The OREC Ozone Generator SP is no longer available for sale.

OREC™ OZONE GENERATOR

SP SERIES

INFORMATION ONLY

INSTALLATION & OPERATION MANUAL

OSMONICS™

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OSMONICS™

We thank you for your selection and purchase of an OSMONICS® product.

With proper care and maintenance, this device should give you many years of trouble-free service. Please take the time to read and understand this Installation and Operation Manual, paying special attention to the sections on **INSTALLATION** and **MAINTENANCE**.

If, in the future, any parts or repairs are required, we strongly recommend that only original replacement parts be used. Our Customer Service Department is happy to assist you with your parts or service requests.

☎ **For more information call toll free in the USA (888) 321-8200.**

☎ **OSMONICS Customer Service and Technical Support Departments can be reached by calling (602) 931-7332 or faxing (602) 931-7727, Monday through Friday, 7:00 a.m. - 4:30 p.m. MST.**

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SP SERIES
OZONE GENERATOR

Table of Contents

INTRODUCTION

Ozone (O_3) is a three-atom allotrope of oxygen (O_2). It is second only to fluorine in electronegative oxidation potential. Ozone is a natural ingredient of the Earth's upper atmosphere, generated by solar energy, and exists in a gaseous form at ambient conditions. Unreacted ozone decomposes in a matter of hours to simple molecular oxygen and therefore it cannot efficiently be stored. It must be produced on-site. A wide variety of ozone equipment configurations and sizes are available for municipal, industrial and laboratory applications.

Ozone is emerging as the most efficient and ecologically sound oxidant to treat both organic and inorganic substances in air and water.

Principles of Operation

The OSMONICS SP Series Ozone Generator is designed to continuously generate ozone. The generator offers the user the capability to regulate the ozone output from 10-100% of its rated capacity. This adjustment can be made manually or automatically, if the generator is factory-equipped with the auto control option.

Ozone generators produce ozone from the oxygen available in atmospheric air (air-feed models) or from a more pure form of oxygen (oxygen-feed models).

Generators using air as a feed gas utilize an air preparation system to produce clean, dry and particulate-free air, which is required for stable ozone production. The air preparation system typically features an oilless air compressor with particulate and coalescing filtration (large SP units only), followed by a pressure-swing adsorption-type air dryer which dries the air to a dewpoint of -60°F (-51°C) or lower. Micron-rated post-dryer filters prevent most particulates larger than 1 micron from entering the ozone generator tubes.

Prior to entering the generator vessel, the clean, dry air is pressure-regulated to a lower pressure and metered as it passes the generator dielectric assemblies.

Generators using oxygen as a feed gas come factory-ready for you to attach the oxygen feed supply. The oxygen supply should be pressure-regulated to less than 30 psig (2.1 bar) prior to entering the "oxygen in" port of the generator.

This controlled gas stream now passes by each dielectric assembly through the space known as the "dielectric gap." The dielectric gap is the point where electrical energy is applied, creating a corona arc across this space. The energy applied across this gap is generated by the high-voltage, secondary step-up voltage transformer and is adjusted by turning the generator raise/lower switch (on auto-control units) or dial (on manual-control units). The amount of ozone produced correlates with the level of energy applied to the dielectric gap (assuming constant gas flow and pressures).

The resultant energy level can be observed or estimated by observing the amperage level displayed on the front of the control panel. As air passes through the dielectric gap, a portion of the oxygen molecules are converted to ozone. Typical output of the total volume of feed gas is between 1-2% by weight on air and 2-4% on oxygen feed. An ozone output data sheet is included in this manual to assist you in estimating the ozone output at certain machine settings.

After the parent gas and ozone mixture leaves the dielectric assemblies, it then passes through an adjustable flow control valve prior to exiting the generator cabinet. A check valve or backflow prevention device helps prevent the backflow of water into the generator.

Since the corona discharge generates heat when in operation, the generator utilizes cooling water to maintain a constant dielectric temperature which optimizes ozone output. Cooling water enters the generator vessel and flows throughout the specially designed generator vessel to remove excess heat and then exits the vessel. Water flow volume can be regulated for optimum cooling.

FRONT PANEL CONTROLS AND INDICATORS

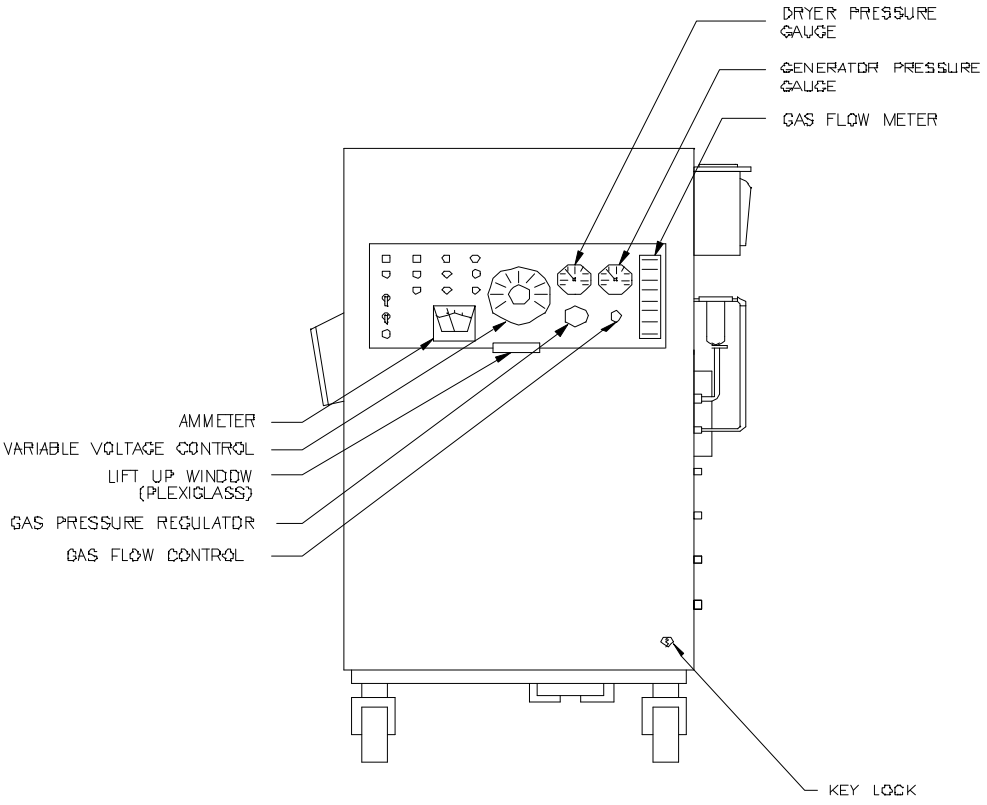

Figure 1: *Typical Ozone Generator (Manual Control Panel)*

Generator Pressure Gauge—This gauge indicates ozone generator pressure in the generator cells. The pressure is regulated with the pressure regulator and gas flow valve on the front panel.

Dryer Pressure Gauge—This gauge indicates the incoming pressure to the dryer (air-feed units only).

Pressure Control (see "Regulator" above)—This regulator reduces the gas pressure before presenting it to the gas flow meter and ozone generator cells. The downstream pressure from the regulator is called "generator pressure." The gas leaves the regulator and passes through the flow meter and into the ozone generator cells.

Gas Flow Meter—Measures the gas flow into the generator. Consult the curves in the operating manual to determine actual gas flow at operating generator pressure. During operation, the ball of the flow meter should be centered at the values listed on the data sheet. Also, the humidity paper at the top of the flow meter should be blue in color, indicating dry feed gas (humidity paper is included in air feed units only).

Gas Flow Valve—This valve is the last manual valve in the gas flow system. Ozone passes through this valve. This valve, in conjunction with the pressure regulator, adjusts the gas flow and pressure in the ozone generator cells.

Master Switch—This switch energizes the control circuitry in the ozone generator, and resets any system faults.

Generator Switch—This switch activates the ozone generator circuitry. For units with auto control, place the switch in the **HAND** position to control the power level manually or in the **AUTO** position for automatic operation (auto-operation option is explained in greater detail in the Appendix).

Raise/Lower Switch—This switch drives the variable voltage transformer that varies the voltage applied to the high-voltage transformer. The generator power and ozone output varies from 10-100% of rated output (with auto-control option).

Generator Voltmeter—This meter indicates primary voltage to the high voltage transformer. The voltage and ozone output is varied using the Raise/Lower Switch (with auto-control option).

