menu system and for a description of the Fault Information provided. Before continuing to checking the drive module function, remove the ozone generator cover. **CAUTION: The ozone generator will remain energized with the cover removed. Do not touch anything inside the ozone generator while the system is energized and the cover removed! Please consult your ClearWater Tech dealer before attempting this procedure.**
  - **Main Power LED:** When illuminated, this "Green" LED indicates that main power is supplied to the drive module up to the "on board" fuse of the drive board.
  - **Transformer Power LED:** When illuminated, this "Green" LED indicates that 48V Buss power is available to the drive module transformer (XFMR) from the "on board" fuse of the to the drive transformer.
  - **Ozone Output LED:** The "Amber" ozone output LED will illuminate when ozone drive is being generated. The LED will also pulse as the output increases or decreases with either the 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 LED:** When illuminated, this "Red" LED indicates that there is a fault with the drive module or the Ozone Reaction Chamber. If this LED is illuminated, refer to the Troubleshooting Guide. **Notes: If the drive module goes to a fault condition, the drive board will restart every 15 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. Before proceeding further replace the ozone generator cover.**
- **Cooling Fan Operation:** Check to make sure the two cooling fans (mounted on the bottom panel of the ozone generator cabinet) are operating. If not, refer to the Troubleshooting Guide.

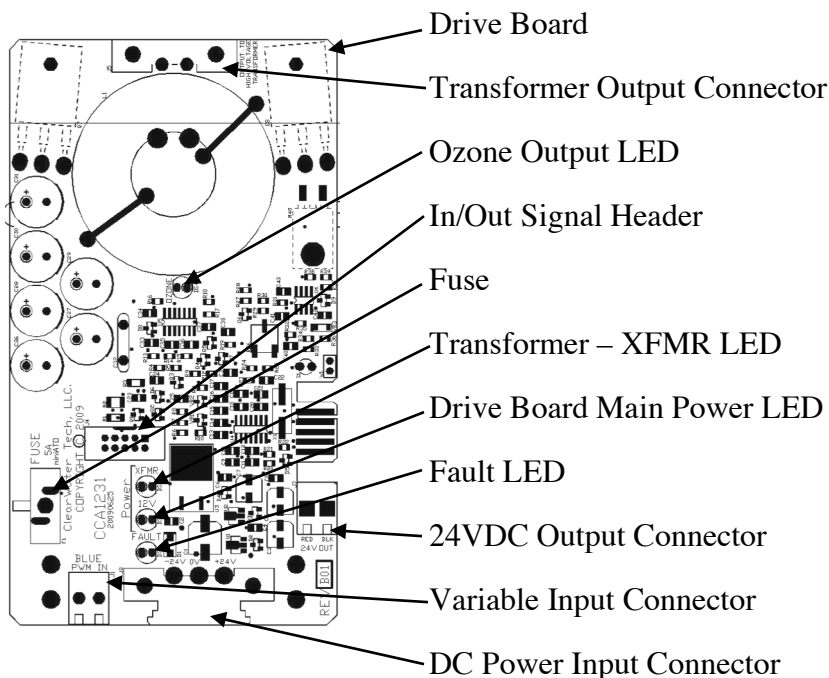
- Cooling Fan Filters: Check the cooling fan filter elements mounted on the bottom of the ozone generator (see Appendix A) and clean as required. Operating conditions in the equipment area will dictate the frequency required for this procedure. Remove the filter element and clean with soap and water, drying them completely before re-installing (see Figure 17).

Booster Pump(s)

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

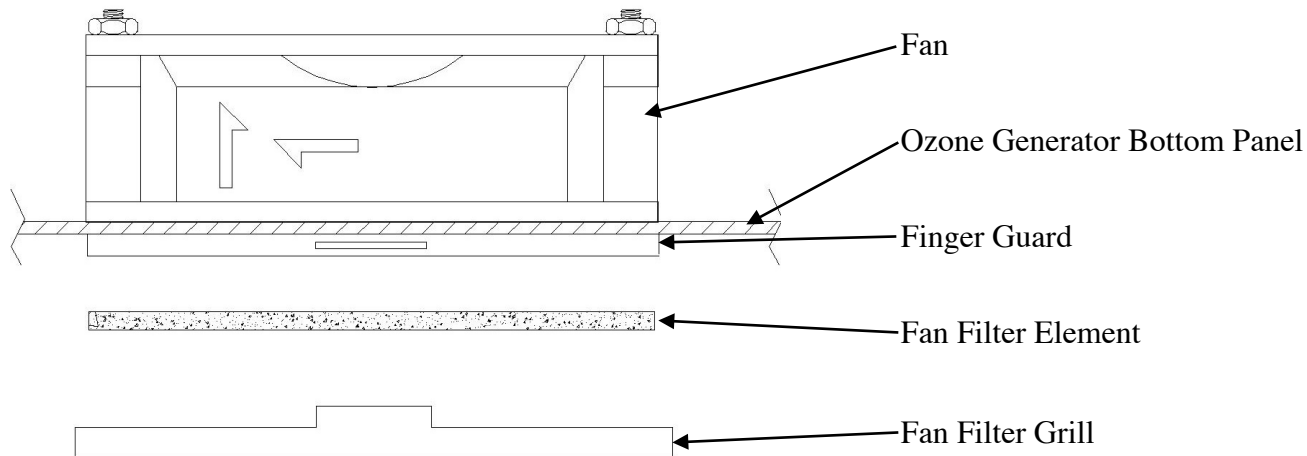
**CD15nx and CD30nx High Output Drive Module**

Figure 16



**Ozone Generator Cooling Fan Assembly**

Figure 17



## System Shutdown Procedures

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

**Step 1:** Turn off power to any peripheral system hydraulic components and air prep system.

**Step 2:** Turn the Main Power switch on the ozone generator to the “OFF” position. The Ozone Generator Information screen should not be illuminated.

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

## Semi-Annual Procedures

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

### Air Preparation System

- Air Inlet Filter: Replace the air compressor inlet filter on the air preparation system module (see Figure 10). **Note: Manufacturers' recommended replacement interval is 4,000 hours of operation. Operating conditions in the equipment area will dictate the required frequency of this procedure.**

## Annual Procedures

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

### Air Preparation System

- Compressors: Following the procedures outlined in the compressor rebuild kit, rebuild the two compressor heads on each air preparation system module (see Figure 10). **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.
- Inline Filter: Replace the inline particulate filter.
- Reaction Chambers: Remove and disassemble the reaction chamber(s) according to the steps outlined below (see Figure 18). Check the chamber interior and dielectric tube for oil, dirt or moisture. **Note: CWT pressurized reaction chambers are anodized blue.**

### Reaction Chamber Removal and Disassembly

**Note: Read through all the steps before disassembling the reaction chamber.**

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

**Step 2.** Disconnect the white high voltage lead from the drive module transformer, the insulation boot will have to be drawn back to expose the connection.

**Step 3.** Disconnect wire connections to drive module. The drive module may be removed or remain attached to the reaction chamber during the rebuild process.

**Step 4.** Disconnect the tubing connections on both ends of the reaction chamber.

**Step 5.** Remove the 4 nuts securing each chamber and remove the reaction chamber from ozone generator.

**Step 6.** Remove retaining screws and washers from the end caps (4 each).

**Step 7.** Using a gentle back-and-forth twisting motion, remove the non-high voltage end cap (the one without the high voltage attachment screw) from the heat sink/cathode assembly. A flat-head screwdriver may be

used to gently pry the end cap off, as long as equal pressure is applied to each side of the end cap. Note: The stainless steel straps should not be removed.

- Step 8.** Remove the high voltage end cap and dielectric from the heat sink/cathode assembly.
- Step 9.** Draw back the white cap along the white high voltage lead at the end cap, this will expose a screw to be removed. Pull/twist the end cap off the glass. Push the contact brush out of the dielectric glass. Also remove the anode (foil-like material) from within the glass, it may come out with the brush.
- Step 10.** Inspect the dielectric, foil, end caps and cathode for breakage, corrosion or debris; then follow the assembly and re-installation steps below.

#### Assembly and Re-installation

- Step 1.** Remove o-rings from end caps, then clean the dielectric glass, end caps and interior of the stainless steel cathode cylinder. Use denatured alcohol and shop towels to clean and be sure to remove all old o-ring debris. A 2" ball hone can be used to clean the major debris out of the cathode if there is heavy buildup. **Note: If the brush's core is intact, but discolored, it is likely fine. The anode foil may also have been discolored from residual oil and heat; it will not require replacement. If there are ragged ends on the foil, trim them off (1/8"-1/4") with a pair of scissors.**

- Step 2.** Prepare the end caps for re-assembly by replacing the o-rings and replacing the Viton washers installed under the elbow fittings.

