HECD-65 and HECD-130

OWNER'S MANUAL

DEL OZONE™

EPA Estab. No. 071472-CA-001

Patent Pending

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DEL OZone™

CAUTIONS AND GENERAL NOTES

This manual covers all DEL Industries, Inc. CD Series Corona Discharge (CD) Ozone Generators, models HECD-65 thru HECD-130. Any variations in system operation or configuration between these models are noted in the text. The principal difference between them is ozone production capacity and air preparation systems. These differences are outlined in the specification section of this manual.

DEL Industries, Inc. reserves the right to make changes to the product covered in this manual to improve performance, reliability, or manufacturability. Make sure that this manual is used with the original product it was shipped with. Although every effort has been made to ensure accuracy of the information contained in this manual, DEL Industries assumes no responsibility for inadvertent errors.

IMPORTANT SAFETY INSTRUCTIONS

READ AND FOLLOW ALL INSTRUCTIONS.

- Read this manual completely before attempting installation and/or operation.
- Install in accordance with the installation instructions.
- Connect to a grounded, grounding type receptacle only.
- Warning - To reduce the risk of electrical shock, replace damaged cord immediately.
- Follow all applicable electrical codes.
- Electric shock hazard. Be sure to turn power OFF and disconnect from power source before any service work is performed. Failure to do so could result in serious injury or death.
- Warning - Short term inhalation of high concentrations of ozone and long term inhalation of low concentrations of ozone can cause serious harmful physiological effects. DO NOT inhale ozone gas produced by this device.
- For your safety, do not store or use gasoline, chemicals or other flammable liquids or vapors near this or any other appliance.
- A spontaneous and violent ignition may occur if oil, grease or greasy substances come in contact with oxygen under pressure. These substances must be kept away from oxygen regulators, cylinder valves tubing and connections, and all other oxygen equipment.

SAVE THESE INSTRUCTIONS!

SECTION 1
General Information

1A. Description

The Corona Discharge ozone generator described in this manual is designed to provide the benefits of ozone gas in an environmentally safe and effective manner. The high quality, specially engineered components ensure efficient ozone output and reliable performance.

1B. Specifications

1B-1. Ozone Output - See Table 1
1B-2. Power Requirements - See Table 1
1B-3. Weight - See Table 1
1B-4. Location Requirements
Mounting: Mount in a clean, protected area.
Ambient Temp: 40°F - 90°F (5°C - 40°C)

1C. Standard Features

1. Models available for ozone production rates of 65 and 130 grams per hour.
2. Medium Frequency, Cold Cathode Corona Discharge.
3. Water cooled vertical tube in shell design.
4. Glass tube dielectric.
5. All stainless steel generator module.
6. Incorporated Oxygen concentrator.
7. Computer controlled with 4 line backlit LCD text display operator interface.
8. ORP control.
9. Variable output.
10. Complete ozone isolation during shut-down.
11. Auto feed-gas flow control to maintain proper operational set points.
12. Amperage display and monitoring by the control system.
13. NEMA-3R White powder coated steel enclosure.
14. Contacts for remote:
    Ambient ozone monitor shut-down
    User interlock
15. Fault protection from:
    Water backflow
    Door open
    Cooling water flow loss
    Feed gas pressure failure
    Low oxygen concentration
    Suction loss
    Overheating
    High ambient air temperature

1D. Accessories and Optional Equipment

1. Ambient ozone monitor / controller
2. Dissolved ozone monitor / controller
3. Mixing / Degassing tower
4. Contact / Degas tanks
5. Degas valves
6. Catalytic ozone destruct units
7. Dry-Tap sensor port
8. Injectors & injector assemblies
9. Ozone flow splitters/controllers
10. Closed-loop cooling
11. Flow switches
12. Booster pumps

1E. Warranty Summary

Limited Warranty:
Two (2) years on entire generator (providing required routine maintenance is performed)

Table 1: Specifications Chart.

MODEL NUMBER		HECD-65	HECD-65-50	HECD-130	HECD-130-03
STD. NOMINAL VOLTAGE		230 VAC, 60Hz, 1Ø	230 VAC, 50Hz, 1Ø	230 VAC, 60Hz, 1Ø	230 VAC, 50Hz, 1Ø
ELECTRICAL LOAD	Amps	13	13	16	16
CAPACITY[1]	lbs/day	3.5	3.5	7	7
	grams/hour	65	65	130	130
OXYGEN FEED-GAS FLOW	scfh	30 max	30	60 max	60 max
	lpm	14	14	28	28
COOLING WATER REQUIRED[2]	GPM	1 (nominal)	1(nominal)	1.5 (nominal)	1.5 (nominal)
	lpm	4	4	6	6
[1]Capacities listed at 5.75% wt. concentration and 60°F (16°C) cooling water					

SECTION 2
Installation

1. Upon receipt inspect HECD generator for evidence of shipping damage. Immediately report any damage to the shipping company.
2. Once the generator is in its mounting position, bolt down using the 5/16" mounting holes in the cabinet feet.
3. Connect Water In/Out: ½" FPT fittings are provided on field connection panel as shown in Figure 1. Plumb the cooling water from a clean, filtered source using copper, Teflon, or PVC tubing. DO NOT USE WATER HIGH IN CHLORIDE! Flow requirements for each unit are listed in the specifications (See chart on inside of cabinet door.)
4. Connect Ozone Out: A ¼" FPT stainless steel fitting is provided on the field connection panel as shown in Figure 1. Plumb the ozone output to the injector assembly input via a stainless steel ball valve and check valve. See Figure 2. Ozone supply tubing must be constructed of 316 stainless steel or rigid Teflon tubing. Use of any other material will lead to failure of the tubing and cause vacuum loss or allow ozone to escape the system.

NOTE: The ozone gas supply line must have a back flow prevention device (such as a check valve) installed between the ozone generator and the point of injection to prevent water from backing up into the generator system.

5. Electrical Connection: Connect input power and ground to the main circuit breaker and din rail terminal located on the inside of the field connection panel (see Figure 1). Power requirements for each generator are listed in the specifications chart on the inside of the cabinet door.
6. ORP Sensor Installation: Consists of mounting the ORP probe and routing the sensor cables.
   A. Flow Cell / ORP Probe Mounting (Preferred Installation)
      1. Refer to installation instructions included with the DT-1000 flow cell.