Generator Ammeter—This meter indicates primary current to the ozone generating circuitry. The meter current is not always the actual current because current transformers are sometimes used to step-down the displayed amperage.

Air/Oxygen Switch—This switch (optional) is used to select compressed air or oxygen as the feed gas. Select the feed gas only after the unit has purged first and then turned off.

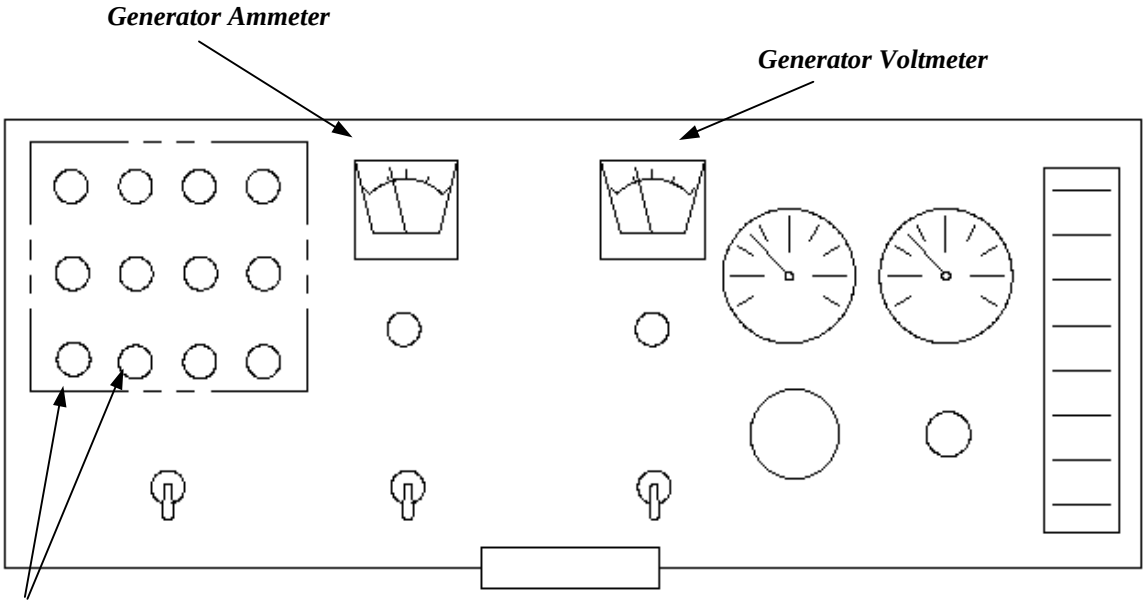

Figure 2: *Control Panel (Auto-control)*

PANEL LIGHTS

Control —This amber light indicates the master switch is **ON**. All doors and panels must be closed, power must be applied and fuses must be good before the control light comes on.

Minimum Volts —This amber light (auto-control units only) indicates when the variable voltage transformer is at its lowest position. This position should be achieved within 30 seconds after the master switch has been turned on.

Generator —This amber light indicates the generator switch has been turned on and the ozone generating circuitry is activated.

NOTE: THE FOLLOWING LIGHTS WILL BE ACCOMPANIED BY GENERATOR SHUT DOWN AND AN AUDIBLE ALARM:

Door Open—This light indicates that the door is ajar.

Gas Pressure —This light comes on should the gas pressure not achieve 7 psig (0.5 bar) or drop below 5 psig (0.3 bar) or exceed 22 psig (1.5 bar) during operation, as sensed by the air pressure limit switch.

High Water Temperature —If the water temperature out of the ozone generator exceeds 120°F (49°C), the temperature switch will turn off the ozone generator (optional).

High Ozone —Indicates a room monitor has detected an excessive amount of ozone in the room.

Backflow —This red light will come on when the backflow leak detector is engaged by water flow back into the ozone gas plumbing.

External Interlock—When connected to an external component (booster pump, etc.), the ozone generator will run only if the external component is in operation.

NOTE: THE UNIT IS SUPPLIED WITH A JUMPER BETWEEN IT1 AND IT2 TO ALLOW THE UNIT TO OPERATE WITHOUT AN EXTERNAL CONTACT CLOSURE. IF EXTERNAL INTERLOCK IS DESIRED, REMOVE THE JUMPER AND CONNECT THE EXTERNAL INTERLOCK.

Water Flow—Indicates the loss of cooling water flow from the generator (optional).

NOTE: OTHER SHUTDOWNS/INDICATORS MAY HAVE BEEN ORDERED WITH YOUR UNIT. PLEASE SEE THE APPENDICES FOR A DISCUSSION OF THESE FEATURES.

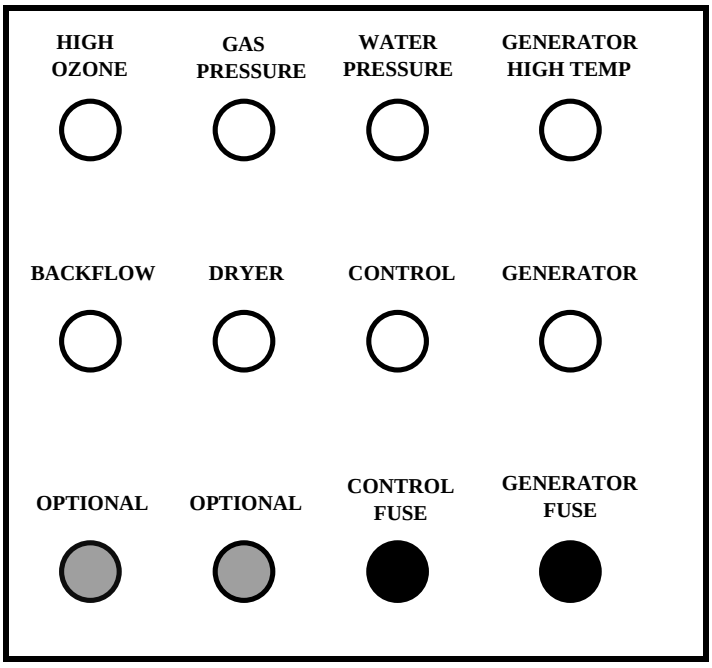

Figure 3: *Typical Light Panel Layout*

NOTE: POSITION OF LIGHTS AND FUSES MAY VARY DEPENDING UPON GENERATOR MODEL.

CONNECTIONS, INDICATORS AND COMPONENTS

Main Safety Disconnect Switch—Located on the right side of the unit. All electrical power for the ozone generator comes through this switch.

Heatless Dryer—Dries the air to at least -60°F (-51°C) dewpoint in preparation for ozone generation. See Appendix for maintenance and more operation information (air gas feed units only).

Water Inlet and Outlet—Cooling water should be 70°F (21°C) or lower and must not exceed 80°F (27°C). Cooling water must never freeze inside the unit. Water must be free of particulates larger than .020 inch (.051 cm).

Water Flow Meter—Measures the cooling water flow. Refer to data sheet for minimum cooling water flow.

Purge Drain—Allows moisture from the water separator filter to exit the system (large SP units only).

CAUTION: NEVER PLUG OR CAP THESE DRAIN FITTINGS!

Gas Out—Ozone is discharged from this outlet port. A stainless steel check valve, to aid in backflow prevention, has been included and must be installed in this port to protect the generator from water damage.

Air Inlet—Compressed air is plumbed to this port (if the compressor is external).