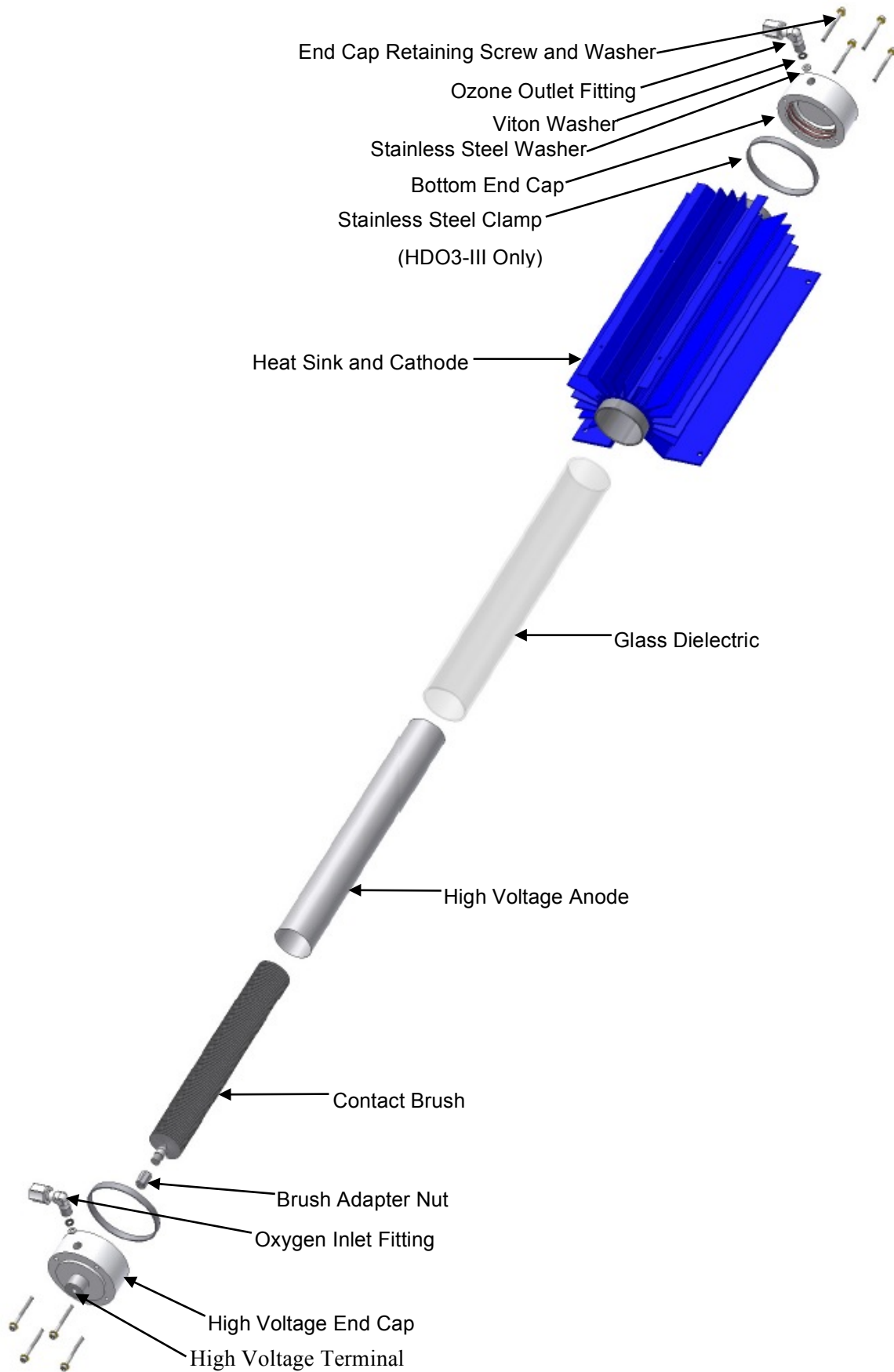
#### Notes:

- A small amount of dielectric silicon lubricant can be used on the o-rings, cathode and/or dielectric glass to make installation easier.
- When replacing washers under the elbow fittings, the stainless steel washer is installed first, then the Viton washer. Re-tape the elbow fittings. The stainless steel elbow fitting is used on the non-high voltage (bottom) end cap.
- Attach the high voltage lead to the screw and install it onto the high voltage end cap. Thread the hex brush adapter nut, with contact brush attached, onto the interior of the high voltage end cap.

- 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. Turn the end cap to the correct orientation.
- Step 4.** Slide the four 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.** Next we focus on assembling the rest of the subcomponents before installing them into the reaction chamber. Roll and insert the anode foil into the glass dielectric, center the anode foil in the glass. Secure the foil with a finger against the inside of the glass to keep it centered and insert the contact brush into the dielectric. Insure the foil is centered before fully seating the glass into the high voltage end cap. Clean the glass with denatured alcohol once more, and do not retouch the glass without re-cleaning.
- Step 6.** Hold the reaction chamber upright on a flat surface, empty side up. Grasp the high voltage end cap and lower the glass into the reaction chamber. Press directly downwards on the high voltage end cap to fully seat the dielectric assembly; the end caps should be flush with the heat sink cooling fins. Turn the end cap to the correct orientation.
- Step 7.** Slide the four 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 the complete reaction chamber assembly into the ozone generator by securing the reaction chamber to its mounts, securing delivery line and connecting the high voltage insulated wire. If the drive module was removed, reinstall it. Reconnect drive board wire connections.

## 2" Pressurized Reaction Chamber – Exploded View

Figure 18





#### Vacuum Break

- **Cleaning:** Disconnect ozone delivery lines. Remove the vacuum break from mounting clamps. Disconnect the overflow tube from flapper valve, open flapper and clean the seat with a soft cloth. Remove riser tube threaded fitting and flush riser tube with water. Re-assemble and re-install vacuum break, making sure to add water to correct level (see Figure 11).

#### Injector Manifold

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

#### Contact Vessel

- **Cleaning:** Contact Column only. Inspect the diffuser slots at the top of the contact column riser tube. If they are clear, no further maintenance is required. If the slots are fouled, disassemble the column and clean as required, following the steps outlined below (see Figure 5).

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

**Step 2:** Disconnect the vent line from the top of the contact column.

**Step 3:** Remove the bolts in the 6" base flange.

**Step 4:** Remove the column, lifting it over the interior riser tube.

**Step 5:** Remove and clean the diffuser.

**Step 6:** Inspect the flange gasket and replace if necessary.

**Step 7:** Reassemble the contact column and attach vent lines.

# Troubleshooting

## Air Preparation

<b>Problem/Symptom</b>	<b>Possible Cause</b>	<b>Solution</b>
Unit not operating	<ul style="list-style-type: none"> <li>• No power to system</li> <li>• Power switch in “OFF” position</li> <li>• Incorrect wiring</li> </ul>	<ul style="list-style-type: none"> <li>• Check main power to system</li> <li>• Turn switch to “ON” position</li> <li>• See “Installation Procedures – Electrical”</li> </ul>
Low air flow or no air flow	<ul style="list-style-type: none"> <li>• Flow meter out of adjustment</li> <li>• Fouled compressor inlet filter</li> <li>• Compressor not functioning</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust flow meter, see “Start-Up and Calibration – Step 5”</li> <li>• Replace inlet filter</li> <li>• Rebuild or replace as required</li> </ul>
Compressor pressure relief valve making noise	<ul style="list-style-type: none"> <li>• Pressure relief valve not operating</li> <li>• Excessive back pressure in system</li> <li>• Pinched tubing</li> <li>• Compressor not functioning</li> <li>• ATF not operating</li> </ul>	<ul style="list-style-type: none"> <li>• Replace pressure relief valve</li> <li>• Check the check valve for proper operation, replace as required</li> <li>• Replace tubing</li> <li>• Rebuild or replace as required</li> <li>• Repair or replace ATF as required</li> </ul>
Unit is making excessive noises	<ul style="list-style-type: none"> <li>• Unit not properly secured to floor</li> <li>• Shipping damage</li> <li>• Fan Blocked</li> <li>• Packaging material not removed</li> </ul>	<ul style="list-style-type: none"> <li>• Place unit on a flat level surface</li> <li>• Locate damage and repair/replace parts</li> <li>• Clear obstructions</li> <li>• Remove packaging material</li> </ul>