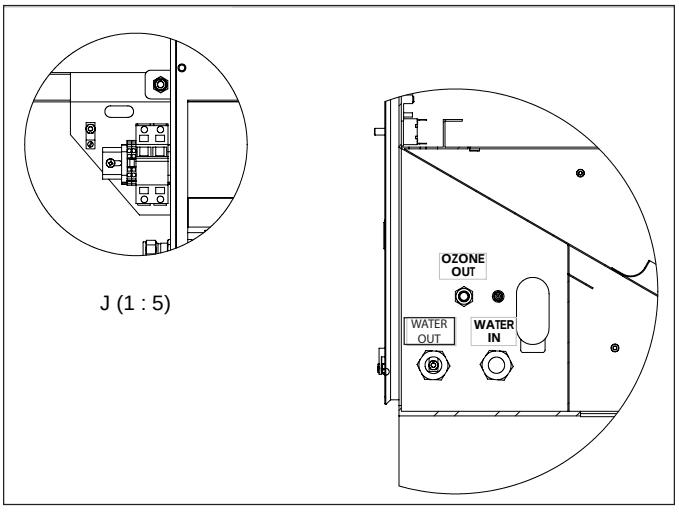


Figure 1: Generator Connectors

   B. ORP Probe Mounting (without flow cell) The sensor should be placed in the process pipe at a point up stream from the point of ozone injection (or other suitable location as determined by process requirements).
      1. Locate the point of insertion in the process pipe. Avoid elbows, tees or other fittings that may contribute turbulence to the treatment flow. See figure 3.
      2. Install an appropriately sized "tee", or alternately, drill and tap 1/2" FPT in the process pipe.
      3. Remove the protective cap and apply Teflon tape to the sensor threads. Thread the sensor into the fitting or tapped hole. Save the protective cap for storage.

      NOTE: Do not allow sensor to dry. Keep in protective cap until system is full of water.

      4. Start the circulation system and check for leaks around sensor.

      NOTE: Over tightening of sensor may cause leaks and/or damage to the sensor.
   C. ORP Cable Routing: Route the cable away from other power wires and protect cable from damage. (i.e. Conduit or attached to plumbing.) Connect the sensor cable to the ORP controller.

7. Dissolved Ozone Monitor/Controller: See ATI Owner's Manual for installation and operation instructions.

8. Final Inspection: Before starting up the ozone generator system check that all mechanical connections are leak proof and that electrical connections are shielded and well insulated. Visually inspect the inside of the generator cabinet for loose wires or connections. Remove all debris from enclosure interior and around installation.

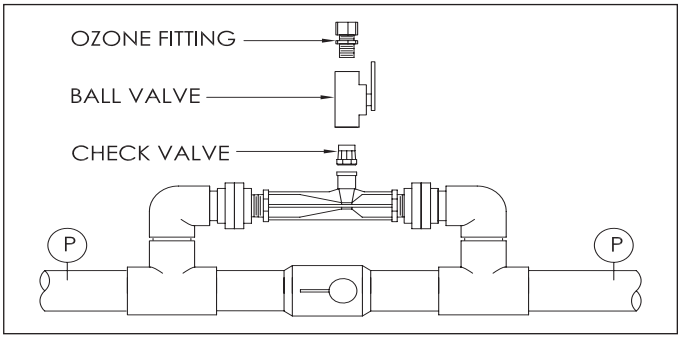


Figure 2: Injector Assembly

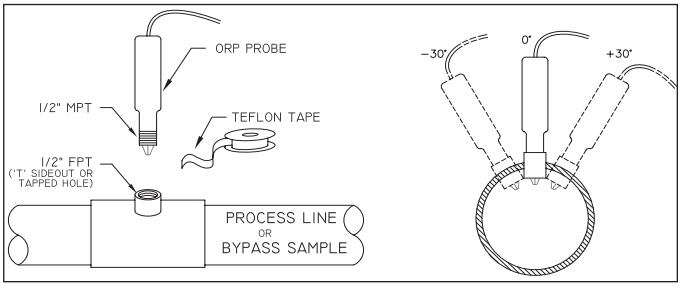


Figure 3: ORP Probe

SECTION 3

System Overview

3A. Control System Components

1. Operator Interface Panel (OIP): Located in the upper right-hand exterior surface of the enclosure. This 4 line LCD display with function buttons (as described below) provides operational data as well as system control. Indicator LED's along with test messages inform the operator of functional conditions of the unit.
2. Programmable Logic Controller (PLC): Mounted within the control unit. The controller and operating software have been designed to control and report all generator functions. Safety interlocks ensure proper activation/shutdown sequences of system functions and are reported through the OIP. Analog IO is analyzed and also reported through the OIP. ORP and external interlocks are built into the controller as well.
3. DC Power supply: Mounted within the Control Unit. Supplies 24 Vdc power to control system components. All relay coils, solenoids, sensors and safety interlocks are powered from this DC source.
4. Power Relays: Two relays mounted within the control unit provide 240 Vac to the air compressors, blower and oxygen concentrator(s). These are controlled by the PLC and provide a green LED indicator when activated.

3B. System Interlocks and Sensors

1. Water Back-flow Detection Unit: Unit is plumbed into the ozone outlet line. Any water reaching this point is trapped and collected. When water is detected in the unit the PLC is signaled causing an immediate shutdown of the high voltage circuitry and the output solenoid valve. A fault message is displayed on the interface panel. The air preparation system remains running for an additional 30 seconds to overcome any trapped vacuum. The fault condition remains until the operator has drained water from the device using the ball valve located on the bottom of the unit. After ensuring that all water has been removed from the unit the system may be restarted normally.

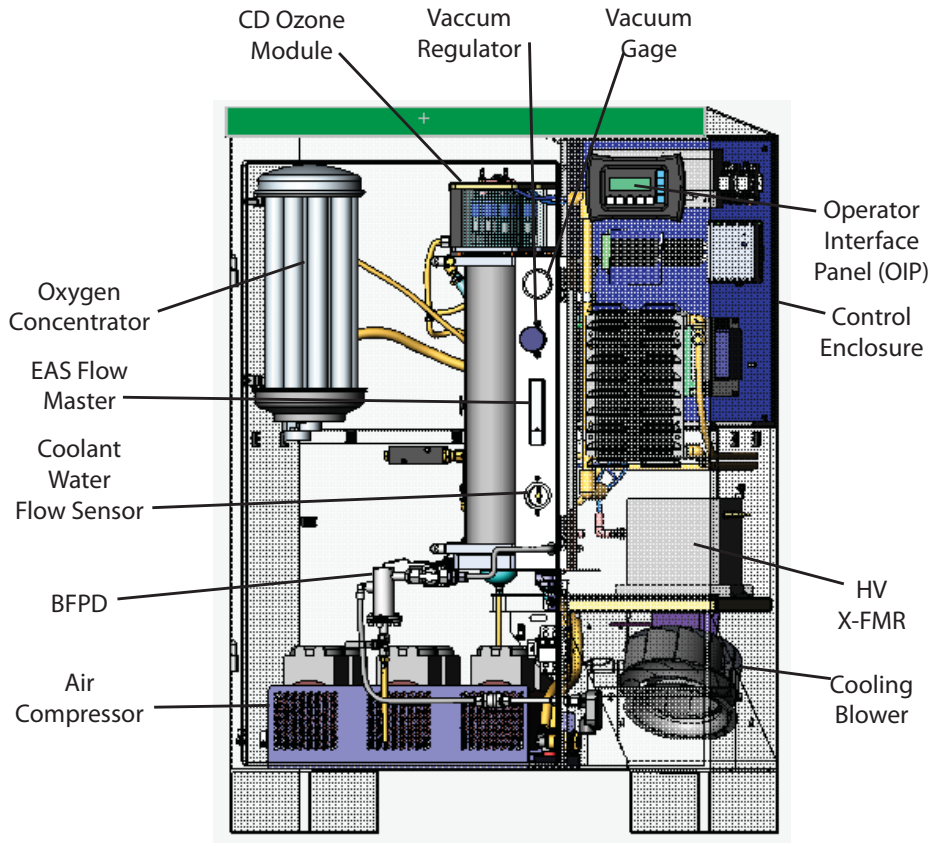
NOTE: Water back flow protection/fault conditions occur when water back flow prevention devices have failed. Prior to re-starting the generator, any solenoid valves, check valves or other protective devices must be replaced.