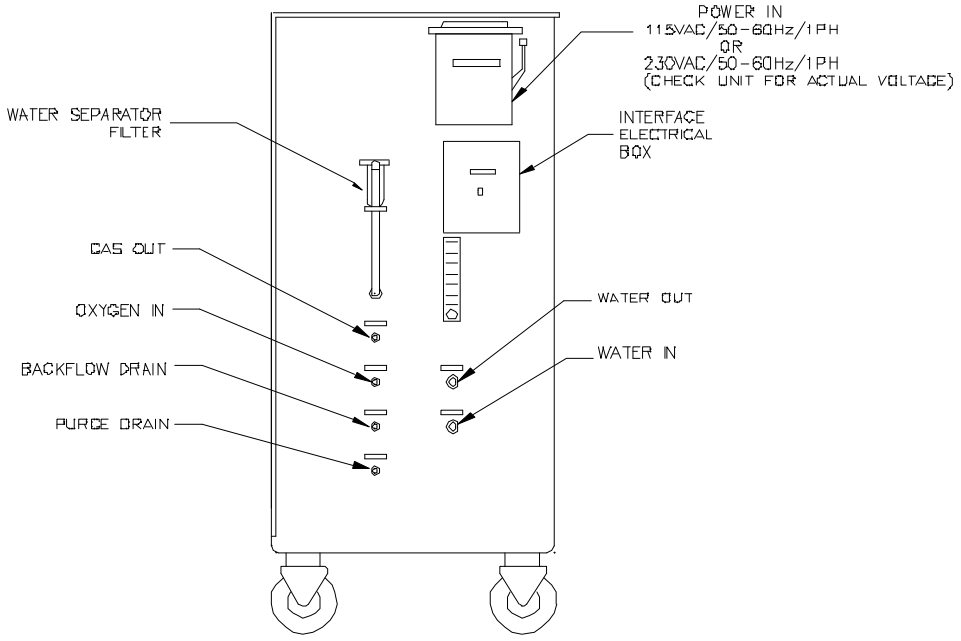

Figure 4 : *Typical Side View of Connections*

Backflow Prevent Drain—Should water from the process flow back into the machine, this drain (optional) allows the operator to relieve the unit of that water. This plug should stay in place unless the backflow of water has occurred.

Ozone Generator Cells—The high voltage is supplied by the high-voltage transformer. The dielectric assemblies are water-cooled within each cell that surrounds the stainless steel generator tubes. Concentrically located inside this tube is a glass dielectric.

Generator Voltage Control—Located on the control panel (manual control units only), this device is a variable voltage transformer. The brushes of the variable voltage transformer pivot around the coil (copper wire winding) to vary the primary voltage to the high voltage transformers.

High-Voltage Transformer—This transformer develops the high voltage to operate the ozone generation process.

Water Flow Switch—Senses the loss of cooling water flow. It is factory-preset.

Gas Pressure Limit Switch—Senses generator gas pressure. It is factory-preset, has a high and low cutout, but can be adjusted if the need arises.

Post-Dryer Filter—Optional filter (air feed gas units only) removes any particulates that may pass out of the dryers.

Electrical Component Panel—The relays, contactors and PLC (optional) are located on this panel, located inside the generator cabinet. A description of some of the components on this panel are:

- **PLC (Programmable Logic Controller)**—This is used to control all system functions except main power.
- **Generator and Compressor Contactor**—Relay-activated generator switch that powers the dielectric generator and compressor (air units).

Fuses

Main Fuses—These fuses are located in the safety disconnect. All current for the ozone generator unit passes through these fuses.

Control Fuse—This fuse, on the front control panel, protects all control circuitry. The unit will not start unless this fuse is good.

Ozone Generator Fuse(s)—These fuses protect the ozone generator circuitry. They are located on the front control panel of the generator unit. Should these fuses blow, it is indicative of a bad dielectric assembly or associated component.

Thermo-melt—A thermo-melt circuit is installed around the dielectric endcaps of the generator cell assemblies. If the thermo-melt circuit is broken, the entire ozone generator will shut down immediately, and oxygen feed will be shut off.

INSTALLATION

Initial Inspection

Inspect the shipping carton for obvious external damage. Note on the carrier's bill-of-lading the extent of the damage, if any, and notify the carrier. Save the shipping carton until your ozone generator is started up.

☎ **If there was shipping damage, call the OSMONICS Customer Service Department at (602) 931-7332 for instructions.**

Location

Place the ozone generator in a position as near as possible to where ozone is to be applied to the process. There should be a minimum of three (3) feet clearance on two sides.

CAUTION: DO NOT SUBJECT THE OZONE GENERATOR TO DIRECT SUNLIGHT, WATER OR FREEZING CONDITIONS. EXCESSIVELY DUSTY, HUMID AND CORROSIVE ENVIRONMENTS AND CHEMICAL FUMES MUST ALSO BE AVOIDED.

Your OSMONICS OREC™ ozone generator must be operated in a clean, dry environment that does not contain any corrosive or volatile air contaminants. Excessive moisture, dust and/or vapors from stored chemicals, paints or solvents will damage the generator's compressor, dryer and dielectric components. Vapors from chlorine or chlorine-containing compounds are especially damaging.

Whenever possible, locate the air compressor where a fresh air supply is available.

Your generator was designed for indoor use. Exposure of the generator to blowing dust, rain, snow or other detrimental, outdoor environments can cause damage to the unit.

CAUTION: THE OPERATION OF YOUR OZONE GENERATOR IN A DAMAGING ENVIRONMENT MAY VOID ITS WARRANTY!

INSTALLATION

Electrical

Ozone Generator—Connect wiring in accordance with the electrical schematic and/or data sheet provided in the Appendix.

Plumbing

Connect the water inlet and outlet on the ozone generator using not less than ½ inch (1.3 cm) piping. The incoming water pressure must be less than 25 psig (1.7 bar).

If it is desired to plumb the purge drain of the cabinet, then connect to a zero back pressure drain. Use ¼ inch (.64 cm) pipe or tubing when plumbing this port.

Connect ozone line to check valve at ozone gas outlet (sometimes installed inside the cabinet in the factory) using stainless steel piping, Teflon® tubing or other ozone resistant plumbing. If using either Venturi (vacuum) type injectors or the pressurized diffusion method of ozone injection, your plumbing method will vary. If ozone is to be introduced into a system with diffusion stones, the ozone plumbing should extend at least two (2) feet above the highest water level. If ozone is to be introduced into an injector, a shutoff valve and vacuum gauge must be installed at the injector's gas inlet.

WARNING: SEVERE DAMAGE WILL RESULT IF WATER BACKS UP INTO THE OZONE GENERATOR! IT IS THE CUSTOMER'S RESPONSIBILITY TO PROVIDE FOR THE OZONE GENERATOR, AN INSTALLATION, WHICH WILL PREVENT THE BACKFLOW OF WATER IN THE OZONE PIPE LINE. IN A TALL CONTACT TOWER SYSTEM, ROUTING THE OZONE PLUMBING AT LEAST TWO (2) FEET ABOVE THE HIGHEST WATER LEVEL IS RECOMMENDED AS MINIMUM PROTECTION.

Ozone- resistant check valves are also available to provide additional protection against backflow. Contact the OSMONICS Customer Service Department for more information.

NOTE: WHEN MAKING OZONE CONNECTIONS, USE TWO WRENCHES TO ENSURE THAT YOU DO NOT OVER-TIGHTEN CHECK VALVE ASSEMBLY.

Connect the remote air compressor assembly (auto-control or custom units only) to the air inlet at the side of the cabinet.