## Ozone Generator

<b>Problem/Symptom</b>	<b>Possible Cause</b>	<b>Solution</b>
Information Display not illuminating or system is not “ON”	<ul style="list-style-type: none"> <li>• No power to unit</li> <li>• Power switch in “OFF” position</li> <li>• Blown Fuse</li> <li>• Incorrect wiring</li> </ul>	<ul style="list-style-type: none"> <li>• Check main power to system</li> <li>• Turn switch to “ON” position</li> <li>• Replace fuse</li> <li>• See “Installation Procedures – Electrical”</li> </ul>
Circuit breaker trips	<ul style="list-style-type: none"> <li>• Incorrect wiring</li> <li>• Circuit breaker amperage does not match draw</li> <li>• Unit flooded with water</li> </ul>	<ul style="list-style-type: none"> <li>• See “Installation Procedures – Electrical”</li> <li>• Replace with correct circuit breaker</li> <li>• Asses damage, correct cause and rebuild as required</li> </ul>
Receive an electric shock upon touching the unit	<ul style="list-style-type: none"> <li>• Incorrect wiring</li> <li>• Unit not grounded</li> <li>• Unit flooded with water</li> </ul>	<ul style="list-style-type: none"> <li>• See “Installation Procedures – Electrical”</li> <li>• Ground unit according to local codes</li> <li>• Asses damage, correct cause and rebuild as required</li> </ul>

**Ozone Generator - Continued**

<b>Problem/Symptom</b>	<b>Possible Cause</b>	<b>Solution</b>
Drive Board Power Problem Information Display indicates: System Problem – Board1 12V or System Problem – Board1 48V	<ul style="list-style-type: none"> <li>No power to the left hand side drive module from power supply</li> <li>Loose wires or connectors</li> <li>Blown drive module “on board” fuse</li> </ul>	<ul style="list-style-type: none"> <li>Check main power to unit</li> <li>Test voltage from power supply to drive module (see “Appendix E – Drive Module Input Voltages”)</li> <li>Check for loose wires or connectors</li> <li>Replace “on board” fuse</li> </ul>
Drive Board Power Problem Information Display indicates: System Problem – Board2 12V or System Problem – Board2 48V	<ul style="list-style-type: none"> <li>No power to the left hand side drive module from power supply</li> <li>Loose wires or connectors</li> <li>Blown drive module “on board” fuse</li> </ul>	<ul style="list-style-type: none"> <li>Check main power to unit</li> <li>Test voltage from power supply to drive module (see “Appendix E – Drive Module Input Voltages”)</li> <li>Check for loose wires or connectors</li> <li>Replace “on board” fuse</li> </ul>
Information Display indicates 0% ozone output	<ul style="list-style-type: none"> <li>Unit is under the control of a remote 4-20mA current signal</li> <li>Manual Ozone Output is turned down to 0%</li> <li>Low pressure into the ozone generator</li> <li>Low vacuum out of the ozone generator</li> <li>Loose wires or connectors</li> <li>Drive board in “Fault” mode</li> </ul>	<ul style="list-style-type: none"> <li>Check the remote signal</li> <li>Disconnect the remote signal</li> <li>Turn up the manual ozone output control by pressing the right hand button. See “Ozone Generator Program Setup – Output Screen”</li> <li>Check air preparation system, make sure the needle on the pressure gauge is in the green zone.</li> <li>Check the line from the ozone generator to the venturi.</li> <li>Tighten fittings</li> <li>Adjust injector see “Start-Up and Calibration – Steps 1-4”</li> <li>See Troubleshooting, “Drive Board Power Problem” above</li> <li>See Troubleshooting, “System Fault” below</li> </ul>
The information display does not indicate “Remote” control when a 4-20mA control signal is connected	<ul style="list-style-type: none"> <li>Unit is configured to ignore the remote 4-20mA signal</li> <li>The 4-20mA signal is not being sensed correctly</li> </ul>	<ul style="list-style-type: none"> <li>See “Ozone Generator Program Setup – Setup Screen 3”</li> <li>Check for loose wires or connections</li> <li>See “Installation Procedures – Electrical”</li> </ul>
System Fault A or D The drive board can not get enough power into the reaction chamber.	<ul style="list-style-type: none"> <li>Loose wire harness connection from the drive board to the drive transformer</li> <li>Drive board incorrectly characterized the system on startup</li> <li>Loose or disconnected High Voltage Lead to transformer</li> <li>Excessive dirt or debris in ozone reaction chamber</li> <li>Water in ozone reaction chamber</li> <li>Broken dielectric</li> <li>Failed drive board</li> <li>Failed drive transformer</li> </ul>	<ul style="list-style-type: none"> <li>Check all wires and connectors</li> <li>With pressure and flow at normal operating conditions, restart the ozone generator.</li> <li>Attach High Voltage Lead to transformer</li> <li>Clean the dielectric and replace O-rings</li> <li>Clean the dielectric and replace O-rings</li> <li>Replace dielectric</li> <li>Replace drive board</li> <li>Replace drive transformer</li> </ul>

## Ozone Generator - Continued

<b>Problem/Symptom</b>	<b>Possible Cause</b>	<b>Solution</b>
System Fault B or E The drive board's feedback had a series of sudden dips indicative of unusual arcing occurring somewhere in the system.	<ul style="list-style-type: none"> <li>Loose wire harness connection from the drive board to the drive transformer</li> <li>Loose or disconnected High Voltage Lead to transformer</li> <li>Excessive dirt or debris in ozone reaction chamber</li> <li>Water in ozone reaction chamber</li> <li>Broken dielectric</li> <li>Failed drive board</li> <li>Failed drive transformer</li> </ul>	<ul style="list-style-type: none"> <li>Check all wires and connectors</li> <li>Attach High Voltage Lead to transformer</li> <li>Clean the dielectric and replace O-rings</li> <li>Clean the dielectric and replace O-rings</li> <li>Replace dielectric</li> <li>Replace drive board</li> <li>Replace drive transformer</li> </ul>
System Fault C or F The thermal switch on the board has closed indicating that it was exposed to temperatures exceeding 140F.	<ul style="list-style-type: none"> <li>Unit is overheating</li> </ul>	<ul style="list-style-type: none"> <li>Check fan for proper operation and clean fan filter</li> <li>Check operating temperature</li> <li>See "Installation Procedures – Getting Started, Equipment Placement"</li> </ul>
Fan not operating	<ul style="list-style-type: none"> <li>Fan obstructed</li> <li>Power supplies not operating</li> <li>Fan inoperable</li> </ul>	<ul style="list-style-type: none"> <li>Remove obstruction</li> <li>Check main power, check fuses, repair and replace as required</li> <li>Replace fan</li> </ul>
Low air flow or no air flow	<ul style="list-style-type: none"> <li>Air preparation system not operating properly</li> <li>Air preparation system being powered from ozone unit</li> <li>Fouled inline filter</li> <li>Air leak</li> <li>Incorrect wiring to air prep system</li> </ul>	<ul style="list-style-type: none"> <li>See "Start Up and Calibration – Step 5"</li> <li>See "Ozone Generator Program Setup – Setup Screen 5"</li> <li>Change inline filter</li> <li>Check all fittings, tighten as needed</li> <li>See "Installation Procedures – Electrical"</li> </ul>
Unit flooded with water	<ul style="list-style-type: none"> <li>Defective check valve</li> <li>Vacuum break incorrectly setup</li> <li>Defective vacuum break</li> </ul>	<ul style="list-style-type: none"> <li>Replace check valve(s)</li> <li>See "Installation Procedures – Pneumatic, Hook-Ups"</li> <li>Replace vacuum break</li> <li>Assess damage, repair as required</li> </ul>
Ozone smell detected in or around ozone generator	<ul style="list-style-type: none"> <li>Insufficient vacuum at venturi</li> <li>Loose internal fittings</li> <li>Defective O-ring seals in reaction chamber(s)</li> <li>Defective dielectrics</li> </ul>	<ul style="list-style-type: none"> <li>Adjust injector see "Start-Up and Calibration – Steps 1-4"</li> <li>Check all fittings, tighten as needed</li> <li>Check and replace as required</li> <li>Check and replace as required</li> </ul>

