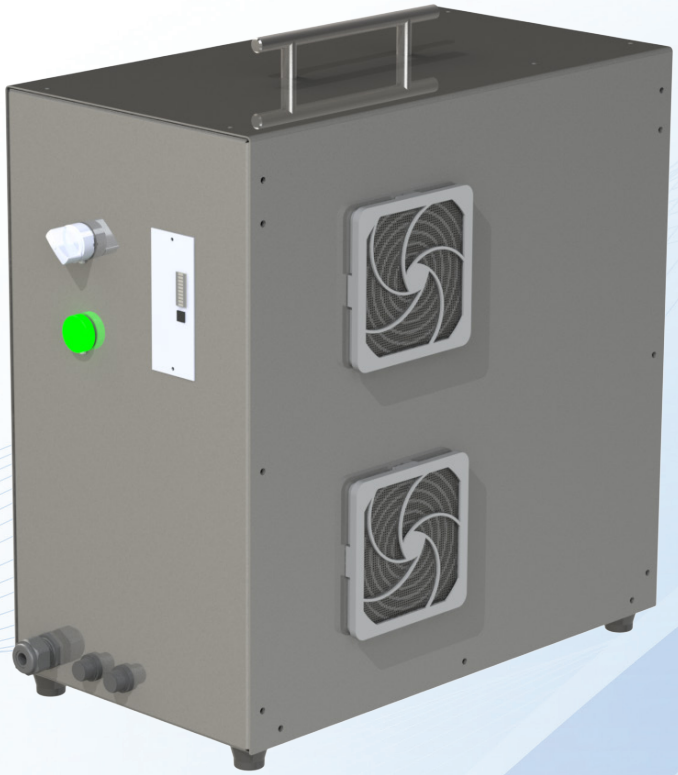
DR SERIES

HIGH OUTPUT SHOCK TREATMENT OZONE GENERATOR

MODEL: DR-25

INSTALLATION & OPERATIONS MANUAL



OZONE SOLUTIONS®

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IMPORTANT SAFETY INSTRUCTIONS, READ AND FOLLOW ALL INSTRUCTIONS.

Read this manual completely before attempting installation.

SAVE THESE INSTRUCTIONS.

INTRODUCTION

Ozone naturally attaches to most organic chemical contaminants, mold spore, odors, etc. It is able to break them down on the moleccular level leaving the area with clean fresh air.

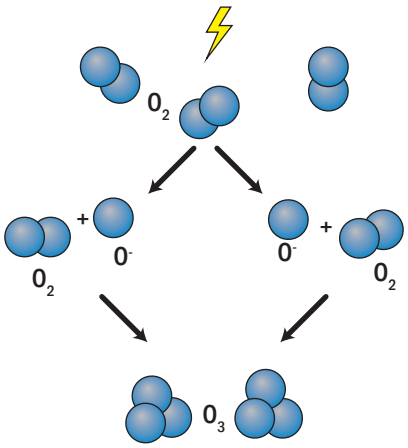
The DR Series ozone generators are a complete ozone generation system. No external compressed air or oxygen supply is required. This system uses ambient air to produce up to 25 grams per hour of gaseous ozone.

Each function of the system is described in this manual. Please read and familiarize yourself with this manual before use.

THEORY OF OPERATION

The DR-25 is an ozone generation system that uses ambient air to produce concentrated ozone gas. This system generates ozone via corona discharge.

Corona discharge is a process where an electrical spark is used to split the molecular bond of natural oxygen molecules (O_2) into a singlet state (O^-). These singlet oxygen atoms then bond to the remaining O_2 molecules to form ozone (O_3). *See picture below for reference.*



I. SAFETY

PRECAUTIONS

Ozone is a powerful oxidizing agent. Observe strict operating procedures while using ozone equipment. It is imperative that only ozone compatible materials are used in conjunction with the ozone system.

NOTE: If the operator has asthma, he or she must not enter an airspace that has a significant ozone concentration. Ozone can induce an asthma attack.

Carefully review and familiarize yourself with the following important safety information concerning the Ozone Generator:

- Ozone is an extremely aggressive and powerful oxidizer. The Occupational Safety and Health Administration (OSHA) 8-hour exposure limit is 0.10 PPM. The OSHA 15-minute exposure limit for ozone is 0.3 PPM. Above 0.3 PPM, there is the risk of damage to respiratory tissues.
- People who have no sense of smell should not operate this equipment.
- Never attempt to verify ozone production by directly breathing or smelling the ozone outlet.
- The Ozone Generator contains high voltages. Tampering can result in serious injury or death. For service instructions, contact Ozone Solutions.

Oxygen itself is not combustible, however it greatly accelerates the burning of combustible materials. Therefore, precautions should be taken to avoid a fire in the area of the generator

- Smoking should not be permitted in the area where the system is located.
- All oxygen connections and hoses should be kept clean and free of grease, oil and other combustible materials.