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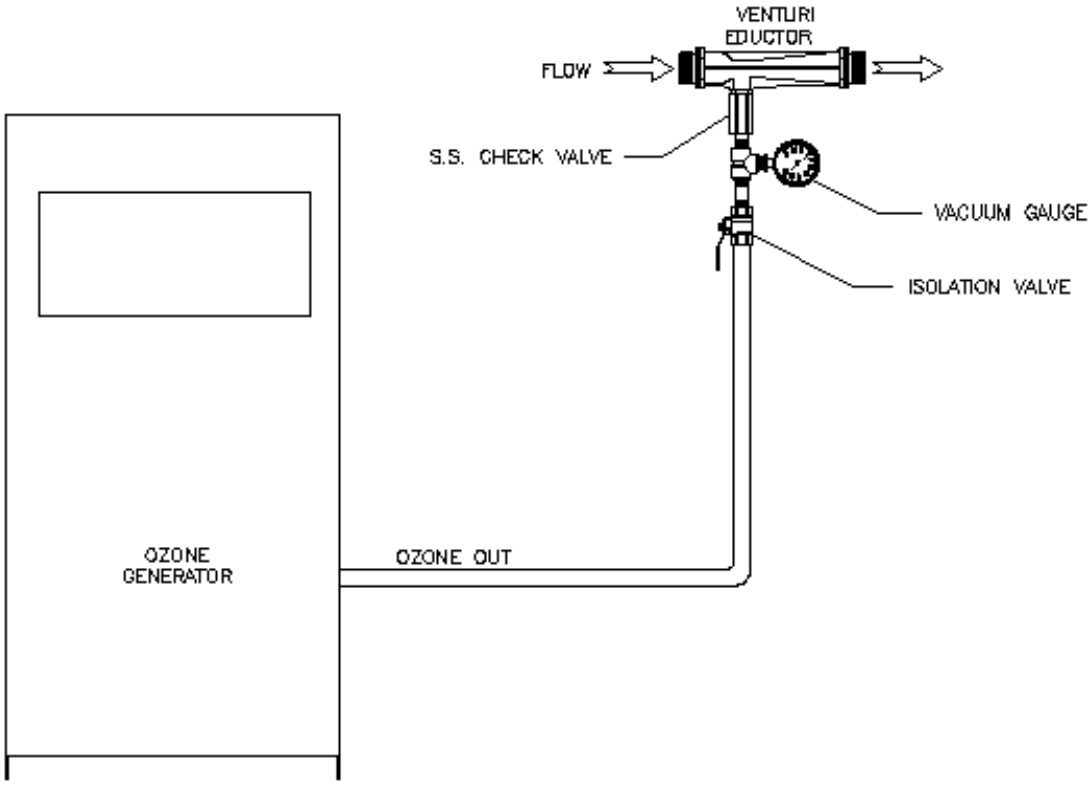
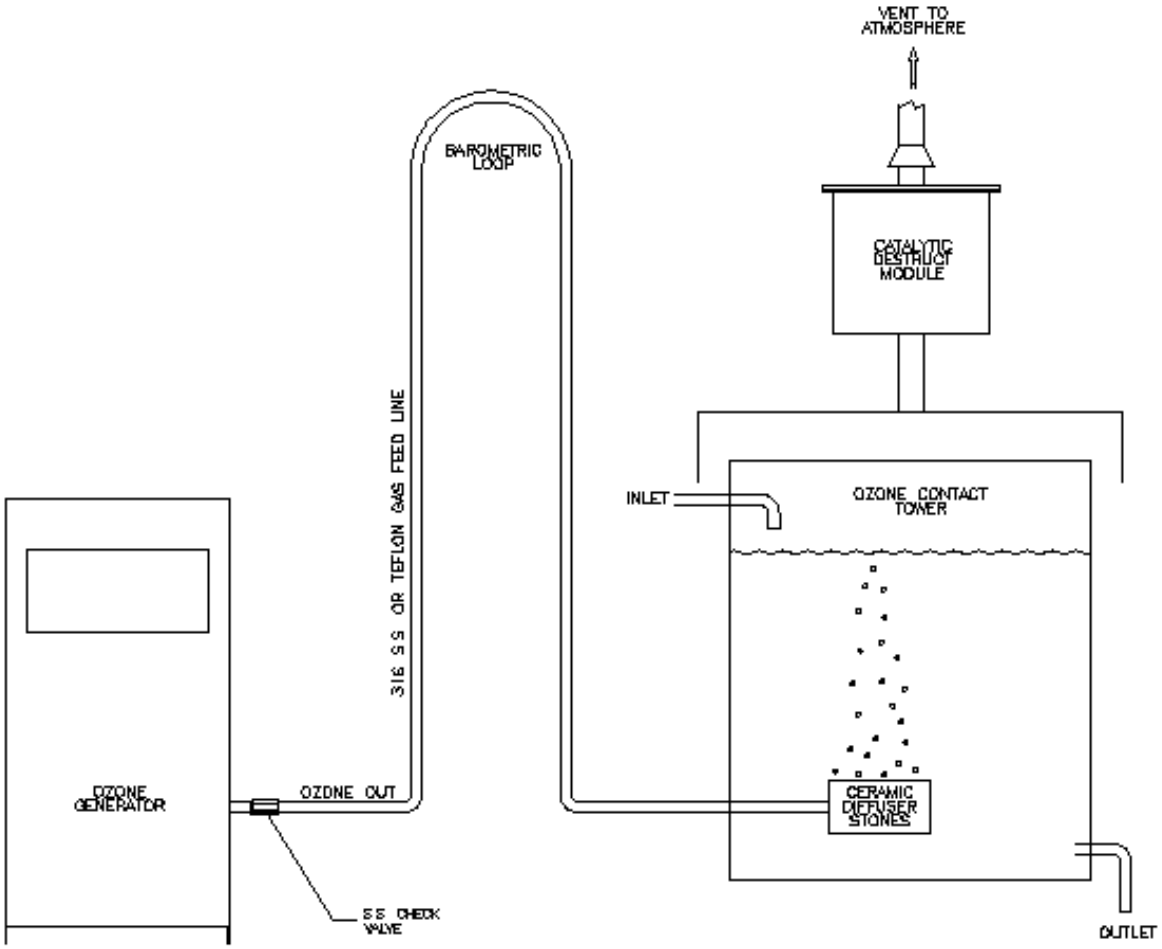
Figure 5: *EDUCTION SYSTEM*



INSTALLATION

Figure 6: *DIFFUSION SYSTEM*



OPERATION

Start-Up

AIR PREPARATION START-UP (OPTIONAL EXTERNAL SUPPLY)

- Switch power **ON** for both refrigerated and desiccant air dryer components.
- Ensure desiccant dryer towers are operating properly by listening for the alternating air purge cycle, which occurs every 30 - 45 seconds.

GENERATOR START-UP

- Water pressure should not exceed 25 psig (1.7 bar). Pressurize line and check plumbing before starting to examine for shipment-induced water leaks. Refer to data sheet for minimum water flow.
- Ensure that all ozone supply lines to your process are open and unrestricted.
- Switch power **ON** at main breaker and disconnect. Control light should be **ON**. (Generator light should be **OFF**.)
- Switch master on/off switch **ON**. (Generator light should now be **ON** on small SP units.)
- Turn on cooling water supply to the generator vessel. Water fault lights may be **ON**, then as water flow comes into the designated operating range, the lights should go **OFF** (on large SP units only). Periodic resetting of the regulators may be required to ensure pressure is within range.
- Adjust gas flow rate to desired setting (see data sheet).
- Adjust generator pressure to be between 10-15 psig (0.7 - 1.0 bar). Refer to the generator data sheet for some suggested gas flow rates, as well as gas pressure vs. flow curves.

NOTE: SINCE PRESSURE AFFECTS FLOW, SOME BALANCING OF THE PRESSURE AND FLOW CONTROLS MAY BE REQUIRED TO STABILIZE FLOW AT DESIRED SETTINGS.

- Allow air to flow through the generator for a minimum of one (1) hour if generator has not been operating within six (6) hours. This allows clean, dry air to flow through the generator dielectrics, thus purging any moisture that has accumulated.
- Switch generator control switch to the **MANUAL** mode. The generator should now be ready to generate ozone. Minimum voltage light should now be **OFF**. Generator light should now be **ON**.

NOTE: THE OZONE GENERATING CIRCUITRY CAN BECOME ACTIVE ONLY AFTER THE TWO MINUTE START-UP PERIOD. THE GENERATOR LIGHT WILL COME ON WHEN THE GENERATOR CIRCUITRY BECOMES ACTIVE.

- Turn and hold the raise/lower switch to the **RAISE** position or rotate the dial clockwise slowly to raise generator power up to the desired ozone output.
- If any one of the automatic shutdown controls (water flow, air pressure, generator temperature, dryer, etc.) is not satisfied two minutes after start-up, the unit will automatically shut down with an audible alarm and a panel light indicating the cause. If this occurs refer to troubleshooting section.

OPERATION

<u>WARNING</u>: DO NOT EXCEED ANY VOLTAGE OR CURRENT LIMITS STATED ON THE DATA SHEET.

Shutdown

AIR PREPARATION SHUTDOWN

- Shut down ozone generation system by reversing the process described in "**Start-Up**."
- Allow all the ozone to purge out of the complete system.

GENERATOR EMERGENCY SHUTDOWN

- Turn the master switch to **OFF**.
- Switch off power at the electrical safety switch located on the side of the unit.

GENERATOR NORMAL "MANUAL" SHUTDOWN

- Turn the raise/lower switch to **LOWER** position and hold until amperage decreases to minimum (auto-control units) or rotate the dial counterclockwise to **0** slowly. Turn the generator switch **OFF** (large SP units only). Optionally turn generator power switch to **OFF** and the amperage should power down automatically (auto-control units only).
- Allow dry air to purge through the generator for a minimum of five (5) minutes. If generator unit is going to be run again within a few hours, it is best to leave the dry air purging through the unit as is.
- Switch the master switch to the **OFF** position.
- Close cooling water supply valves (if desired).
- Close air supply valves from air preparation unit (if desired).
- Disconnect power.

GENERATOR FAULT SHUTDOWN

Should the ozone generator shut down with a fault, perform the following:

- Observe which red signal light is on.
- Turn the master switch to **OFF**.
- Consult the "Troubleshooting" section of the manual.