## Ozone Injection/Contacting

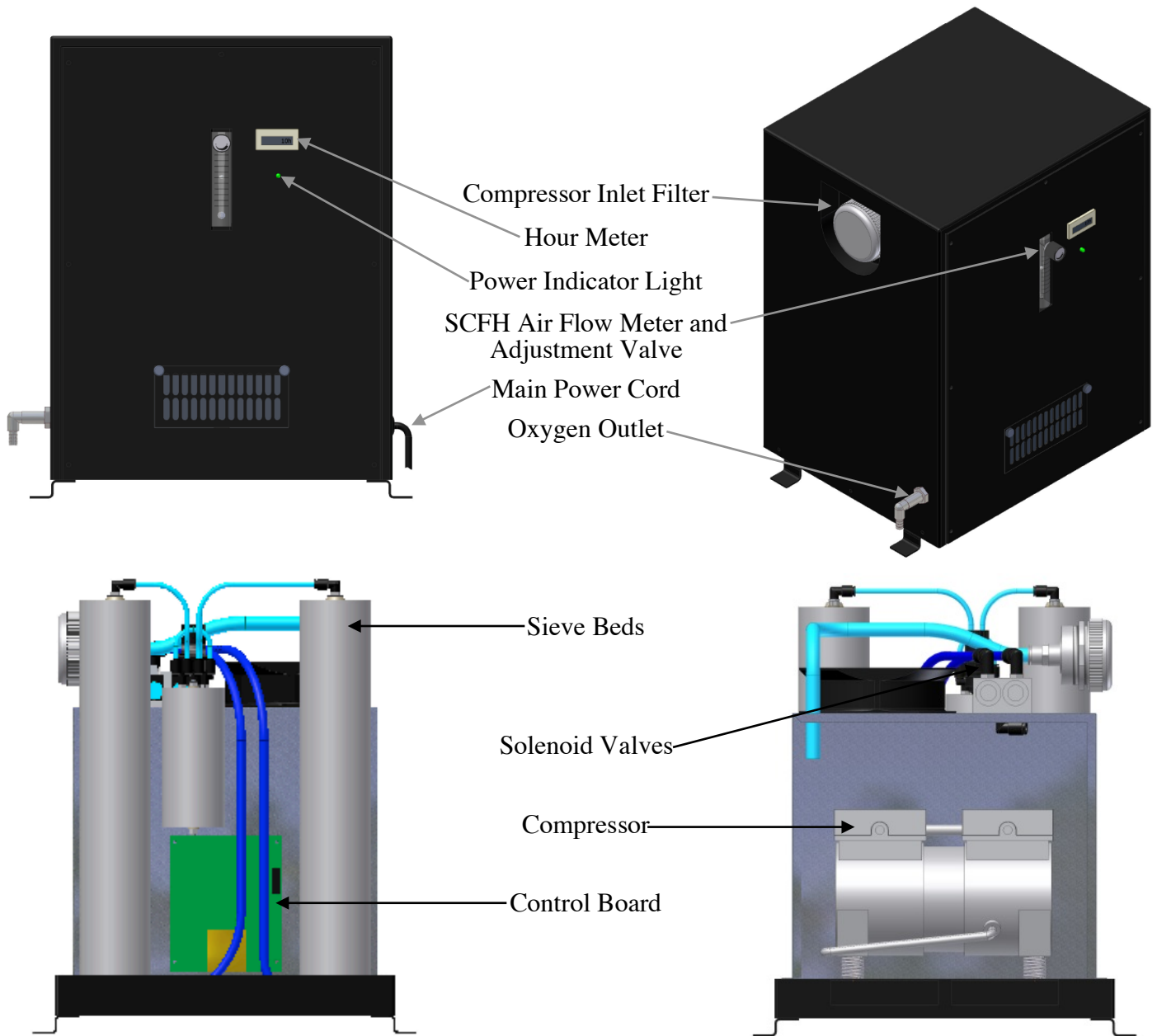
<b>Problem/Symptom</b>	<b>Possible Cause</b>	<b>Solution</b>
Water backflow past injector check valve	<ul style="list-style-type: none"> <li>Defective check valve</li> </ul>	<ul style="list-style-type: none"> <li>Replace check valve</li> </ul>
Water bubbling in vacuum break	<ul style="list-style-type: none"> <li>No vacuum</li> <li>Debris on seat of vacuum break flapper valve</li> </ul>	<ul style="list-style-type: none"> <li>See "Start-Up and Calibration"</li> <li>Clean seat of flapper. See "Maintenance Procedures – Annual"</li> </ul>

**Ozone Injection/Contacting – Continued**

<b>Problem/Symptom</b>	<b>Possible Cause</b>	<b>Solution</b>
Low Vacuum	<ul style="list-style-type: none"> <li>• Hydraulics/Pneumatics out of adjustment</li> <li>• Defective check valve</li> <li>• Hydraulic back pressure</li>   <li>• Defective solenoid valve</li> <li>• No water in vacuum break</li>   <li>• Booster pump not functioning properly</li> </ul>	<ul style="list-style-type: none"> <li>• See “Start-Up and Calibration – Steps 1-4”</li> <li>• Replace check valve</li> <li>• Back wash filter (if so equipped)</li> <li>• Check for obstruction in venturi</li> <li>• Rebuild or replace as required</li> <li>• Fill vacuum break with water. See “Start-Up and Calibration – Vacuum Break”</li> <li>• Check booster pump (contact dealer)</li> </ul>
High Vacuum	<ul style="list-style-type: none"> <li>• Hydraulics/Pneumatics out of adjustment</li> <li>• Change in hydraulics – excessive water flow through ozone injector</li> </ul>	<ul style="list-style-type: none"> <li>• See “Start-Up and Calibration – Steps 1-4”</li> <li>• See “Start-Up and Calibration – Steps 1-4”</li> </ul>
Ozone smell detected in or around vacuum break or ozone injector	<ul style="list-style-type: none"> <li>• No vacuum</li>   <li>• Loose fittings</li> <li>• Broken fittings</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust injector see “Start-Up and Calibration – Steps 1-4”</li> <li>• Check all fittings, tighten as needed</li> <li>• Check and replace as required</li> </ul>