Do not attempt to modify or enhance the performance of a generator in any way.

PERSONAL SAFETY

Flushing ozone from the system

Safety warnings regarding ozone gas are found at the beginning of this manual. The Ozone System produces a large amount of ozone, which can be inadvertently "stored" within the Ozone Generators, manifolds, and ozone lines.

Eventually the ozone (even while in the system) will safely revert back to oxygen, but in the right conditions the ozone can remain in the system for 24 hours or even longer. In the event that maintenance must be performed on the components in contact with ozone, the following is recommended for reducing the possibility of exposure to the ozone.

Whenever possible it is recommended that the machine run with maximum permissible air flow for at least 10 minutes with the Ozone Output OFF in order to flush out residual ozone.

In most circumstances, a very small amount of ozone will be contained within the system after shutdown; therefore, exposure will be minimal.

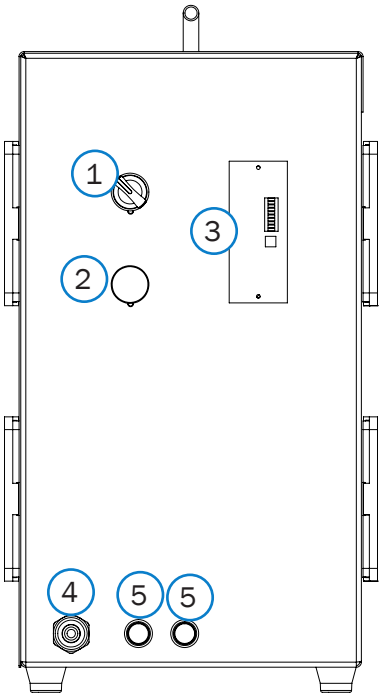
If the machine cannot be operated prior to maintenance or repair, a waiting period of 12 to 24 hours (if ozone has been produced recently) is recommended to allow the ozone to decay by reverting back into oxygen.

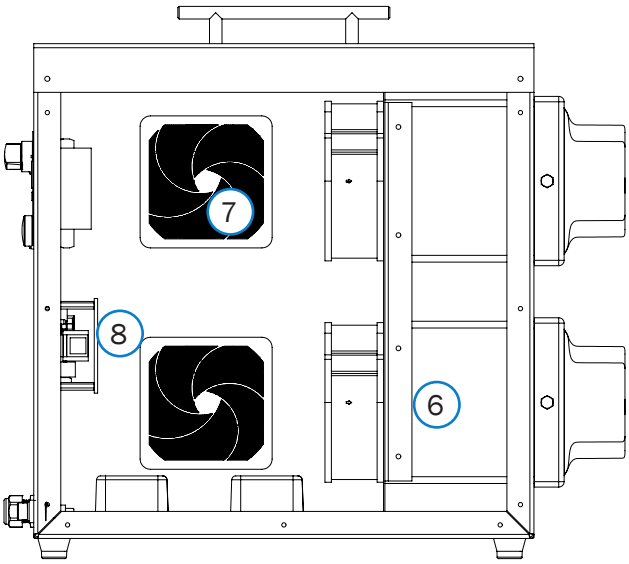
Isolating energy sources

The Ozone Generator has electrical and mechanical hazards, and maintenance or repair should not take place unless all energy sources have been turned off, disconnected, and/or drained.

II. COMPONENTS

DIAGRAM





DESCRIPTION

1. Ozone Output control: Turn the dial to adjust power to the corona cell. The “I” setting will produce 12.5 g/hr of ozone. The “II” setting will increase the ozone output up to the MAX setting (25 g/hr).
2. Ozone Setpoint Light: This light will illuminate once the ozone setpoint is reached. When illuminated, ozone is not being generated.
3. Timer: The timer acts as the on/off switch for the system. It can be set to various timing options as well as a “hold” setting.
4. Power Cord
5. 10 Amp Fuse
6. Ozone Cell
7. Inlet Filter
8. Ozone Sensor (if equipped)

III. INSTALLATION & OPERATION

REQUIREMENTS

Location

This oxygen concentration system is not weather proof; therefore, a dust-free, indoor environment is required for operation. All components must be accessible for future maintenance and service.

If mounting the machine, ensure the wall or support system can withstand the weight of the unit. There are tabs located at the top of the machine and mounting feet on the bottom.

Temperature & Humidity

Water must not be allowed to condense in or on the machine. For best performance, the operating temperature should be between 40ºF and 95ºF with a maximum relative humidity of 60%. The storage temperature should be between -20ºF and 170ºF.

Electrical

This requires an electrical input of 110 Volts A/C, single phase. Please refer to the table in section IV for additional specifications.