OPERATION

Estimating Ozone Output

Your ozone generator has been factory tested to ensure it meets performance specifications and output. As part of the factory test procedure, your generator's ozone output has been measured using the ultraviolet absorption method of measurement throughout various machine settings. This information is recorded on the ozone generator test data sheet in the Appendix of this manual. From time to time, you may have the need to estimate approximately how much ozone your generator is producing. The most accurate method would be to purchase or rent an ozone monitor (OREC™ Model 03DM110) capable of measuring high concentration ozone and re-measuring the actual output at your site.

If access to a monitor is not practical, it is possible to closely estimate your ozone output by adjusting the machine settings to match the settings shown on the data sheet. At these settings (and assuming that your generator has been well maintained) your ozone output should be similar to the output indicated in the data sheet. The most critical settings to duplicate are:

- Gas flow rate (taken from flow meter on front of generator control panel).
- Generator operating pressure (taken from generator pressure gauge on control panel).
- Observed amperage (amperage gauge on generator control panel).
- Cooling water temperature and flow rate.

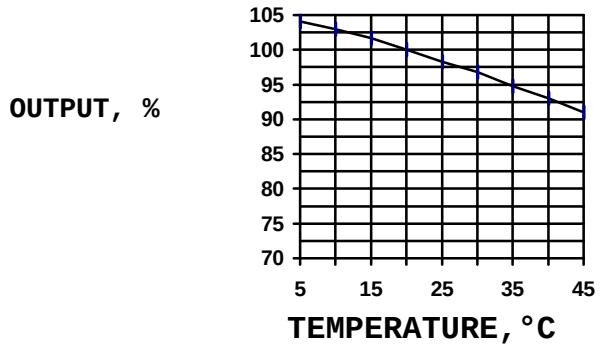
NOTE: DETERMINE WHETHER AIR OR OXYGEN IS BEING USED AS A FEED GAS BEFORE OPERATING GENERATOR.

To select a specific ozone output, first duplicate a gas flow and generator pressure setting suggested on the data sheet. While referencing the ozone data sheet or output curve, apply power by turning the **RAISE/LOWER** switch until the amperage indicator (on control panel) matches your desired ozone output shown on the graph.

COOLING TEMPERATURE EFFECT ON OZONE OUTPUT

Cooling water temperature has a dramatic effect on ozone output. Refer to the graph (at right) which can be used to more accurately determine ozone output at your actual cooling water temperature.

WARNING: If the cooling water temp is too low, condensation may form inside the generator cabinet and damage internal circuitry.



SERVICE AND MAINTENANCE

It is highly recommended that service and maintenance be performed as set forth below. There are tables available (at the end of this section) that allow the logging of maintenance work and daily checks as they are performed. You may want to remove these tables from the manual and keep them with the ozone generator. All service should be performed and logged to ensure warranty compliance.

WARNING: ALL SERVICE AND MAINTENANCE SHOULD BE DONE WITH UNIT POWER OFF!

Daily

FOR GENERATOR

- Be sure that all gauges (flows, voltage and current) are within the specified operating limits.
- Be sure that the humidity indicator at the top of the flow meter is blue in color (air feed gas only).
- Balance gas flows and generator pressures to predetermined rates (if out of range). See generator data sheet for suggested settings.
- Check cooling water flow to ensure it is in range. At present, pressure should not exceed 20 psig (1.4 bar).
- Check overall system for obvious water or air leaks.

FOR AIR PREPARATION (OPTIONAL EXTERNAL SUPPLY)

- See "Compressor Information" section in Appendix.
- If supply air has an air accumulator or receiver, excess moisture should be drained on a daily basis. This can be performed manually or by installing an auto purge/drain valve.

Monthly

- Perform a daily inspection.
- Clean or replace the compressor air intake filters.
- See “Compressor Information” section in Appendix.
- Inspect post dryer filters. See “Filter Information” section in Appendix for suggested maintenance.
- Optionally check ozone output with an OREC™ DM110 monitor. If out of desired range (% wt.), adjust **RAISE/LOWER** switch or dial on generator to correct. Some gas flow rate balancing may be required.

CAUTION: DO NOT EXCEED AMPERAGE RATING LIMITATIONS.

Quarterly

- Perform a monthly inspection and additional steps below.
- Inspect and replace, if required, any water or oil separator filter elements. This may need to be done more often in more humid or dirty environments.

SERVICE AND MAINTENANCE

NOTE: ***REFER TO THE MANUFACTURER'S INSTRUCTIONS ON FILTER HANDLING AND INSTALLATION IN THE "FILTER INFORMATION" SECTION IN APPENDIX.***

- With power disconnected and locked out, clean the POWERSTAT® brushes of the VARIABLE VOLTAGE TRANSFORMER with isopropyl alcohol and a clean, lint-free towel. **DO NOT** saturate components with alcohol. Avoid getting alcohol on the high voltage wire. Allow alcohol to dry thoroughly before starting the unit.
- Clean or replace the post-dryer filters. See "Filter Information" section in Appendix.
- Use compressed air to remove any obvious dust or lint from the generator.

Semi-Annually

- Perform a regular monthly inspection (as above).
- Replace the post-dryer filter.
- Replace the ozone generator cabinet filter(s).
- Inspect the gas outlet check valve.

Annually

- Perform a quarterly inspection and additional steps below.
- Replace cabinet filters twice a year.
- With power disconnected and locked out, check the tightness of all nuts and screws including the electrical terminals and ground wires.
- Inspect the interior for air or water leaks.
- Check the pressure relief valves for smooth opening and closing.
- Replace gas outlet check valve.
- Inspect the copper wire windings of the VARIABLE VOLTAGE TRANSFORMER surface for a build up of dirt and/or carbon. Clean with isopropyl alcohol using a non-abrasive, lint-free wipe. Replace the carbon wiper brush(es) on the VARIABLE VOLTAGE TRANSFORMER. Refer to "**Variable Voltage Transformer**" section included in the Appendix.
- Replace the humidity indicating paper in the top of the flow meter (air feed gas units only).
- Perform ream-and-clean maintenance (see next page) of the dielectrics exterior and the stainless steel generator tube interiors.

NOTE: WE RECOMMEND REPLACING THE CHECK VALVE EVERY TWO YEARS.

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SERVICE AND MAINTENANCE

REAM & CLEAN PROCEDURE FOR DIELECTRICS

Read each part of this procedure thoroughly before carrying out the instructions. OSMONICS is not responsible for any damage or breakage caused by incorrect performance of this procedure.

1. **Necessary Equipment**
   - Lint free cloths
   - Deionized (DI) water or equivalent
   - Medical grade isopropyl alcohol (90% preferred)
   - Two small spray bottles (one for DI water and one for isopropyl)
   - Basic hand tools
   - ½ inch PVC pipe orbroom handle long enough to fit into stainless (SS) tube.
   - Surgical type rubber gloves
   - Ream and clean tool assembly. (See ***Figure 8:*** *Ream Tools* on page 24.)
   - Duct tape

2. **Preparation for Ream and Clean**
   - Turn off electrical disconnect at ozone generator or unplug unit.
   - Turn off power at main electrical panels as an extra safety measure.
   - Turn off cooling water.
   - If external air is used, turn off, or close valve which provides feed air to ozonator.
   - Clean an area near the generator so that all dielectrics can be placed there. It may be advisable to put down some card-board or another absorbent layer to catch dripping water, isopropyl alcohol, and possible nitric acid.
   - Drain all water from the unit.

3. **Cabinet Entry**
   - Unlock cabinet (if unit has a lock).
   - Loosen all screws on side of cabinet.
   - Remove or open cabinet cover(s).

4. **Glass Removal**
   - Once the cabinet cover has been removed the dielectric assembly including the cooling water jacket should be clearly visible.

WARNING: NEVER DISASSEMBLE THE DIELECTRIC ASSEMBLY OR CLEAN THE INTERIOR OF THE GLASS TUBE (THE INSIDE OF THIS GLASS TUBE SHOULD ONLY BE CLEANED BY THE FACTORY).

WARNING: SURGICAL GLOVES MUST BE WORN WHEN HANDLING DIELECTRICS BECAUSE THE OUTSIDE OF THE DIELECTRIC MAY HAVE A NITRIC ACID RESIDUE. GLOVES WILL ALSO PREVENT THE CONTAMINATION OF DIELECTRICS BY BODY OIL.

   - Disconnect high voltage lead(s) at the transformer.
   - Remove all nuts and bolts that hold the Teflon end cap of the dielectric assembly to the SS tube flange. Dielectric assembly should rise slightly due to spring clip at bottom of SS tube. Do not separate the Teflon end cap from the glass tube. See ***Figure 7:*** *Glass Removal* on next page.