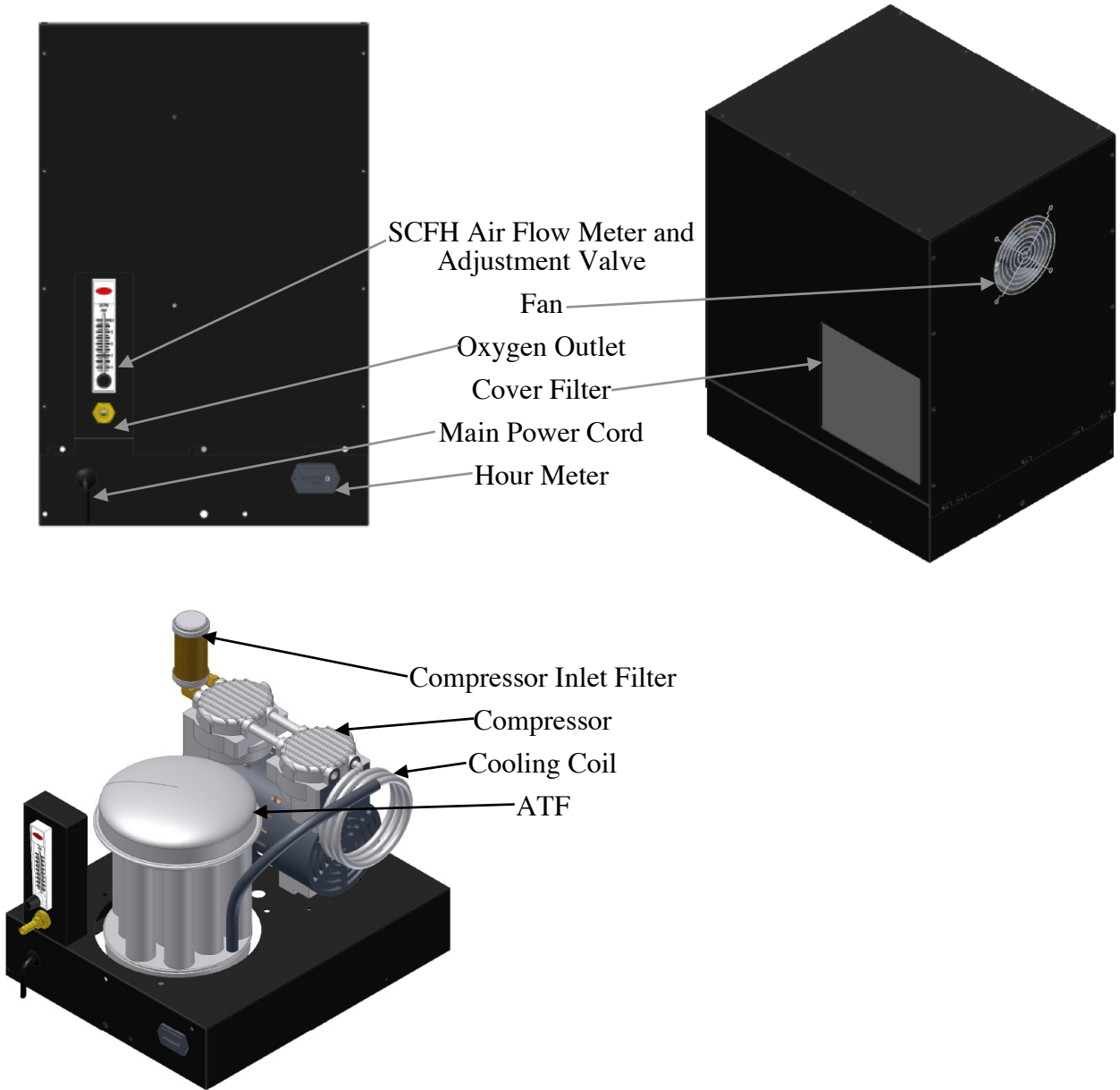
# Appendix A – Specifications

## Air Preparation System (Aerous 15 Shown)



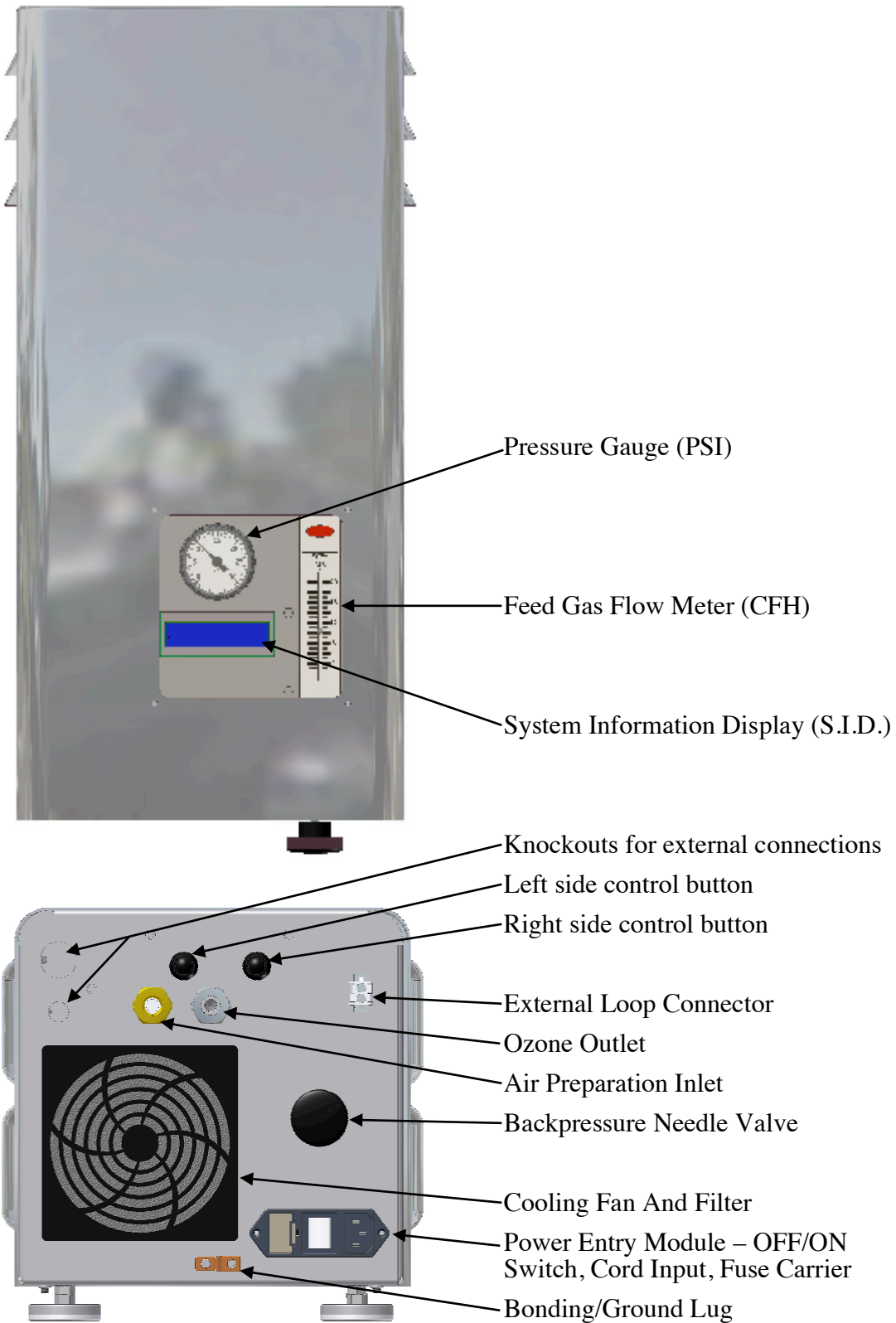
Air Prep System	Specifications	Oxygen Output/SCFH
Aerous 8	19.75" H x 11.89" W x 13.75" D 68 lbs (with cover)	90% (+/-3%) @ 8 SCFH, 10 PSI
Aerous 15	20.50" H x 12.64" W x 15.10" D 75 lbs (with cover)	90% (+/-3%) @ 15 SCFH, 10 PSI

**Air Preparation System (Workhorse 12C Shown)**



Air Prep System	Specifications	Oxygen Output/SCFH
OXS80 (Workhorse 8C)	15.5" H x 17" W x 16" D 45 lbs (with cover)	90% (+/-3%) @ 8 SCFH