2. Low Pressure Limit Switch: This switch is located in the oxygen sensor enclosure located on the upper rear interior wall and connected to oxygen supply tubing. If pressure in the oxygen feed gas line drops below 2 psig the switch opens initiating a system shutdown and displaying a fault message on the interface panel.
3. Vacuum Switch: This switch is located on the flow panel and connected to the gage port on the Vacuum Regulator. If the vacuum in the ozone supply line falls below 1 psig (2 in.Hg) the switch will open initiating a system shutdown and displaying a fault message on the interface panel.

NOTE: The injection point (venturi) that receives ozone from the generator must be drawing at least 15% greater flow (scfh) than the feed gas rate of the ozone generator. A slight vacuum will be developed in the ozone generator due to this flow differential.

4. Transformer Temperature Limit Switch: This limit switch is located on the high voltage transformer(s). If the case temperature of the transformer rises above 150°F (66°C) the switch will open initiating system shutdown and displaying a fault message on the interface panel.
5. Coolant Temperature Limit Switch: This limit switch is located on the water jacket of the ozone module. If coolant temperature rises above the 110°F (43°C) setpoint of the switch it opens initiating system shutdown and displaying a fault message on the interface panel.
6. Door Interlock Switch: Attached on the right side of the enclosure door opening, this switch will shut down the H.V. power circuit immediately, if the door is opened, and initiate a full shut-down. A fault message is displayed on the interface panel.
7. Ambient Ozone and External Interlock: This circuitry functions as other safety interlock switches but is designed for field wiring to external control devices. Terminals for field wiring are located on the DIN rail next to the input power circuit breaker. Circuit requires a dry contact to switch 24 Vdc @ 10mA as supplied by the Generator's internal supply.
8. Coolant Flow Sensor: This device is located on the flow panel and supplies the PLC with a pulse output proportional in frequency to the coolant flow rate. If coolant flow drops below .5 GPM the PLC initiates system shutdown and displays a fault message on the interface panel.
9. Oxygen Flow Sensor: This device is located in the oxygen stream in the oxygen sensor enclosure and supplies the PLC with an analog signal proportional to oxygen flow rate.
10. Oxygen Concentration Sensor: This device is located in the oxygen stream inside the oxygen sensor enclosure and supplies the PLC with an analog signal proportional to oxygen concentration rate. If oxygen concentration falls below 80% the PLC initiates system shutdown and displays a fault message on the interface panel.
11. Ambient Air Temperature Limit Switch: This limit switch is located on the lower right hand corner of the enclosure. If the ambient air temperature rises above 100°F (37°C) the switch will open initiating system shutdown and displaying a fault message on the interface panel.

Figure 4: System Layout Diagram



3C. High Voltage Power Supply

CAUTION: LETHAL VOLTAGES ARE PRESENT. NEVER BYPASS SAFETY INTERLOCKS.

1. Power Inverter: This device is mounted within the control unit and supplies a regulated frequency (factory set) controlled AC Pulse Train to the primary windings of the High Voltage Transformer(s). Power delivered to the HV circuit is modulated by the PLC with input from the OIP (Ozone Power Level).
3. High Voltage Transformer(s): Steps voltage supplied by the inverter up to the necessary level for ozone production. Primary connections are located against side wall of the enclosure. High Voltage terminal (secondary) is located facing into the main enclosure.
4. High Voltage Cable(s): Delivers the output of the H.V. transformer to the module H.V. housing. The cable assemblies are fitted spark plug style terminals to mate with terminals on the transformer and H.V. housing insulator plate on the module.

3D. Corona Discharge (CD) Modules

1. CD Water Jacket: The water jacket consists of a stainless steel outer tube and 7 small inner tubes (ground tubes) with a plate on each end sealing the heat exchanger and providing connection points for air, ozone and cooling water. Gaskets provide a seal on each end to the high voltage housing on top and the end cap on bottom.
2. High Voltage Cold Cathode Electrodes: Each generator module contains 7 gas filled electrodes.
3. High Voltage Housing: Consists of a specialized ceramic head bonded to a glass cylinder. This housing provides means of high voltage feed to the electrode connecting sockets and isolation from the water jacket.
4. End Cap: Machined cap provides end sealing for the CD Cell and vertical electrode support. Specialized conical springs in the cap cradle the glass tubes and center the end within the ground tubes.
5. Gaskets and Centering Disks: Die-cut gaskets provide the seal between end housings and the water jacket. An additional disk within the HV housing provides centering support for electrodes. These are all service items and should be replaced as normal maintenance with any module cleaning and service.

3E. Air Preparation and Oxygen Control

1. Air Compressors: Each generator incorporates a set of air compressors designed and sized to provide on-board oxygen concentrators with the required air volume flow rate and pressure. These are mounted to a common tray secured in the bottom of the enclosure. Compressors receive power through power relays in the control unit. Compressor on/off control is regulated by the PLC.

2. Oxygen Concentrator(s): Each oxygen concentrator receives power indirectly from the PLC through a power relay located in the control unit (see Figure 4). The PLC monitors oxygen system performance and will fault if flow, pressure or oxygen concentration fall below 80%. The PLC regulates start/stop cycling to allow steady state performance and purge cycles during startup and shutdown.
3. Output Solenoid Valve: The solenoid valve is located on the ozone output supply line. It isolates the generator during shut down. This solenoid valve receives power directly from the PLC which controls its operation based on oxygen performance, water back flow, vacuum and pressure in the system.
4. Flowmeter: Indicates the flow of oxygen entering the ozone generator. Factory flow settings are listed in the specifications for each system. (See specifications on the inside of the door.) This meter is in addition to the oxygen flow sensor and the value displayed on the OIP.
5. Oxygen Orifice: Sized to regulate oxygen flow to the maximum capacity of the oxygen concentrator(s).
6. Vacuum Regulator: Regulates the oxygen flow into the generator module based on a vacuum set point (factory set to 3-5 in Hg). When sufficient suction is being developed by the injector(s) downstream the regulator will allow full flow (as set by the Orifice above) to pass. As suction is reduced, flow is restricted proportionally to maintain the vacuum set point. If suction is lost completely flow is cut off.
7. Vacuum Gage: Displays the vacuum developed at the vacuum regulator (above.) Typically the gage will read the set point unless excessive suction is attempting to overdraw the system.

3F. Operator Interface

The Operator consists of an LCD display, a keypad, and indicator LEDs.