- Carefully take hold of the exposed top segment of the glass tube and pull the glass dielectric out of the SS tube. The top 3½ inches of glass will be concealed by a wrap of Teflon sheeting.

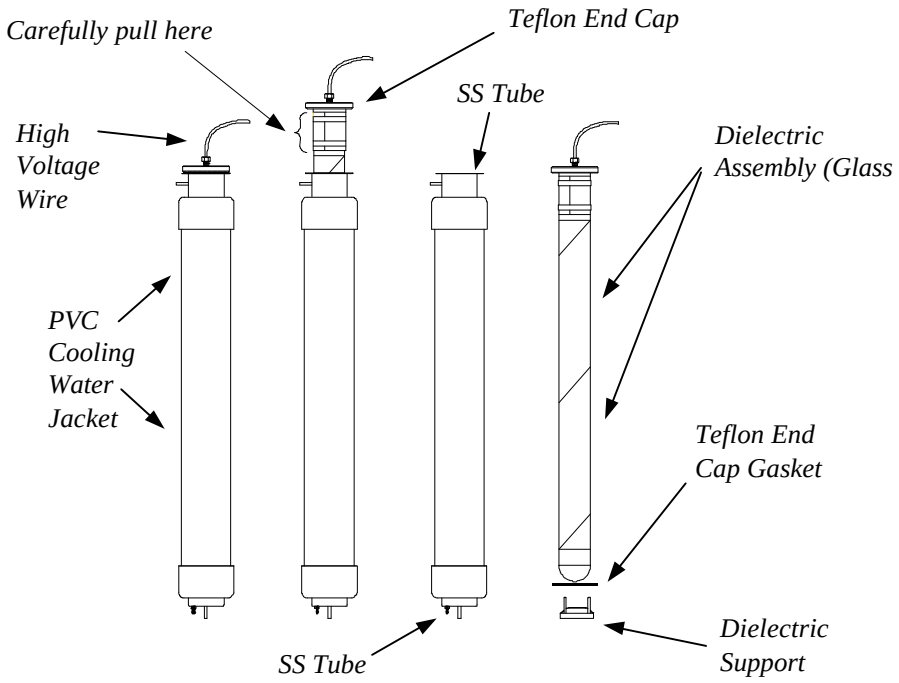

Figure7: *Glass Removal*

- If the dielectric does not spring up far enough, it will be necessary to carefully wiggle the end cap side to side until the glass moves freely. Continue until the top of the glass is exposed enough to grab onto. Always take special care to prevent glass breakage.
- Remove the dielectric support from the bottom interior of the SS cylinder and soak in DI water.

5. **Ream tool assembly**
   - When built, the assembly should fit the interior of SS tube(s).
   - Wrap lint-free cloths smoothly and uniformly around the end of the ½ inch pipe, broom handle or other long item that is non-abrasive. Pipe or broom handle should be a little longer than the inside length of the SS tube(s).
   - Wrap duct tape around the outer surface of the lint free cloths.
   - Wrap one more lint free cloth loosely around the end of the ream tool. The wrapped end of the tool should then fit firmly into the stainless steel tube.
   - A ream and clean tool kit, P/N 03299 (see ***Figure 8***), may be purchased through OSMONICS Phoenix Operations (see Technical Service on page 29).

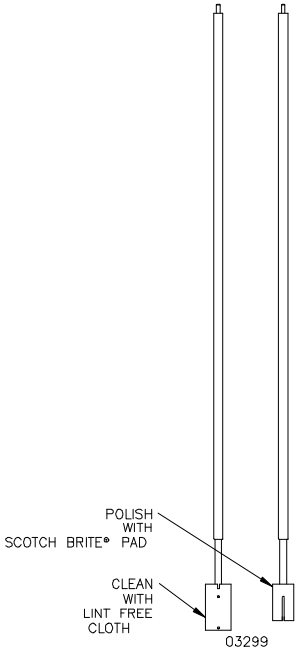

Figure 8: *Ream Tools*

6. **Dielectric Cleaning**

NOTE: CLEAN OUTSIDE OF GLASS ONLY. MAKE SURE TO WEAR SURGICAL GLOVES.

- Thoroughly clean the outside of the glass using lint free cloths and a spray bottle filled with deionized water (see ***Figure 9A:*** *Dielectric & Tube Cleaning* on next page).
- If nitric acid build up is very extensive, a mild Scotch Brite® pad and deionized water may be used to scour the outside surface of the glass tube.
- After the glass is cleaned, spray the outside of the glass tube with isopropyl alcohol and wipe off with clean lint free cloths.
- Set dielectric aside in clean area. They are now prepared for reinstallation.

7. **Stainless Steel (SS) Tube Cleaning**
   - Remove the ozone out manifold, Teflon tube or cross over tube (may be Teflon or SS) at the closed end of the SS tube(s). It will be necessary to soak this manifold or tube in DI water if nitric acid is present.
   - Spray inside of the SS tube with DI water . Drape one clean lint free cloth over the end of the ream tool and spray it with DI water. Run the reaming tool through the tube to clean off any dirt, nitric acid or residual material coating the inside of the tube (see ***Figure 9B*** on next page). Remove the outer cloth after each pass and replace with a clean cloth. Repeat this procedure until the cloth comes out clean. Repeat this procedure for each SS tube.

- Spray inside the SS tube with isopropyl alcohol and wipe out with the ream tool using a clean cloth. This will displace any moisture left from the cleaning with DI. water. Repeat for each SS tube.

Thoroughly clean the outside of the glass using lint free cloths and a spray bottle filled with deionized water. A mild Scotch Brite® pad may be used if necessary. Finish by wiping the outer surface of glass with isopropyl alcohol.

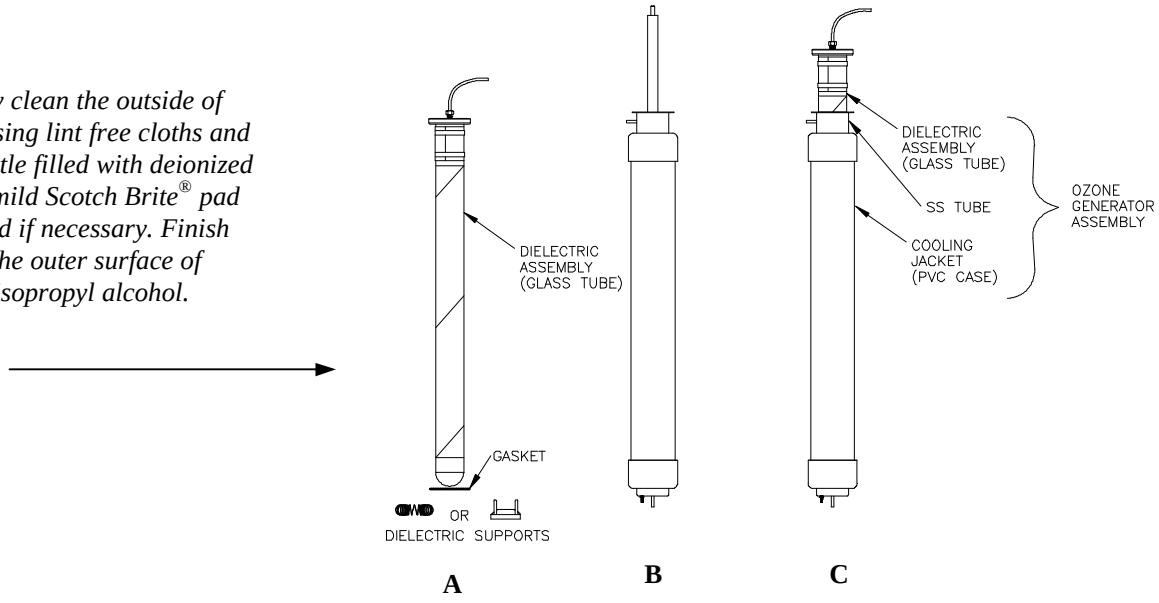

Figure 9: *Dielectric & Tube Cleaning*

8. Reassembly

- Reinstall the cleaned and dried dielectric support in the bottom of each tube.
- Use clean lint free cloth and isopropyl alcohol, and make one more pass over each dielectric before reinstalling.
- Reinstall dielectrics, making sure the gasket is in place and all bolts are tightened. Tighten only enough to slightly compress the gasket.
- Reconnect high voltage lead wires. Make sure that they are a minimum of one inch from any ground potential. If multiple high voltage transformers are used in ozonator, the bundles of high voltage wires (from each transformer) must be a minimum of three inches from each other.
- Replace cabinet cover and secure all fasteners. Apply power to ozonator cabinet, air compressor, etc.
- Turn on master switch of ozonator. **DO NOT GENERATE OZONE YET!**
- Before generating ozone again, allow system to run with just air flow for 12 hours. This promotes adequate drying of the cleaned dielectrics.