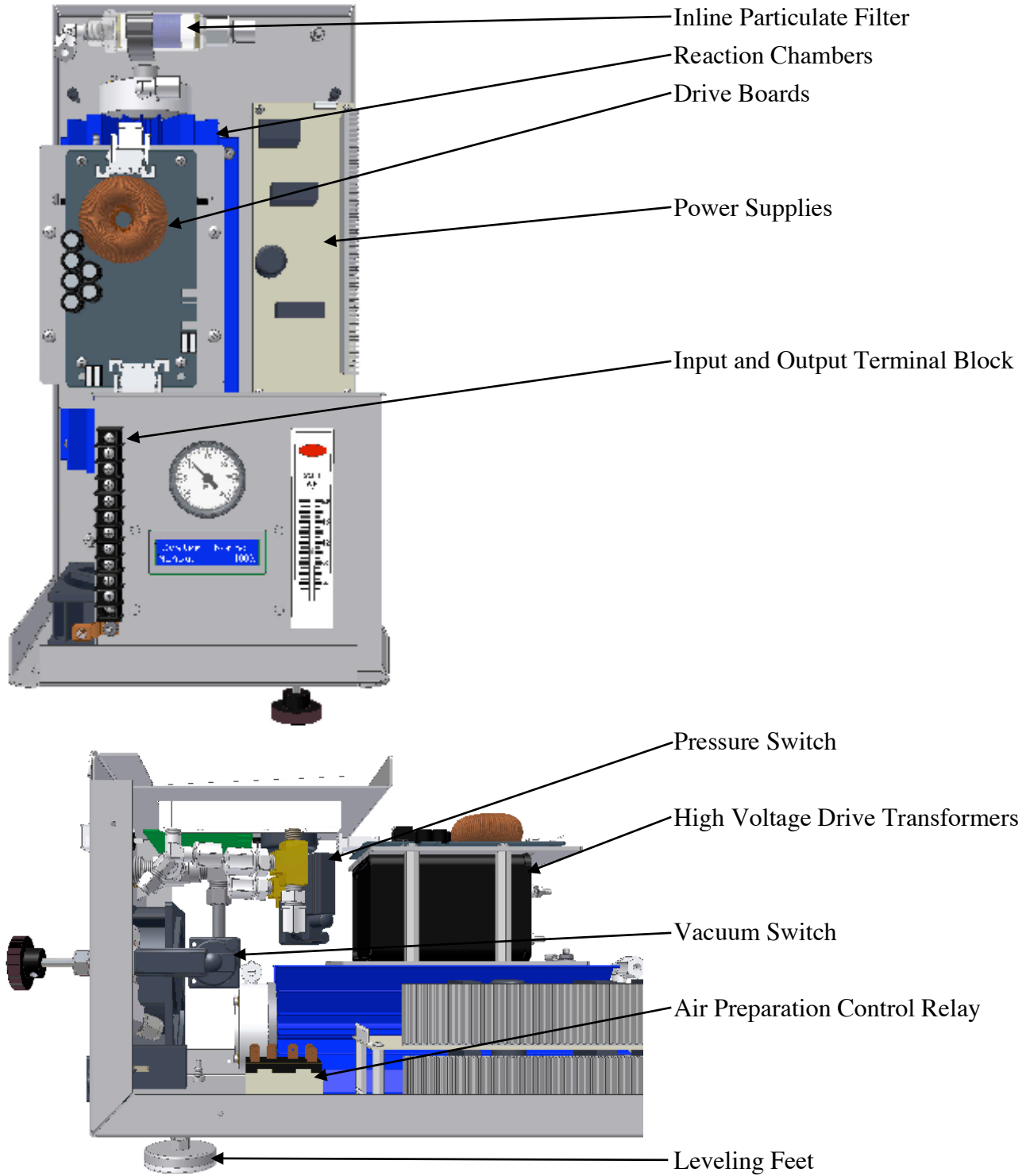
**CD15nx – Ozone Generator**



Shown: ClearWater Tech CD15nx Ozone Generator



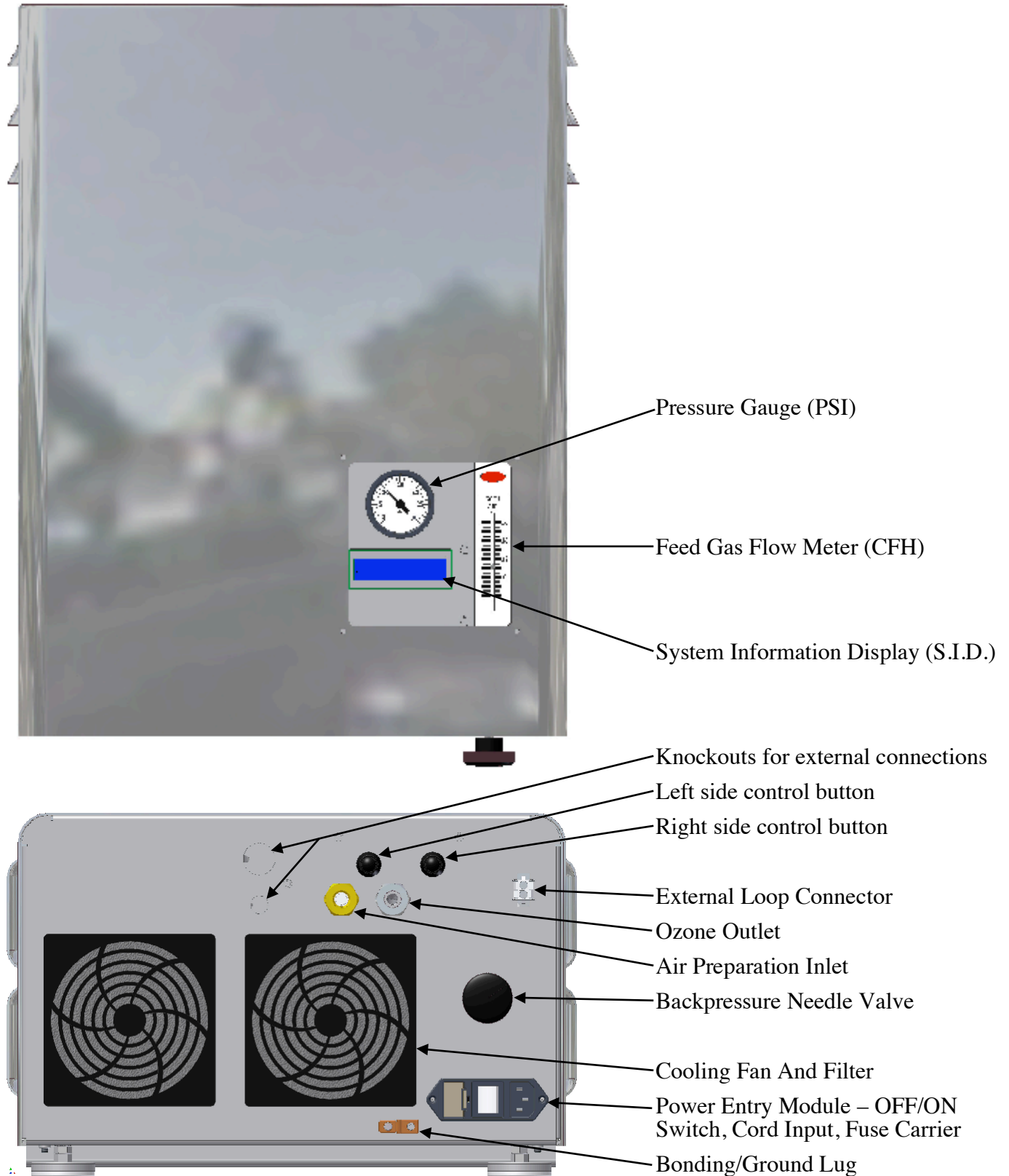
**CD15nx – Ozone Generator**



Shown: ClearWater Tech CD15nx Ozone Generator

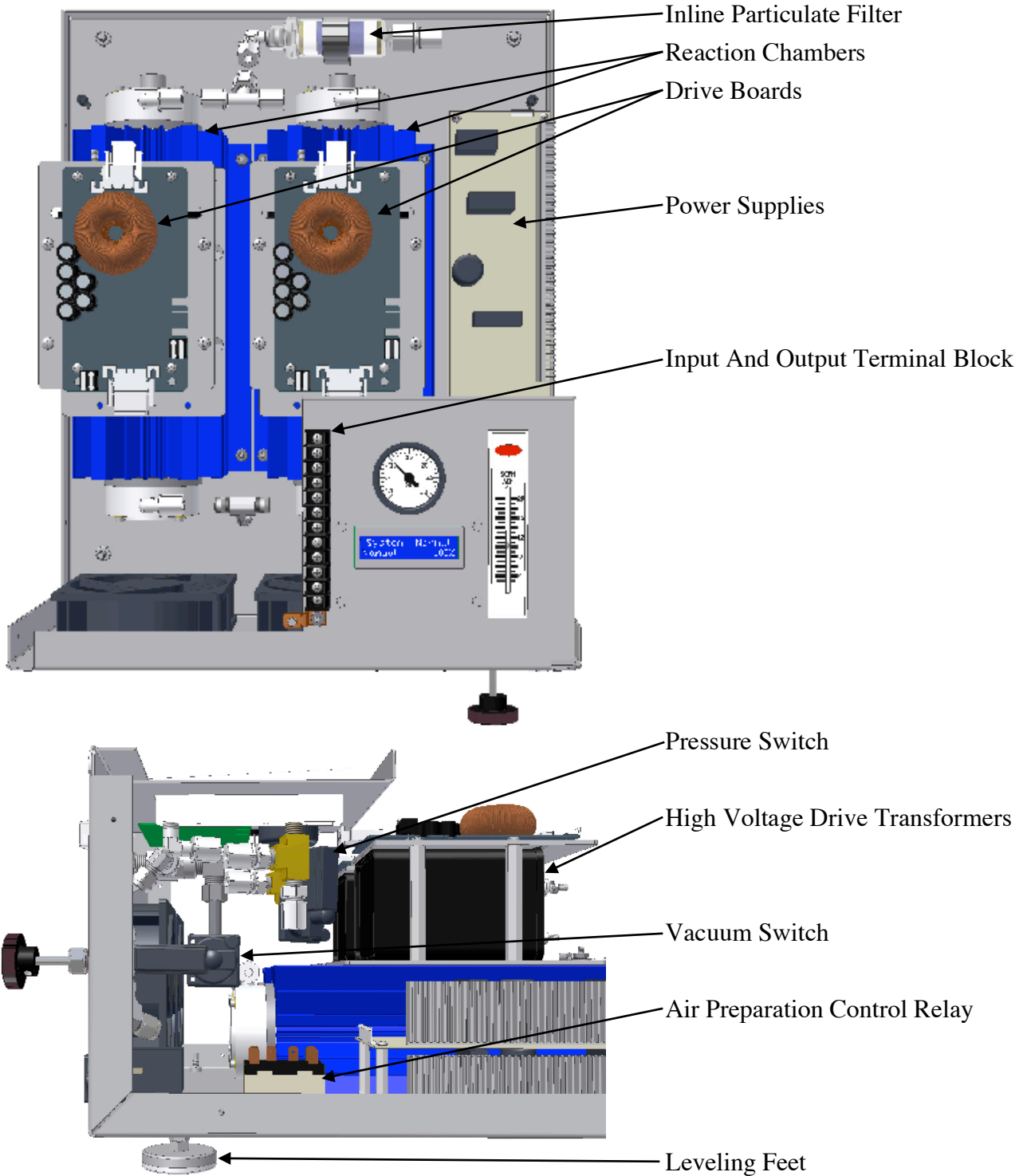
Ozone Generator	Specifications	Ozone Output/SCFH
CD15nx	21" h x 10.2" w x 9.8" d, 28 lbs	15g/h, 5.5% @ 7 scfh, 10PSI PSA Oxygen
Mounting	Z Bar	