OPERATOR INSTRUCTIONS

IMPORTANT: Read and understand the Safety section of this manual before operating the Ozone System.

1. Plug the unit into a standard 110 Volt A/C 60 Hz power souce. (*Note: If the operator wishes to turn off the unit without entering the room where ozone is present, then place the unit inside the desired room with the power cord going under the door to a safe area that can be reached later.)*
2. Make sure all tubing connections between the ozone generator and the exit point are secure and in good working condition. Failure to do so could result in the discharge of ozone into an undesired space.
3. Turn the Ozone output control dial to the desired setting. Note: Ozone will not be generated at this time. Ozone generation occurs once the timer button is pressed *(see next step.)*
4. Pressing the black button on the timer will start the system and begin ozone production. The timer will start at the “hold” setting, which results in continuous ozone generation until the user turns the machine off.
5. Press the button again to scroll through the various timing options, if desired.
6. The unit may be turned off with the button on the timer or by unplugging the unit.
7. After shock treating a room, allow the ozone to decay for at least 12 hours before re-entering the room.

IV. ADDITIONAL INFORMATION

SPECIFICATIONS

Ozone Production (g/hr)	Flow Rate (CFM)	Power Supply (VAC)	Power Consumption (Watts)	Current (Amps)	Dimensions (D x W x H)	Weight (lbs)
25	140	110 - Single Phase	500	20	23 x 11.1 x 20.4	~37

WARRANTY

Ozone Solutions warrants all equipment assembled, manufactured, and sold to be free from defects in material and workmanship under normal use and service for a period of one (1) year after date of sale to the original purchaser.

Some products may have a specific warranty period other than what is outlined in this document. For such products, the manufacturer warranty will supercede this warranty. Ozone Solutions will honor the manufacturer's warranty, but if and when advised by the manufacturer, may have the customer deal directly with the manufacturer. This warranty covers all parts that are not outlined in a product maintenance schedule. This warranty will be void if any piece of the equipment is used in a manner other than what is explicitly outlined in the product manuals.

If any part of the equipment manufactured by Ozone Solutions proves to be defective during the warranty period, please call Ozone Solutions at 712.439.6880, or email service@ozonesolutions.com.

Prior authorization is required before working on or shipping a product back to us. Failure to get prior authorization may result in denial of your claim. Once authorized, you may return the defective equipment to Ozone Solutions with the transportation charges prepaid. If Ozone Solutions finds the equipment to be defective, it will be repaired or replaced at our discretion, free of charge, to the original purchaser (F.O.B. factory).

This warranty shall not place any liability on Ozone Solutions for any transportation charges, labor, or cost for, or during the replacement of any parts. The replaced part(s) or product will then continue the original warranty duration. The replaced parts will not start a new one (1) year coverage period. The purchaser by acceptance of the equipment will assume all liability for the consequences of its use or misuse by the purchaser, employees, or others. This warranty shall not apply to any piece of equipment, or part thereof sold by this company which has been subject to any accident caused in transit, alterations by unauthorized service, negligence, abuse, or damage by flood, fire, or act of God.

This warranty shall constitute the entire warranty and/or agreement between Ozone Solutions and the original purchaser, and in lieu of all other warranties, expressed or implied, either oral or written, including the warranty of merchantability and fitness for a particular use and of all other obligations or liabilities on our part. Ozone Solutions neither assumes nor authorizes any other person or entity to assume for us any liability associated with the sale of its products or equipment.

The term "original purchaser," as used in this warranty, means whom the product was originally sold to by Ozone Solutions or by an authorized dealer. Ozone Solutions reserves the right to make changes in its products without notice. Because of this, Ozone Solutions is not obligated to replace warranty defective part(s) and/or product with the same original part or product.