3F-1. Display

1. The display contains several lines of system information and configuration menus.

3F-2. Control Buttons

1. Use the Up and Down Arrow keys to scroll through the menu. Press the Enter key to view sub-menus and the ESC key to go back up one level.
2. In the "Settings" and "Maintenance" menus, choose a setting by scrolling up or down with the arrow keys. Press enter to edit the setting and use the arrow keys to increase or decrease the setting value. Press the ESC key when finished.
3. User Function keys are as follows:

Key	Function
F1	Toggle Startup and Shutdown.
F2	Toggle Standby mode.
F3	Not used
F4	Acknowledge Error messages
F5	Not used

3F-3. LED indicators

1. LED indicators serve as status indicators.

LED	Status	Indication
F1	On	System is in Startup mode.
	Off	System is in Shutdown mode
F2	On	System is in Standby mode.
	Off	System is not in Standby mode.
F3	On	ORP is below set point.
	Off	ORP is above set point.
F4	On	Not Used
	Off	Not Used
F5	On	Service Interval Expired (See Maintenance Menu)
	Off	No Service Interval expired.

SECTION 4
Operation

Upon completing all of the generator system connections outlined in Section 1, GO TO APPENDIX A, COMPLETE PRE-COMMISSIONING CHECKLIST and FAX TO DEL INDUSTRIES AT 805-541-8459. Once form has been faxed, call DEL at 805-541-1601 to schedule commissioning. Your generator is ready for initial start up. After start up the control system will automatically cycle the generator on and off as needed to maintain water quality. Initial system start up procedures would need to be followed again in the event of a safety interlock system shut down or an interruption in the main power.

4A. Control System Start-Up

1. Start process water circulation to produce a vacuum in the suction port of the injector. Open isolation valve in ozone supply line if so equipped.
2. Start cooling water and verify flow.
3. Verify that all sensor circuits are properly connected.
4. Toggle main circuit breaker to the "ON" position. Close the door.

   NOTE: Door must be closed for the system to operate.

Push F1 "ON/OFF" button. The system's cooling fan will start and the oxygen concentrator will begin operating, unless a shutdown has occurred within the past 60 seconds, in which case the system will start after the 60 seconds has elapsed. After approximately 5 seconds the output solenoid valve will open. However, the system will not start under any of the following conditions:

1. If the ORP level is already above the set point of the ORP controller.
2. The system will not start up if the door is not secured. A door interlock switch is incorporated into the enclosure to prevent accidental exposure to high voltage components.
3. The system will not start up if there is not enough vacuum being generated by water flow through injector.
4. The system will not start up if there is not enough coolant water flowing through the generator.
5. The system will not start up if the oxygen concentration is not at least 80%.
6. The system will not start up if the ambient air temperature is greater than 105°F (41°C).

If you experience complications, see TROUBLESHOOTING section 7 or call 800-676-1335 for assistance. If water flow is not detected by the flow sensor within 30 seconds after start up, the system will go into shut down mode. The cooling fans and oxygen concentrator will remain on for 30 seconds and then shut down. If water flow detected by the flow switch, the ozone generator time delay circuitry will be activated, and the ozone generator will start up after a 5 minute delay.

4B. Feed gas Flow System Preparation

The oxygen concentrator systems are factory set to optimal values and should not require adjustment. Vacuum regulators and pressure limit switches are factory set for normal operating conditions but may need minor adjustment after installation, depending on the size and number of injectors used. Once 'dialed in' for a particular installation these instruments maintain proper operation with minimal subsequent maintenance.

The vacuum regulator is factory set to maintain a slight vacuum within the system up to the maximum rated flow of the generator. To do so the suction rate provided by the injector(s) must exceed the rated flow of the generator by approximately 10-15%. As suction increases, beginning at 0 scfh, the regulator will gradually allow an increasing flow of oxygen through the system, up the maximum rated flow of the generator.

As suction is decreased (by reduced motive flow through the injector or shutting down of one of a series of injectors) the regulator will decrease flow proportionally so as to maintain the vacuum set-point. If no suction is offered at all the flow will be cut off and the vacuum limit switch will signal the PLC that a loss of vacuum has occurred.

NOTE: Too much suction from the injector(s) could cause damage to the ozone generator. The vacuum gage should read between 2in/Hg. (low vacuum limit set point) and 10in/Hg+2) for proper operation.

4C. ORP Controller Preparation

Refer to the ORP Controller Owner's Manual for instructions on setting up the ORP controller.

4D. Dissolved Ozone Monitor/Controller Prep

Refer to ATI Owner's Manual for instructions on setting up the dissolved ozone monitor/controller.

4E. Ozone Generator Start-Up

At this time there should be specified feed gas flow through the flowmeter, the cooling fans should be operating, the oxygen concentrator should be running, and the output solenoid valve should be open. The ozone generator will automatically be activated five minutes after the air prep circuitry has started processing feed gas.

4F. System Shut-Down

The following sequence of steps must be used when shutting down the ozone generator system either for servicing or for storage.

1. Press the F1 button on the OIP to immediately halt ozone production. Air preparation system will remain on for an additional 30 seconds, and an internal 60 second timer will begin. This timer will delay any subsequent startup by any of the remaining 60 seconds to allow compressors to vent excess pressure.
2. If desired, turn off the process water circulation pump to deactivate the flow switch.
3. The generator is now fully shut down and the system start up procedures must be initiated to bring the unit back into operation.
4. If the system is going to be shutdown and stored during freezing weather, it is very important that the cooling water jacket be drained to protect it from freezing.

SECTION 5

Maintenance & Service

CAUTION: COMPRESSORS ARE EXTREMELY HOT!

5A. Preventative Maintenance Schedule

24 hrs. Time Estimate: (5 min.)

1. Verify that no fault messages are displayed on the OIP and ORP readings indicate normal operation.
2. Check indicators of all meters (flow, amps, vacuum, oxygen concentrator inlet pressure, flowmeter and vacuum) for proper levels.
3. Check water level in the contact tank (or mixing tower) and flow through off-gas vent.

168 hrs. (10 Min.)

1. Perform normal daily inspection.
2. Visually inspect cabinet filter for foreign objects or obstructions. Clean as needed.
3. Visually inspect compressor air filters for foreign objects or obstructions. Clean and replace as needed.
4. Visually inspect coalescing filter for moisture and soiling. Clean bowl and replace filter element as required.
5. Check CD module insuring all electrodes are lit.
6. Check for proper vacuum and air flow at the flowmeter, adjust as needed.
7. Check for proper operation of the ozone destruct unit and water dump valve.

Monthly (30 Min.)

1. Perform normal weekly maintenance.
2. If used, clean ORP/pH electrodes. Remove the sensor from the water line, wash it with a detergent solution, rinse well, and follow with a muriatic acid wash (soak approx. 30 seconds). Return the electrode to the water line.
4. Perform a function test and calibration of ambient ozone monitor (if installed).

Every Three Months (45 Min.)

1. Perform normal monthly maintenance.
2. Visually inspect cooling fans and filter. Clean filters as required.
3. Inspect oxygen concentrators for proper operation. Ensure that flow rates and pressures are normal. Log hours (max of 10,000 hours till rebuild of compressor is necessary.)
4. Check oxygen plumbing for evidence of chafing. Repair as needed.
5. Test all PLC safety interlocks.

Every Six Months (1 Hour)

1. Perform normal three month maintenance.
2. Inspect high voltage transformer thermo switch, power contacts and high voltage feed through for security, corrosion and remove dust buildup.
3. Perform general cleaning and good housekeeping steps throughout the cabinet.
4. Inspect electrical system for corroded contacts or chafed wires. Clean/repair.
5. Check that the high voltage cable is not chafing on the high voltage transformer.