### CD30nx – Ozone Generator



Shown: ClearWater Tech CD30nx Ozone Generator

**CD30nx – Ozone Generator**



Shown: ClearWater Tech CD30nx Ozone Generator

Ozone Generator	Specifications	Ozone Output/SCFH
CD30nx	21" h x 15.8" w x 9.8" d, 39 lbs	30g/h, 5.5% @ 14 scfh, 10PSI PSA Oxygen
Mounting	Z Bar	

# Appendix B – Parts List

## Air Preparation System

<b>OXS90 Replacement Parts</b>	
<b>Description</b>	<b>Part Number</b>
Compressor Inlet Filter	OXS350
Compressor Rebuild Kit	OXS356
Pressure Relief Valve	OXS361
Compressor Vibration Mount	OXS365
Indicating Desiccant Refill (if so equipped)	DES16

## Air Preparation System

<b>Aerous Replacement Parts</b>	
<b>Description</b>	<b>Part Number</b>
Rebuild Kit – Aerous 8 – Sieve Beds and Solenoid Valve	ASP71A
Rebuild Kit – Aerous 15 – Sieve Beds and Solenoid Valve	ASP76A
Enclosure Filter - Aerous 8	OXS350
Enclosure Filter - Aerous 15	OXU351
Inlet Filter Package - Aerous 8 & 15	OXU371
Sieve Bed (Single) – Aerous 8	OXU375
Sieve Bed (Single) – Aerous 15	OXU381
Silencer – Aerous 8 & 15	OXU382
Solenoid Valve Assembly - Aerous 8 & 15	OXU379
Compressor – Aerous 8 120V 60Hz	OXU373
Compressor – Aerous 8 220/240V 50/60Hz	OXU374
Compressor – Aerous 15 120V 60Hz	OXU340
Compressor – Aerous 15 220/240V 50/60Hz	OXU345
Pressure Regulator – Aerous 8 & 15	OXU380
Output Storage Tank – Aerous 8 & 15	OXU384
Control Board – Aerous 8 120V 60Hz	OXU372
Control Board – Aerous 8 220/240V 50/60Hz	OXU386
Control Board – Aerous 15 120V 60Hz	OXU377
Control Board – Aerous 15 220/240V 50/60Hz	OXU378

**Ozone Generator**

<b>CD15nx and CD30nx Replacement Parts</b>	
<b>Description</b>	<b>Part Number</b>
Reaction Chamber – Complete	RCC10
Dielectric Anode 2”	RCC71SA
Non High Voltage End Cap	RCC115
High Voltage End Cap	RCC110
O-ring Set	ORS40
Drive Module Transformer	HVT275SA
Drive Module Board	CCA1232SA
Power Supply Board – Single	PSR820
Cooling Fan – 24VDC	FA46
Cooling Fan Filter	FA40
Information Display Board – CD15nx	CCA15NXSA
Information Display Board – CD30nx	CCA30NXSA
Inline Particulate Filter	FLT34
Pressure Switch	PS20SA
Fuse, Bussmann MDA-10 – 10 amp, 250VAC Slow Blow, Main Power	FUS25
Fuse, Littelfuse Minifuse 297005 – 5 amp, 32VAC, Drive Board	FUS75
Vacuum Switch	SWT90SA

# Appendix C – Maintenance Kit

## Air Preparation System

<b>ASP80 – Maintenance Kit – OXS90 Air Preparation System</b>		
<b>Part Number</b>	<b>Quantity</b>	<b>Description</b>
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 – Replacement Cover Filter

<b>ASP70A – Maintenance Kit – Aerous 8 Air Preparation System</b>		
<b>Part Number</b>	<b>Quantity</b>	<b>Description</b>
OXU371	1	Inlet Filter Package – Aerous
OXU350	1	Enclosure Filter – Aerous 8

<b>ASP75A – Maintenance Kit – Aerous 15 Air Preparation System</b>		
<b>Part Number</b>	<b>Quantity</b>	<b>Description</b>
OXU371	1	Inlet Filter Package – Aerous
OXU351	1	Enclosure Filter – Aerous 15

## Ozone Generator

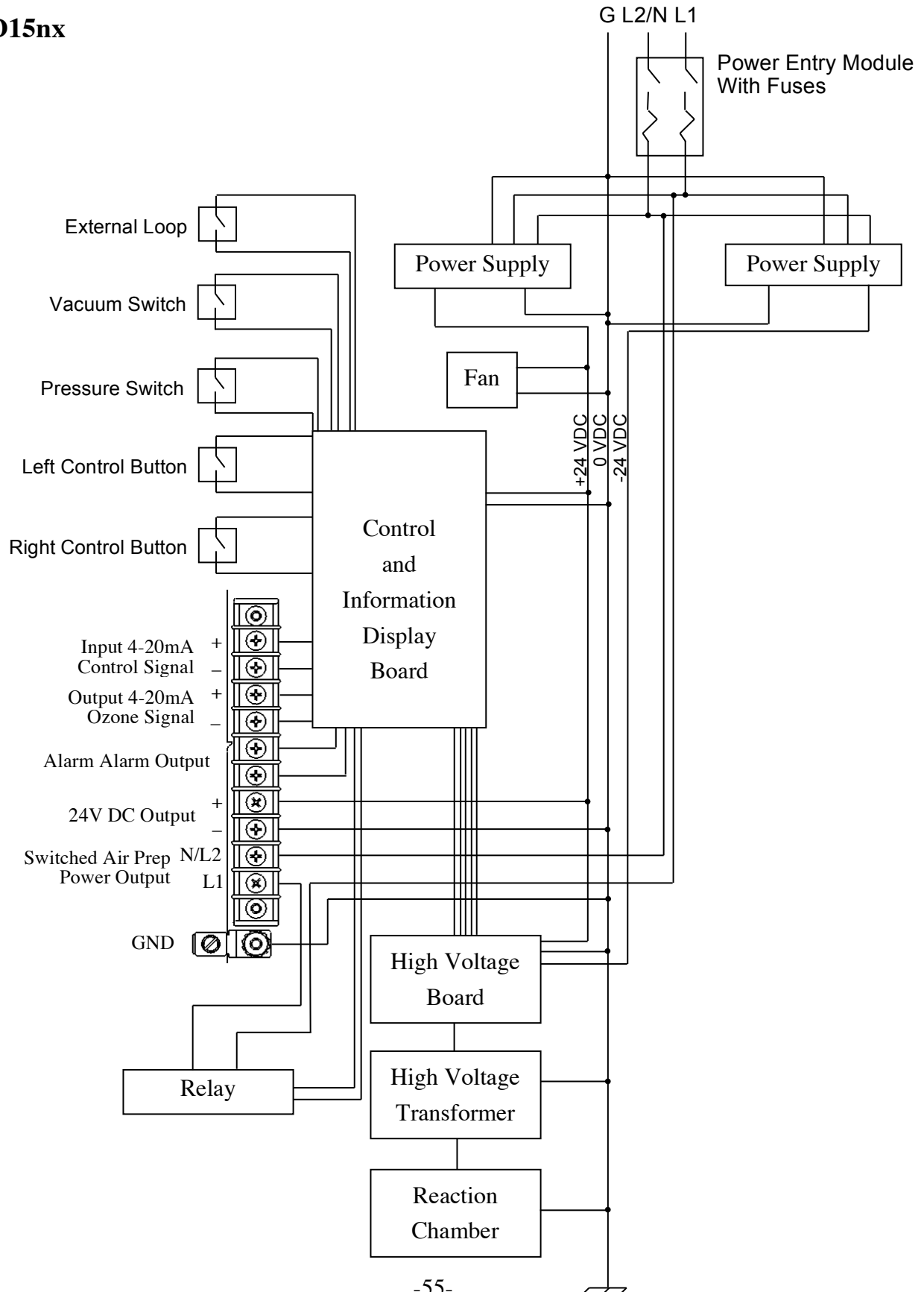
<b>ASPM370A – Maintenance Kit – CD15nx Ozone Generator</b>		
<b>Part Number</b>	<b>Quantity</b>	<b>Description</b>
FA40	1	Filter – Fan filter, element only
FLT34	1	Filter – Inline particulate filter
FUS75	1	Fuse – Littelfuse Minifuse 297005 – 5 amp, 32VAC, Drive Board
FUS25	2	Fuse – Bussmann MDA-10 – 10 amp, 250VAC Slow Blow, Main Power
ORG110	4	O-ring – 2” CD reaction chamber, pressurized end cap, large
ORG120	4	O-ring – 2” CD reaction chamber, pressurized end cap, small
HSW100	2	Sealing washer, Viton
HWW9004	2	Hardware washer - #6, flat, S.S.
CKV21	1	Check Valve – 1/4” X 1/4” FPT, for Venturi Injector