SERVICE AND MAINTENANCE

OSMONICS OREC™ SP SERIES OZONE GENERATOR SUGGESTED MAINTENANCE INTERVALS

TIME INTERVAL	DAILY	MONTHLY	QUARTERLY	SEMI-ANNUALLY	ANNUALLY
AIR PREPARATION					
COMPRESSED AIR PRESSURE	INSPECT				
DRYER PRESSURE	INSPECT				
GENERATOR PRESSURE	INSPECT				
GAS FLOW	INSPECT				
DEWPOINT READING	INSPECT				
HUMIDITY INDICATOR STATUS	INSPECT				
PURGE FLOW OPERATIONAL?	INSPECT				
PRESSURE RELIEF VALVES			CHECK		
SEPARATOR FILTER		INSPECT	CLEAN		REPLACE
POST DRYER FILTER		INSPECT	CLEAN	REPLACE	
COMPRESSOR AIR INTAKE FILTERS		INSPECT & CLEAN	INSPECT & CLEAN		REPLACE
OZONE GENERATOR					
CABINET FILTER(S)				REPLACE	
WATER FLOW	INSPECT				
GENERATOR VOLTS	INSPECT				
GENERATOR AMPS	INSPECT				
GENERAL CLEANING (w/compressed air)			CLEAN		
POWERSTAT GENERAL CLEANING			CLEAN		
POWERSTAT BRUSHES			CLEAN		REPLACE
GAS OUTLET CHECK VALVE				INSPECT	REPLACE
DIELECTRIC CLEANING					CLEAN

OSMONICS OREC™ SP SERIES OZONE GENERATOR MAINTENANCE LOG

Ozone Generator Serial Number: _____

Feed Gas (circle one) AIR / OXYGEN

Location: _____

Gas Pressure: _____

DATE												
AIR PREPARATION												
COMPRESSED AIR PRESSURE (psig)												
DRYER PRESSURE (psig)												
GENERATOR PRESSURE (psig)												
GAS FLOW (scfh/lpm)												
DEWPOINT READING (optional)												
HUMIDITY INDICATOR STATUS (light blue/dark blue)												
PURGE FLOW OPERATIONAL? (yes/no)												
SEPARATOR FILTER (clean/replace every three months)												
POST DRYER FILTER (replace annually)												
COMPRESSOR AIR INTAKE FILTERS (clean/replace monthly)												

Make copies of these sheets for your maintenance log book!

SERVICE AND MAINTENANCE

OSMONICS OREC™ SP SERIES OZONE GENERATOR MAINTENANCE LOG

Ozone Generator Serial Number: _____

Location: _____

DATE												
OZONE GENERATOR												
CABINET FILTER(S) (replace twice/year)												
WATER FLOW (gpm/lpm)												
GENERATOR VOLTS												
GENERATOR AMPS												
GENERAL CLEANING (w/compressed air)												
POWERSTAT CLEANING (quarterly)												
GAS OUTLET CHECK VALVE												
DIELECTRIC CLEANING (inspect/clean annually)												

Make copies of these sheets for your maintenance log book!

SERVICE AND MAINTENANCE

Technical Service/Return Material Procedure

☎ **Contact your local distributor regarding support of your installed equipment.**

☎ **For service or technical support, OSMONICS OREC™ Technical Service Department can be reached by calling 602/931-7332, Monday through Friday, 7:00 AM - 4:30 PM Mountain Standard Time or faxing 602/931-7727.**

✉ **Mail and returns should be sent to:**

OSMONICS
Phoenix Operations
4953 W. Missouri Avenue
Phoenix, AZ 85301-6100 USA

When any merchandise is returned to the factory, please call and obtain a return material order (RMO) number and have the following information available:

- Customer's name, address, phone and fax numbers (Shipping and Billing).
- A hard copy purchase order number (no exceptions) for repairs or cases where parts are required that are not under warranty.
- A contact person's name and phone number to call if the equipment is beyond repair or to discuss any other warranty matter.
- Equipment model and serial numbers.
- Reason for return, i.e., repair, warranty, incorrect part, recalibration, etc.

We will then fax to your attention an RMO form that must accompany the returned item.

NOTE: THE RMO NUMBER MUST BE CLEARLY WRITTEN ON THE OUTSIDE OF THE PACKAGE(S) BEING RETURNED.

ANY ITEMS SENT BACK TO THE FACTORY WITHOUT AN RMO NUMBER WILL BE REFUSED AND RETURNED TO SENDER

SERVICE AND MAINTENANCE

Troubleshooting

This troubleshooting guide will assist you in identifying the most common operating problems you may experience with your machine. Many of these problems are easily corrected by the operator, but with other problems or those not understood, you should contact the OSMONICS Technical Service Department. Have the problem and symptoms clearly defined and operating data available.

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
Ozone Generator Does Not Start.	1. An interlock switch may be open.	1. Be sure that all panel doors are closed, the control light is on and the door light is off.
	2. A fuse may be blown in the main switch box or the control fuse.	2. Check continuity of the fuse with a multimeter. Find cause of blowing fuse; shorted component, etc.
	3. The master switch is in the AUTO position, the remote off light is on, indicating that the remote start switch is open (remote start function is optional).	3. Go to manual or close remote start switch.
	4. Thermo-melt circuit is open.	4. Repair as necessary.
Ozone Generator Fuses Blown. ***CAUTION: WHEN ACTIVE, THE SECONDARY OF THE HIGH-VOLTAGE TRANSFORMER CAN BE UP TO 18,000 VOLTS!***	To locate the cause of the blown ozone fuse, shut off the safety switch, ground the secondary terminals of the high-voltage transformers to remove any capacitive voltage, remove the high-voltage (secondary) leads from the high-voltage transformer and insert a new fuse. Switch on the safety switch, start the unit and raise the variable voltage transformer raise/lower control. If the fuse does not blow, then the problem is in an ozone dielectric assembly. With the power off, attach one tube at a time and raise the power. When the fuse blows, it indicates a faulty dielectric assembly. Replace the dielectric assembly. ***NOTE: ALWAYS SWITCH OFF THE SAFETY SWITCH BEFORE TOUCHING THE HIGH-VOLTAGE COMPONENTS.*** ***NOTE: ALWAYS GROUND HIGH-VOLTAGE SECONDARY TERMINALS BEFORE TOUCHING.***	

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
Control Fuse Blown.	A blown control fuse indicates either a short circuit in the wiring or a bad control component is drawing excessive current.	Isolate failed component or wiring and replace.
Ozone Generator Shuts Down, Sounding Alarm Two Minutes After Start-Up. (General. See other areas for further descriptions.)	1. The generator air pressure may be under 10 psig (0.7 bar). 2. A high ozone condition may exist at the location of the monitor (optional). 3. An external interlock may fail or be in an alarm state.	1. Be sure that the dryer pressure is at least 40 psig (2.8 bar). 2. Locate the source of the ozone: plumbing line came loose, leak in plumbing fitting, too much ozone applied to process, etc., and take corrective measures. 3. Determine which interlock may have caused the alarm and correct.
AUTOMATIC PRESSURE, TEMPERATURE, HIGH OZONE OR DRYER SHUTDOWN. **Gas Pressure Light** (LARGE SP UNITS ONLY)	1. The air compressor may be overloaded. 2. The pressure is not achievable and the compressor is operable. 3. The generator pressure may have dropped below 5 psig (0.3 bar) or raised above 22 psig (1.5 bar). 4. Failure of air compressor. 5. Limit switch has bad contacts. 6. Limit switch not functional or out of adjustment or need mechanism lubricated.	1. Allow compressor to cool and start again. Check compressor information in Appendix. 2. Check for system leaks and be sure that the compressor air inlet filter is not restricted. 3. Restart machine, reduce generator pressure to 2 or 3 psig (0.1 or 0.2 bar) and raise up slowly to over 5 psig (0.3 bar). 4. Check filters or consult compressor information in Appendix. 5. Clean contacts with 300 grit sandpaper. 6. Adjust, lubricate or replace the switch.