Every Twelve Months (1-2 Hours)

1. Perform normal six month maintenance.
2. Disassemble, inspect and clean corona discharge ozone generator module. Refer to system service section.
3. Inspect the cabinet interior for evidence of any water leaks and resulting damage or corrosion.

5B. Corona Discharge (CD) Module Service

5B-1. CD Module Removal

1. Perform normal system shut down procedure.
2. Turn main circuit breaker off
3. Turn cooling water off.
4. Disconnect cooling water lines located on the bottom of the flow panel.
5. Disconnect the ozone tubing at the elbow on the BFPD.
6. Unscrew the two wing screws located on the end of the flow panel.
7. Swing flow panel out side of enclosure.
8. Disconnect the HV cable on the top of the CD module.

5B-2. CD Module Disassembly

1. Remove the ¼-20 allen head screws securing the top section (end cap) of the generator.
2. Set aside the end cap and gasket. This will expose the ends of the high voltage electrodes which are enclosed by ground tubes.
3. The electrodes can be disconnected by gripping the exposed ends firmly and carefully pulling the electrodes out. (Twisting the electrodes slightly will help with removal).
   CAUTION: Place electrodes in a safe place to prevent damage.
4. Remove the ¼-20 allen head screws securing the bottom electrode housing to the module. Set housing aside for inspection.

5B-3. Inspect CD Module Components

1. End Cap
   a. Inspect end cap electrode springs for damage and/or corrosion. Clean, repair, or replace as needed.
   b. Inspect gasket for damage. Replace if needed.
2. High Voltage Housing
   a. Inspect high voltage housing for cracks and bonding interfaces to ceramic cap and aluminum fastening ring, replace if necessary.
   b. Inspect bottom of housing for evidence of water intrusion and excessive corrosion. (This may indicate a water jacket failure or back flow problem). Troubleshoot cause and replace parts as needed.
   c. Inspect gasket for damage. Replace if needed.
3. Electrodes
   a. Inspect for deposit buildups, pitting or cracks. Replace as needed.

4. CD Water Jacket
   a. Remove Teflon centering disc from top of module.
   b. Clean thoroughly then inspect all weld seams. Pay particular attention to any pitting areas caused by excessive intergranular corrosion. This could lead to generator failure. (Replace water jacket if needed).
   c. Remove zinc anode from top of jacket assembly.
   d. Carefully removed zinc anode from bottom of jacket assembly and drain remaining cooling water into an appropriate vessel.

5B-4. CD Module Assembly

CAUTION: It is imperative that all CD module components be contaminant free at the time of the assembly. Remove all surface corrosion, grease, oil, dirt, lint, etc. When handling the electrodes after cleaning, do not touch the glass. Use a clean, lint-free cloth while installing them.

1. Clean water jacket ground tubes by swabbing the inside of the tubes with an alcohol soaked, clean, lint free cloth.
2. Clean electrodes using an alcohol soaked, clean, lint free cloth.
3. Install new zinc anodes using Teflon® tape on threads to insure a watertight seal.
4. Install end cap. Insure the gasket is properly seated in the recessed groove on the water jacket end plate. Torque screws to 25 in-lbs.
5. Install new Teflon® centering disc. Be careful not to over tighten.
6. Carefully insert clean electrodes into module. Ensure that they are properly seating into bottom section end cap by gently pushing down on the electrode and observe that the electrode bounces on the spring on the bottom section end cap.
7. Install the gasket into the recessed groove on the top of the module.
8. Carefully place the high voltage housing over the top of the electrodes. Insure that all of the springs in the end cap capture the contact tip of each electrode.
9. Install ¼-20 allen head screws and torque to 25 in-lbs.
10. Connect HV cable to terminal on top of top section end cap.
11. Swing flow panel back into the cabinet.
12. Connect cooling water lines. Ensure lines do not get crossed. The cooling water should flow from the bottom of the module to the top.
13. Secure panel to control box by fastening thumb screws.
14. Connect and tighten stainless steel tubing at elbow on BFPD assembly.

    CAUTION: Always double check all connections and ensure proper installation before restarting the generator.

15. Perform an operational check of the generator before continuing with normal usage.

5C. Power Supply Service

The power supply has no user serviceable parts. Power supply service will consist of removing the defective unit and shipping to DEL Industries for repair or replacement.

NOTE: Returned parts must be properly packaged to avoid damage during shipment. Call for packaging instructions.

5C-1. High Voltage Transformer Removal

1. The high voltage transformer is mounted to the transformer deck located below the control enclosure.
2. Remove the two ¼-20 allen head screws from the transformer deck.
3. Carefully slide the transformer deck out approximately 3-4"
4. Disconnect the input leads from the terminal block on the rear panel.
5. Carefully disconnect the thermal disc leads.
6. Carefully disconnect the high voltage cable from the tap on the transformer.

   NOTE: Be sure to identify each wire that is disconnected to assure proper reassembly.

7. Remove the hardware securing the transformer to the transformer deck, and remove the transformer.
8. Replacement is accomplished by reversing these procedures.

5D-1. Air Compressor Servicing

CAUTION: Before performing service to the ozone generator make sure the power is off by turning of the main circuit breaker.

1. Air compressor requires a rebuild every 10,000 hours of operation.
2. Purchase rebuild kit from DEL Ozone.
   See section 5E for replacement parts and ordering information.
3. Follow instructions in kit to rebuild compressors

5E. Service Interval Timers

There are four (4) service interval timers which provide reminders for service required. When one or more service timers have expired, the F5 LED will be illuminated.

To clear the F5 LED indicator:

1. Enter the "Hours Until Service" menu.
2. Note the items which have 0 hrs remaining.
3. Perform the required maintenance.
4. Enter the "Maintenance" menu (under the "Hours Until Service" menu).
5. Select the item which has been serviced and change the status from '0' to '1'. This will cause the corresponding service timer interval to reset.

Service interval timers:

Item	Service Interval (Hrs)
Compressors	10 000
Air Filters	750
Electrodes	4 000
Check Valve	4 000

SECTION 6
Replacement Parts and Order Information

6A. Ordering Information:
For replacement parts call DEL at 1-800-676-1335.
Be prepared with the following information:

1. Customer Name
2. Customer Address
3. DEL Model Number
4. DEL Serial Number
5. Date of Purchase
6. Proof of Purchase

6B. Standard Replacement Parts List:

1. Compressor Rebuild Kit 2-1025
2. Zinc Anodes 2-0151
3. CD Module Centering Disk..... 7-1061
4. Cabinet Air Filter 7-1122
5. Coalescing Filter Element 7-0125
6. Compressor Air Filter Element 7-1120
7. CD Module Electrodes 9-0450-02
8. Ozone Tubing, Teflon 7-0126
9. Ozone Tubing, Stainless Steel 8-0098
10. Installation & Operations Manual..... 4-0696
11. Check Valve Rebuild Kit 8-0333

SECTION 7
Troubleshooting

Symptom: Water back-flow message is displayed on OIP
1. Water is present in the water back-flow detection unit:
   a. Determine the cause of water back-flow and correct. Clean or replace check valves that failed. Drain water and restart system by pressing F4 then Escape then F1.
2. Loose connection or broken wire in the interlock circuitry:
   a. Check wiring from the back-flow detection unit to the control system.