**ASPP370A – Maintenance Kit – CD30nx Ozone Generator**

<b>Part Number</b>	<b>Quantity</b>	<b>Description</b>
FA40	2	Filter – Fan filter, element only
FLT34	1	Filter – Inline particulate filter
FUS75	2	Fuse – Littelfuse Minifuse 297005 – 5 amp, 32VAC, Drive Board
FUS25	2	Fuse – Bussmann MDL-10 – 10 amp, 250VAC Slow Blow, Main Power
ORG110	8	O-ring – 2” CD reaction chamber, pressurized end cap, large
ORG120	8	O-ring – 2” CD reaction chamber, pressurized end cap, small
HSW100	4	Sealing washer, Viton
HWW9004	4	Hardware washer - #6, flat, S.S.
CKV21	1	Check Valve – 1/4” X 1/4” FPT, for Venturi Injector

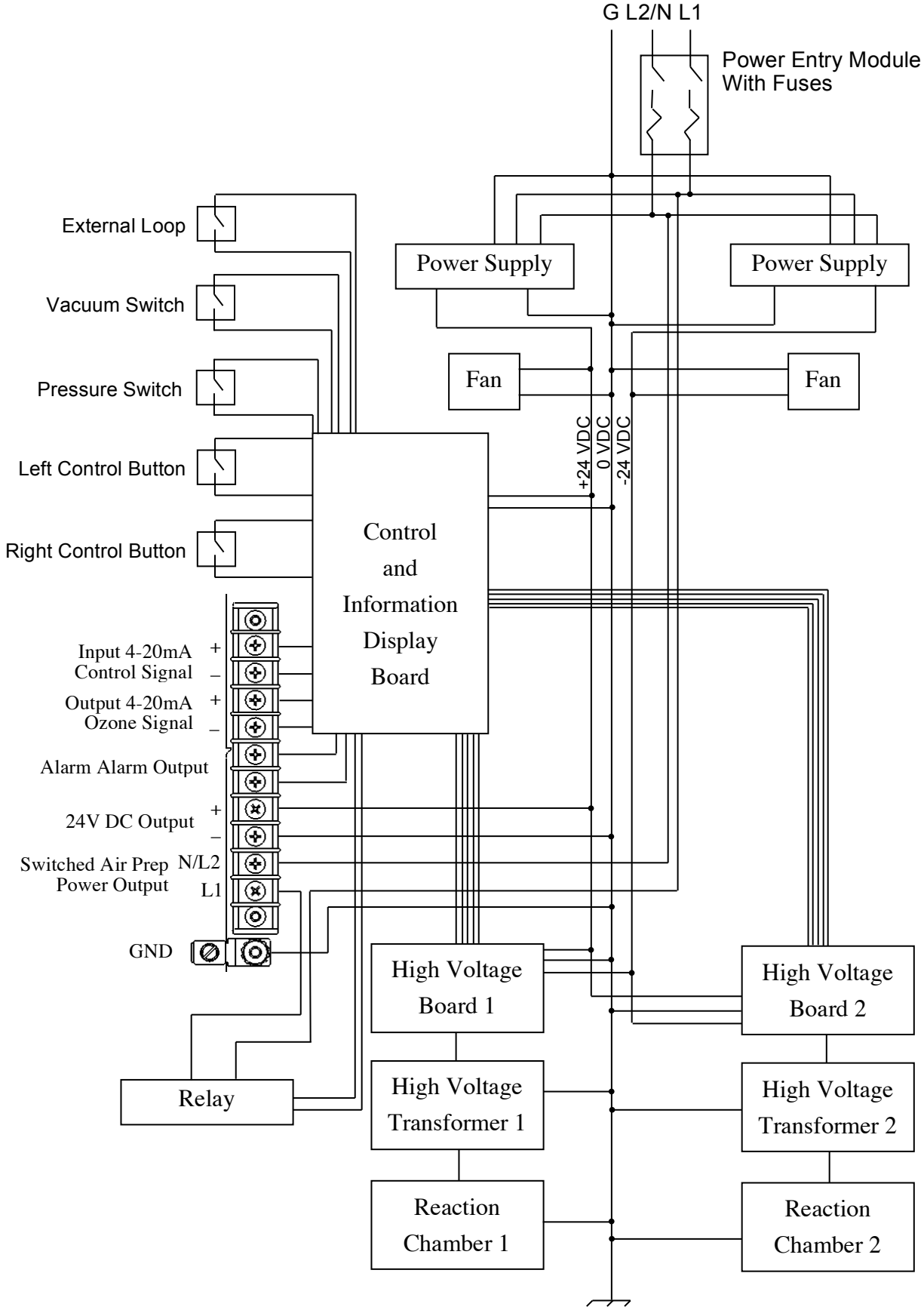
# Appendix D – Logic Schematics

CD15nx

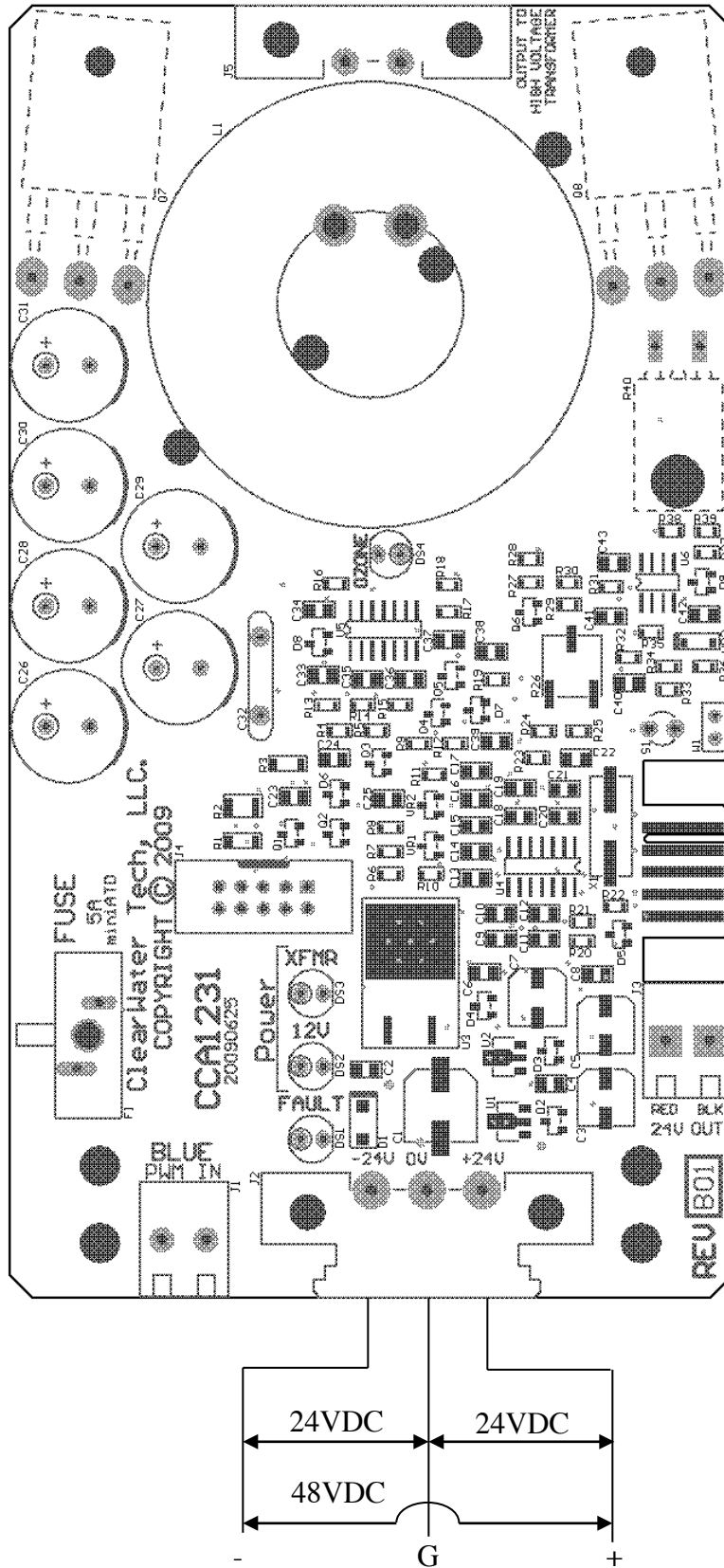




CD30nx



# Appendix E – Drive Module Input Voltages



# Appendix F – Warranty Information

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## 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.**