SERVICE AND MAINTENANCE

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
AUTOMATIC PRESSURE, TEMPERATURE, HIGH OZONE OR DRYER SHUTDOWN. **Generator Temperature Light** (LARGE SP UNITS ONLY)	1. The cooling water flow may be too low.	1. Refer to data sheet for minimum cooling water flow at 70°F (21°C) water inlet temperature. ***NOTE: ALLOW 10 MINUTES FOR THE OZONE GENERATOR TO COOL BEFORE RESTART.***
	2. The air flow may be too low.	2. Refer to data sheet for specific gas flow rate.
	3. The inlet water temperature may be too high.	3. May have to find other source for cooling water or add chiller (maybe go to closed-loop system).
	4. Clogged plumbing fitting in the water cooling system.	4. Check for water flow at flow meter. Filter this water prior to entry of cooling system.
	5. Failed temperature switch resulting in false alarm.	5. With power off, check continuity of the temp. switch after pulling one of its wires from the terminal switch.
AUTOMATIC PRESSURE, TEMPERATURE, HIGH OZONE OR DRYER SHUTDOWN. **Water Flow Light** (LARGE SP UNITS ONLY)	1. The water pressure may be too low or too high.	1. Reduce pressure to zero and slowly raise to 20 psig (1.4 bar) as indicated on the water pressure gauge. Make sure pressure is regulated to at least 18 to 22 psig (1.2 to 1.5 bar).
	2. Water flow may be outside of acceptable range.	2. Ensure that water flow is within range.

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
AUTOMATIC PRESSURE, TEMPERATURE, HIGH OZONE OR DRYER SHUTDOWN. **High Ozone Light** (Optional)	1. A high ozone condition exists at the location of the monitor. 2. The concentration set adjust on the monitor has been set too low. A problem exists with the monitor's operation. 3. There may be interference from other gases or smoke near the monitor gas sample inlet.	1. Locate the source of the ozone: plumbing line came loose, leak in plumbing fitting, too much ozone to process, etc., and take corrective measures. 2. Refer to the monitor's manual. 3. Smoke from cigarettes, etc., can cause false alarm situations. Many chemicals and gases can cause alarm conditions. The monitor's environment must be free of gases, chemicals or smoke.
AUTOMATIC PRESSURE, TEMPERATURE, HIGH OZONE OR DRYER SHUTDOWN. **Backflow Light** (Optional)	Water has backed up and engaged the backflow leak detector.	Open backflow drain and remove any water. Replace any check valves in the line.
Unable to Achieve Normal Amperage at Normal Voltage	1. Fuses may be blown. 2. Dielectric assemblies may have failed.	1. Turn off or lock out the safety switch. Check the fuses. If blown, replace. 2. See Dielectric Assembly Failure section of this manual.

SERVICE AND MAINTENANCE

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
Extreme Flicking of the Ammeter Needle	This is usually indicative of an arcing dielectric caused by moisture in the system.	Lower the voltage. Observe the relative humidity indicator paper in the top of the gas flow meter. It must be blue. If it is not blue, proceed as follows: • Check the water separator filter for automatic purge draining. • Assure the integrity of the automatic dryer system. • Be sure that the water has not backed up into the system from the ozone outlet. • Remove and clean dielectric assemblies.
DIELECTRIC ASSEMBLY FAILURE **Locating Faulty Dielectric Assembly** ***<u>WARNING</u>: ALWAYS SHUT OFF OR LOCK OUT ALL SAFETY SWITCHES AND CIRCUIT BREAKERS WHEN WORKING WITH THE DIELECTRIC ASSEMBLIES AS THE HIGH VOLTAGE TRANSFORMER ACHIEVES VOLTAGES UP TO 15,000 VOLTS. GROUND THE SECONDARY TERMINALS OF THE HIGH VOLTAGE TRANSFORMERS TO REMOVE CAPACITIVE VOLTAGE AND FOR SAFETY WHILE HANDLING THESE TERMINALS.***	If the ozone generator fuse blows, turn off the main power and remove all high-voltage generator leads from the high voltage transformer. Replace the generator fuse and start up the ozone generator. Raise voltage. If the fuse does not blow, then the transformer is good and there is a faulty dielectric assembly. Turn off the main power and isolate each dielectric assembly lead. Connect on lead to the transformer. Restart the unit and raise to full power. Continue by the process of elimination until the last added dielectric lead blows the fuse and/or pulls more current on the ammeter than the other dielectric(s), which indicates the faulty dielectric assembly. Once the faulty dielectric assembly has been located, completely isolate the high voltage lead from the other dielectric assembly leads. Reconnect all good dielectric assembly leads and operate until it is convenient to replace the faulty dielectric assembly. ***<u>CAUTION</u>: DO NOT DISCONNECT THE GAS AND WATER TO THE FAULTY DIELECTRIC ASSEMBLY.*** **There will be a proportional loss of ozone output.** ***<u>CAUTION</u>: DO NOT EXCEED MAXIMUM VOLTAGE LIMITS.*** **Accept the lower current until the faulty dielectric assembly can be replaced.**	

PROBLEM	CORRECTIVE ACTION
DIELECTRIC ASSEMBLY FAILURE **Removal Of Broken Ozone Dielectric Assembly**	Turn off all electrical power to the unit. Remove the dielectric assembly access panel on the top of the ozone generator. At least 48 in of clear space above the ozone generator should be available for dielectric assembly removal. Remove eight flange bolts from the faulty dielectric assembly white end cap. The dielectric should spring up and out of the stainless steel tube about 1 inch (2.5 cm). Lift the end cap and glass (together as one unit) from the stainless steel generator tube by grasping the complete assembly under the end cap. If the glass is too badly shattered or unreachable, it will be necessary to remove the complete generator assembly. The complete assembly consists of a stainless steel tube, water cooling jacket, and dielectric with end cap. To do this, drain the water from the ozone generator, and remove all plumbing and electrical connections associated with the faulty dielectric assembly. Unscrew one side of the water jacket straps and remove the generator assembly from position. Once the assembly is out, shake out all the glass from the assembly. Before installing the new dielectric assembly, swab out the stainless steel tube first with deionized (best) or distilled water and then with isopropyl alcohol (medical grade) and lint-free cloths. Swab stainless steel tube dry. Reconnect all piping. Insert new dielectric into the top of the ozone generator tube. ***WARNING: IT IS IMPERATIVE THAT THE GREEN GROUND LEAD BE RECONNECTED.***

PROBLEM	CORRECTIVE ACTION
DIELECTRIC ASSEMBLY FAILURE **Installation of New Dielectric Assembly, Complete with New End Cap and High-Voltage Cable**	***CAUTION:*** ***DO NOT REMOVE THE END CAP FROM THE DIELECTRIC AT ANY TIME.*** It is best to handle dielectrics wearing surgical gloves. Wipe off the exterior of the dielectric and Teflon strip with a clean, lint-free cloth saturated with alcohol. Allow the alcohol to dry before inserting the dielectric. ***CAUTION:*** ***DIELECTRICS MUST BE CLEAN FROM DIRT, MOISTURE AND OILS, INCLUDING HUMAN BODY OILS.*** Place the gasket on the stainless steel flange. Insert the dielectric, being careful not to scratch the glass. Be sure that the Teflon strip butts up against the end cap and is opposite the gas inlet of the stainless steel tube. Tighten the eight bolts evenly and snugly (**DO NOT OVER-TIGHTEN)**. Reconnect the secondary cable at the high voltage transformer. ***WARNING:*** ***IT IS IMPERATIVE THAT ALL HIGH-VOLTAGE WIRES ARE AT LEAST 1 INCH (2.5 CM) FROM ANY GROUND POTENTIAL (METAL ALLOY PLUMBING, BOLTS, NUTS, STEEL STRUCTURE).*** Purge feed gas through unit (**DO NOT GENERATE OZONE**) for a minimum of six hours (overnight is best) before applying voltage to the ozone generator assemblies, thus purging the system of all humidity. Take note of humidity paper for blue color indicating dry feed gas. ***WARNING:*** ***IF IT IS EVER NECESSARY TO REMOVE THE COMPLETE DIELECTRIC ASSEMBLY, IT IS IMPERATIVE THAT THE GREEN GROUND LEAD (BOLTED TO THE STAINLESS STEEL TUBE) BE RECONNECTED TO GROUND STUD IN THE FLOOR OF THE CABINET.***

For more information call toll free in the USA (888) 321-8200

Manufactured in the USA

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