Symptom: High ambient temperature is displayed on OIC.
1. Room temperature has exceeded 100°F
2. Blower has stopped working:
   a. Check wiring for loose connection or broken wire.
3. Loose connection or broken wire in the interlock circuitry:
   a. Check wiring from the system startup switch and door interlock switch to the control system.
4. Faulty temperature switch. Replace the switch.

Symptom: Low coolant flow is displayed on OIP
1. Cooling water flow sensor is not registering flow.
   a. Water is not properly flowing past the flow sensor.
   b. Check wire connections from the flow switch to the control system.
   c. Faulty flow sensor. Replace the sensor.

Symptom: Low pressure is displayed on OIP.
1. Low pressure limit switch is causing an open circuit:
   a. Oxygen concentrator is not operating properly.
   b. Be sure the circuit breaker is in the proper position.
   c. Be sure the flow meters are set properly.
   d. Check for air leaks.
2. Loose connection or broken wire limit switch to the Control System:
   a. Check wiring to the low-pressure limit switch located in the oxygen sensor enclosure.
   b. The system may be restarted by pushing F4 then Escape then F1.

Symptom: Low vacuum is displayed on OIP.
1. Low vacuum limit switch is causing an open circuit:
   a. Ozone injection system at the application point is not pulling a sufficient vacuum. Injection system must be designed to draw in a higher volume of air than is put out by the air preparation system in order to develop a vacuum greater than 2 in.Hg.
   b. Flowmeter is set for too much flow. Adjust the flowmeter to the required flow and check the injection point for sufficient flow.
   c. Solenoid valve mounted in the ozone output line is not opening. Check wiring for breaks or loose connections. Replace the solenoid valve.
2. Loose connection or broken wire in the Interlock Circuitry:
   a. Check wiring from the vacuum limit switch to the Control System.

Symptom: High coolant temperature is displayed on OIP.
1. Ozone generator cooling system is not working:
   a. Check for proper water flow.
   b. Check for high water inlet temperature.
2. Thermostat switch is defective:
   a. Replace the thermostat switch.
3. Loose connection or broken wire in the thermostat interlock system:
   a. Check wiring from the thermostat switch to the control circuitry.

Symptom: High transformer temperature is displayed on OIP.
1. H.V. transformer has overheated:
   a. Correct the problem and replace the transformer.
2. Thermostat switch is defective:
   a. Replace the thermostat.
3. Cooling blower is not working:
   a. Check blower for loose connections.
   b. Replace the cooling fan.
4. Loose connection or broken wire in the thermostat interlock system:

DEL OZONE
COMMERCIAL PRODUCT
LIMITED TWO YEAR WARRANTY

The limited warranty set forth below applies to products manufactured by DEL OZONE – 3580 Sueldo Street, San Luis Obispo, California 93401, and sold by DEL OZONE or its authorized dealers. This limited warranty is given only to the first retail purchaser of such products and is not transferable to any subsequent owners or purchasers of such products. Systems sized 65 grams or greater require factory commissioning and startup to maintain warranty as set forth below.

DEL OZONE warrants that DEL or DEL authorized dealers will repair or replace, at DEL's option, any part of such products proven to be defective in materials or workmanship within two (2) years of the date of receipt. Parts are covered under the two (2) year warranty when and only when the stated maintenance requirements are met. Contact Tanks and degas valves have a ninety (90) day warranty. Compressor(s) must be maintained per operation and maintenance manual. Required maintenance includes a compressor rebuild after one (1) year or every 8,760 hours, which ever is reached first. Warranty does not include parts for compressor(s) rebuild kit(s), or other consumable items. See owner's manual for complete maintenance details. This Warranty specifically excludes any components not manufactured by DEL OZONE that are external to the products covered, such as pumps, air compressors, monitors, tanks, or related components. DEL OZONE will assist with warranty claims for such components purchased through DEL OZONE; limited to the extent of the manufacturer's standard warranty. ANY REPAIR OR REPLACEMENT WILL BE WARRANTED ONLY FOR THE BALANCE OF THE ORIGINAL TWO (2) YEAR WARRANTY PERIOD

.

NOTE: USE ONLY DEL AUTHORIZED DEL REPLACEMENT PARTS. USE OF ANY OTHER PART(S) WILL VOID THIS WARRANTY.

Any replaced parts must be returned to DEL OZONE for warranty evaluation.

THIS LIMITED WARRANTY DOES NOT INCLUDE ANY OF THE FOLLOWING:

(a) Any labor charges for troubleshooting, removal, or installation of such parts.

(b) Any repair or replacement of such parts necessitated by faulty installation, improper maintenance, improper operation, misuse, abuse, negligence, accident, fire, flood, repair materials, and/or unauthorized accessories.

(c) Any such products installed without regard to required local codes and accepted trade practices.

(d) Damage to unit caused by water backflow;

(e) Any implied warranty of merchantability or implied warranty of fitness for particular purpose, and such warranties are hereby disclaimed.

(f) DEL Ozone shall not be liable under any circumstances for loss of use of such product, loss of profits, direct damages, indirect damages, consequential damages, and / or incidental damages.

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

Extended Warranties and Service Agreements are available. Contact DEL for additional details.

TO OBTAIN WARRANTY SERVICE:

DEL OZONE Commercial Department
PO Box 4509, San Luis Obispo, CA 93403
Customer Service Number: (800) 676-1335
Fax Number: (805) 541-8459
E mail **service@delozone.com**

PROVIDE:

1. **Project, contact name, mailing address and telephone.**
2. **Installer/Mechanical Contractor.**
3. **Unit Part Number, Serial Number, and date of purchase.**
4. **The date of failure.**
5. **A description of the failure.**

After this information is provided, DEL Ozone may release a *RETURN GOODS AUTHORIZATION (RGA) NUMBER.* After receiving the RGA number the part in question must be returned to DEL Ozone, freight prepaid, with the RGA number clearly marked on the outside of the package. All preauthorized defective parts must be returned to DEL Ozone within thirty (30) days. Under no circumstances may any product be returned to DEL Ozone without prior authorization. Returns without the assigned RGA number on the outside of the package will be refused and shipped back to the sender at their expense. Upon receipt of preauthorized returned goods, DEL Ozone will repair or replace, at DEL Ozone's option, the defective product(s) and return them (freight prepaid for products under warranty). Buyer's acceptance of the product and use thereof constitutes acceptance of these terms

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APPENDIX "A"
PRE-COMMISSIONING CHECKLIST
Fax completed form to DEL Industries
805-541-8459 - See Following Page (pg.13)

PRE-COMMISSIONING CHECKLIST

Customer: _____ Date: _____

Job Name: _____ Model #: _____

Location: _____ Serial No.: _____

_____

_____

Please complete one checklist for each ozone generator to be commissioned.
Initial all items, note any exceptions/deviations observed including related item numbers and detail of any corrective action taken or recommended.

	1. Ozone generator
_____	a) Properly anchored to mounting surface.
_____	b) Correct voltage supplied and connected.
_____	c) Cooling water supply and return connected from proper source.
_____	d) Ozone line (St. steel or Teflon) connected to outlet fitting.
_____	e) Flow switch (or pump interlock) connected.
	2. Injector(s)
_____	a) Correct orientation with water flow direction.
_____	b) Ozone line (St. steel or Teflon) connected with st. steel ball valve and check valve at or near injector.
	3. Ozone destruct(s)
_____	a) Securely mounted
_____	b) Inlet, vent, and drain connections correct.
_____	c) 110 VAC outlet provided (catalytic destruct only).
_____	4. ORP (or other) sensor probe(s) properly installed in accessible location for maintenance. Cable connected to ORP controller.
	5. Ambient ozone monitor(s)
_____	a) properly installed and interlocked with ozone generator.
_____	b) Sensor installed per manufacturers instructions
_____	6. Contact Tank(s) or Mixing Tower(s) Properly mounted and plumbed.
_____	7. Degas valve(s) installed properly and plumbed to ozone destruct inlet.
_____	8. Main circulation system in working order including pumps, filters, heater, …
_____	9. Booster pump operational and ozone side-stream plumbing complete and in proper operating order.

Use a second sheet for notes if necessary.

Signed: _____

APPENDIX "B"
MSDS
Gaseous Version MSDS
Aqueous Version MSDS

OZONE Material Safety Data Sheet

SECTION I: MATERIAL IDENTIFICATION

IDENTITY: OZONE (Gaseous)	**ISSUED: February, 1992**
FORMULA: O_3	**REVISED: March, 2009**

Description (origin/uses): Occurs in atmosphere from UV light action on oxygen at high altitude. Commercially obtained by passing air between electrodes carrying a high voltage alternating current. Also found as a by-product in welding areas, high voltage equipment, or UV radiation.

Ozone is used as an oxidizing agent in air and water disinfection: for bleaching textiles, oils, and waxes; organic synthesis as in processing certain perfumes, vanillin, camphor; for mold and bacteria control in cold storage.

Cautions: A powerful oxidizing agent, ozone generally exists as a gas and is highly chemically reactive. Inhalation produces various degrees of respiratory effects from irritation to pulmonary edema (fluid in lungs) as well as affecting the eyes, blood, and central nervous system.

Manufacturer/Supplier: On-site generation, equipment available from various suppliers, including:

DEL Ozone
3580 Sueldo Street
San Luis Obispo, CA 93401
Phone: (805) 541-1601
FAX: (805) 541-8459

SECTION II: INGREDIENTS AND HAZARDS

Ozone, CAS No. 10028-15-6: NIOSH *RTECS* No. RS8225000

1991 OSHA PELs
8-hr TWA: 0.1 ppm vol. (0.2 mg/m^3)
15-min STEL: 0.3 ppm vol (0.6 mg/m^3)

1990 IDLH
10 ppm

1990 NIOSH REL
Ceiling: 0.1 ppm vol. (0.2 mg/m^3)

1991-1992 ACGIH TLV
Ceiling: 0.1 ppm (0.2 mg/m^3)

1990 DFG (Germany) MAK
TWA: 0.1 ppm (0.2 mg/m^3)
Category 1: Local Irritant
Peak Exposure Limit: 0.2 ppm
5 min momentary value, 8 per shift

Other Designations: Triatomic oxygen: CAS No. 10028-15-6, NIOSH *RTECS* No. RS8225000

SECTION III: PHYSICAL DATA

Boiling Point:	-169° F	**Melting Point: . . . . . .**	-315.4° F (-193° C)
Vapor Pressure:	>1 ATM	**% Volatile by Volume: . .**	100%
Vapor Density (AIR = 1):	1.6	**Molecular Weight: . . . . .**	48 Grams/Mole
Solubility in Water: . . .	0.49 ml @ 32° F (0° C), 3 ppm @ 20 ° C	**pH: . . . . . .**	Not Listed
		Critical Temperature: . .	10.22° F (-12.1° C)

Appearance and Odor: Colorless to blue gas (greater than -169° F): characteristic odor often associated with electrical sparks or lightning in concentrations of less than 2 ppm and becomes disagreeable above 1-2 ppm. CAUTION: Olfactory fatigue develops rapidly, so do not use odor as a preventative warning device.

SECTION IV: FIRE AND EXPLOSION HAZARD DATA

Flash Point: . . . . . . Nonflammable
Extinguishing Media: . Use large amounts of water spray or fog to put out fires involving ozone. Use appropriate fire-fighting techniques to deal with surrounding material.

Special Fire Fighting Procedures: Wear a self contained breathing apparatus with full face pieces operated in a pressure-demand or other positive-pressure mode.

Unusual Fire/Explosion Hazards: Decomposition of ozone into oxygen gas, (O_2), can increase strength of fire.

SECTION V: REACTIVITY DATA

Stability: Ozone is not stable. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Ozone is chemically incompatible with all oxidizable materials, both organic and inorganic.

Conditions to Avoid: Ozone is unstable at room temperatures and spontaneously decomposes to oxygen gas. Avoid ignition sources such as heat, sparks, and open flame. Keep away from strong reducing agents and combustible materials such as grease, oils, and fats.

Products of Hazardous Decomposition: Ozone spontaneously decomposes to oxygen gas, even at room temperatures.

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SECTION VI: HEALTH HAZARD DATA

Carcinogenicity: Ozone is not listed as a carcinogen by the NTP, IARC, or OSHA.

Primary Entry: Inhalation

Target Organs: Respiratory system, eyes, blood.

Summary of Risks: There is no true threshold limit and so no exposure (regardless of how small) is theoretically without effect from ozone's strong oxidative ability. Ozone passes straight to the smallest bronchioles and alveoli and is not absorbed by mucous membranes along the way. Initial small exposure may reduce cell sensitivity and/or increase mucous thickness producing a resistance to low ozone levels. Short exposure to 1-2 ppm concentrations causes headache as well as irritation to the respiratory tract. but symptoms subside when exposure ends. High concentrations of ozone produce severe irritation of the eyes and respiratory tract. Exposure above the ACGIH/OSHA limits produce nausea, chest pain, coughing, fatigue, reduced visual acuity, and pulmonary edema. Symptoms of edema from excessive exposure can be delayed one or more hours. Inhalation of >20 ppm for an hour or more (>50 ppm for 1/2 hour) can be fatal.

Acute Effects: Acute damage from ozone appears to be mainly from its oxidizing effect on contact with tissue.

Chronic Effects: Respiratory disease. Deleterious effects on lungs and acceleration of tumors have been reported.

Medical Conditions Generally Aggravated by Long-Term Exposure: History of respiratory or heart disorders.

First Aid: Remove from ozone containing air, get prompt medical help*, administer oxygen if necessary.

Eye Contact - Gently lift eyelids and flush eyes continuously with flooding amounts of water for 15 minutes or until transported to a medical facility*.

Inhalation - Remove exposed person to fresh air, support breathing, administer humidified oxygen as needed, get medical help*.

Ingestion - Highly unlikely since ozone is a gas until -169° F,

*** GET MEDICAL ASSISTANCE = APPROPRIATE IN-PLANT, PARAMEDIC, or COMMUNITY**. Get prompt medical assistance for further treatment, observation, and support after first aid.

SECTION VII: PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case of Spill/Leak:

1. Discontinue production
2. Isolate and vent area
3. Immediately notify personnel
4. Deny entry
5. Follow applicable OSHA regulations

Disposal: Provide ventilation to dilute and disperse small amounts of ozone (below OSHA PELs) to outside atmosphere. Follow federal, state, and local regulations.

Handling/Storage Precautions: Ensure proper personnel training and establish emergency procedures.

SECTION VIII: CONTROL MEASURES

Respiratory Protection: High Level (>10 ppm) - Self Contained Breathing Apparatus: MISH/NIOSH approved.
Low Level (0.3 - 10 ppm) - Canister Type (carbon) respirator may be used.

Eye Protection: Wear chemical safety goggles if necessary to work in high ozone (>10 ppm).

Skin Protection: Effects of ozone on skin are minimal to non-existent.

Ventilation: Provide general and local exhaust ventilation to dilute & disperse small amounts of ozone into outside atmosphere.

SECTION IX: SPECIAL PRECAUTIONS AND COMMENTS

Storage Segregation: Prevent ozone from coming into direct physical contact with strong acids or bases or with strong oxidizing/reducing agents.

Engineering Controls: Install ventilation systems capable of maintaining ozone to concentrations below the ACGIH/OSHA exposure limits (see sect. II). Install ambient ozone monitor(s) configured to shut down ozone equipment and turn high speed ventilation on.

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Material Safety Data Sheet

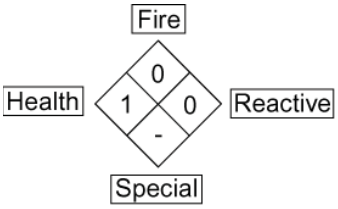
This MSDS complies with OSHA's Hazardous Communication Standard 29 CFR 1910.1200 and OSHA form 174.

DEL Ozone
3580 Sueldo Street
San Luis Obispo, CA 93401

Product Information 805-541-1601

NFPA 704 Designation
Hazard Rating

4 = Extreme
3 = High
2 = Moderate
1 = Slight
0 = Insignificant



Product Name	**AQUEOUS OZONE SOLUTION**
Chemical Name	DISSOLVED OZONE GAS IN WATER 0 TO 2 PPM
Product Description	AQUEOUS SOLUTION OF OZONE DISSOLVED IN POTABLE WATER
D.O.T. Shipping Classification	NON REGULATED

I PHYSICAL DATA

Boiling Point	212 F	Freezing Point	32 F
Specific Gravity	1.0	Solubility in Water	COMPLETE
Evaporation Rate	APPROX 1	Physical Form	LIQUID
Appearance & Odor	COLORLESS (CLEAR) WATER WITH FRESH, ASEPTIC ODOR		

II HAZARDOUS INGREDIENTS

MATERIAL	HAZARD	CAS #	% BY WT	ACGIH TLV	OSHA PEL
None					

III FIRE AND EXPLOSION HAZARD DATA

Flash Point	NA Method NA	Auto Ign. Temp.	NA
Flammable Limits in Air	NON APPLICABLE	Lower NA	Upper NA
Extinguishing Media	NON APPLICABLE		
Unusual Fire & Explosion Hazards	NONE		
Special Fire Fighting Procedures	NONE		

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Material Safety Data Sheet Cont.

Product Name **AQUEOUS OZONE SOLUTION**

IV HEALTH HAZARD DATA	
Threshold Limit Value	NOT DETERMINED
Route of Exposure	☐ Inhalation ☐ Ingestion ☐ Skin ☒ Eye ☒ Not Hazardous
Eye Contact Hazard	Exposure may cause mild eye irritation, but is not expected.
Ingestion Hazard	Not Hazardous
Inhalation Hazard	Inhalation is not likely to be a primary route of exposure but could become irritating if aerosols are exposed to individual for extended period of time.
Skin Contact Hazard	No skin irritation is expected from short term exposure.
Skin Absorption Hazard	No published data indicates this product is absorbed through the skin.
Effects of Acute Exposure	Mild skin or eye irritation.
Effects of Chronic Exposure	Repeated exposure of the skin to concentrated product should be avoided to prevent irritation and drying of the skin.

V EMERGENCY AND FIRST AID PROCEDURES	
Eye Contact	If exposure to water containing aqueous solution of ozone causes irritation to eyes, flush eyes with plenty of clean, ozone free, running water for at least 15 minutes, lifting the upper and lower lids occasionally. Remove contact lenses if worn. Seek medical attention if irritation persists.
Skin Contact	Not likely to become irritated unless repeatedly exposed to large volumes of material. If irritation develops, rinse affected area with ozone free potable water. If irritation continues seek medical advice.
Inhalation	Inhalation of mists could lead to irritation of lungs. If symptoms develop, move individual away from exposure and into fresh air. If symptoms persist, seek medical attention.
Ingestion	NA

VI REACTIVITY DATA			
Incompatibility (Materials to Avoid)	Natural rubber (may degrade, or “dry”, rubber components over extended periods of exposure)		
Conditions to Avoid	NONE KNOWN		
Hazardous Decomposition	NONE		
Stability	☒ STABLE ☐ UNSTABLE	Hazardous Polymerization	☐ MAY OCCUR ☒ WILL NOT OCCUR

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Material Safety Data Sheet Cont.

Product Name **AQUEOUS OZONE SOLUTION**

VII SPILL OR LEAK PROCEDURES	
Steps To Be Taken If Material Is Released Or Spilled	NONE
Waste Disposal Method	DISPOSE OF THE SAME AS POTABLE RINSE WATER

VIII SPECIAL PROTECTIVE INFORMATION				
Respiratory Protection (Specify Type)	NOT REQUIRED FOR NORMAL USE OF THIS PRODUCT			
Ventilation	Local Exhaust	PREFERABLE	Special	NA
	Mechanical (general)	OK	Other	NA
Protective Gloves	NOT REQUIRED			
Eye Protection	NOT REQUIRED			
Other Protective Equipment	NOT REQUIRED			

IX SPECIAL PRECAUTIONS	
Precautionary Labeling	Certified testing of DEL Ozone systems by NSF (National Sanitation Foundation) has shown that under normal conditions of use, aqueous solutions containing low levels of ozone gas dissolved in potable water do not present a safety hazard when contact to the individual is incidental. When used in a room with normal ventilation, levels of ozone gas being released into the air have been shown by NSF to be well below the periodic exposure levels established by OSHA for worker safety through the use of DEL's ozone management technology.
Precautions To Be Taken In Handling	Aqueous solutions of ozone in potable water should not be sprayed as an aerosol (i.e. >20psi) to avoid releasing higher levels of ozone gas into the work area. The decay rate of ozone gas is a function of temperature and exposure to organic material. Certified testing has shown that when ozone gas has been properly dissolved in ambient temperature (or colder (33 – 70 °F)) potable water at a level not exceeding 2 mg/l (ppm) using DEL's ozone management technology, the rate at which ozone is released from the water as ozone gas is below the PEL established for gaseous ozone.

Rev. Date 03/26/09