CONTACT INFORMATION

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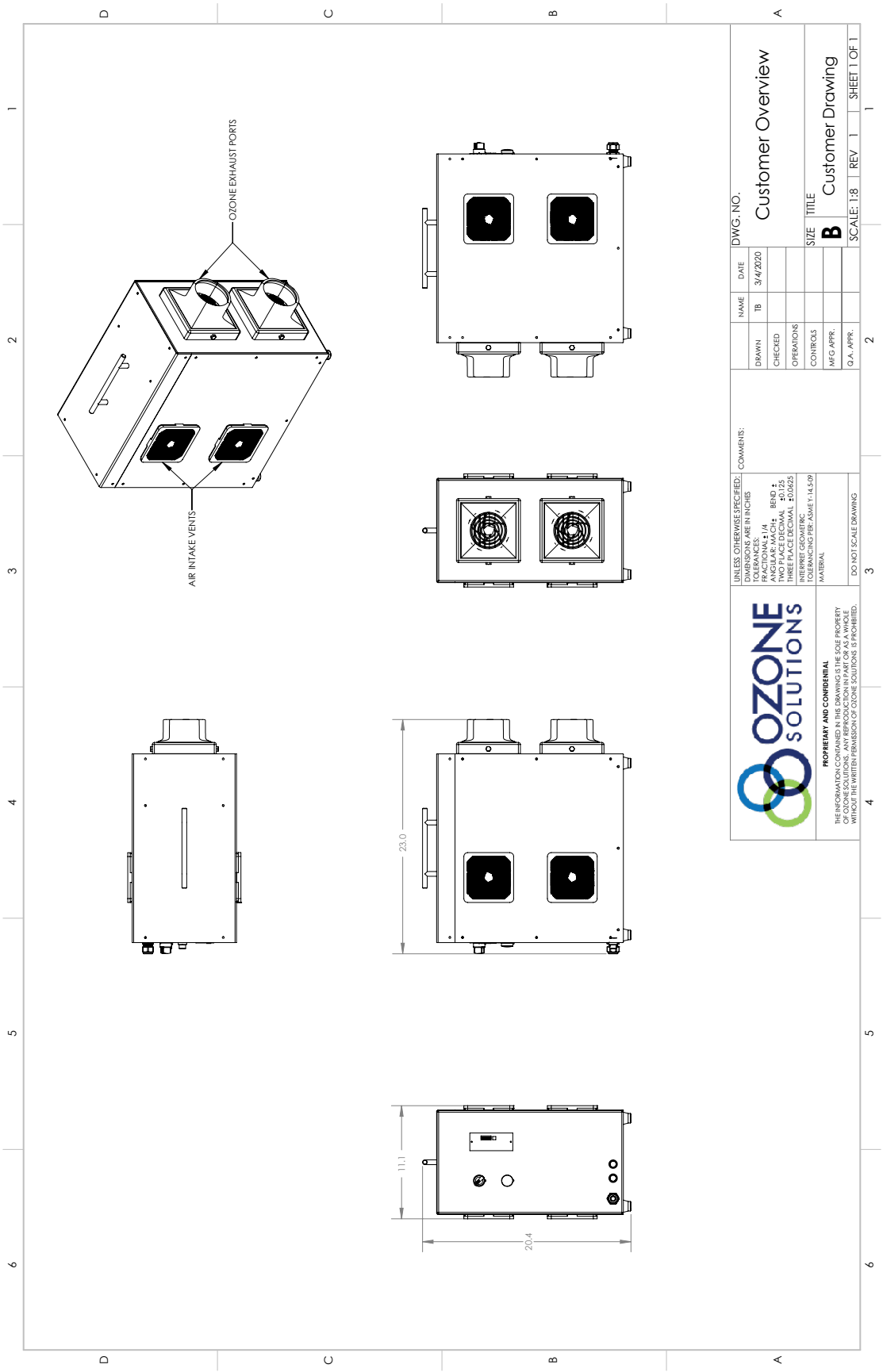
Website: www.ozonesolutions.com

APPENDIX A - CAD DRAWING



APPENDIX B - MAINTENANCE

IMPORTANT: The DR Series Ozone Generator has electrical and mechanical hazards. Maintenance or repair should not take place unless all energy sources have been turned off, disconnected, and/or drained.

Maintenance Table

Component	Action	Time Period	Part Numbers
Ozone Cell	Clean	1 month or as needed	N/A
Inlet Filter	Clean/Replace	3 months or as needed	Foam Filter Replacement
Ozone Sensor (if equipped)	Replace	1 year	RME-1.0
Fuse	Replace	As needed	10 Amp fuse

The DR-25 is designed to operate continuously with little to no maintenance. If the unit does not produce its maximum ozone output, the following cleaning process can be performed:

- Unplug the DR-25 from its power source and re-move end cap.
- Use a compressed air source of no more the 100 PSI to remove any debris from the ozone block. Keep the wand six inches away to prevent damage.
- The same air source can then be used to clean the four 3 ¼ inch particulate filters located on the sides of the unit. If the particulate filters need replacement, contact Ozone Solutions.
- Once a month, after heavy use or after using in high humidity, the ozone blocks should be cleaned. To clean the ozone blocks, remove the rivets that hold on the end cap. (This is the end of the generator that the air blows out of.)
- A razor blade can be used to lightly scrape off the acidic crust buildup on the ozone block tubes.

Ensure that the unit is properly operating before resuming the ozonating process. If any failure should occur please contact Ozone Solutions.

APPENDIX C - SAFETY DATA SHEET

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SAFETY DATA SHEET FOR OZONE

FORMERLY MSDS

1. PRODUCT IDENTIFICATION

PRODUCT NAME: Ozone

COMMON NAME / SYNONYMS: Triatomic Oxygen, Trioxygen, O3

OZONE GENERATOR MANUFACTURER / SUPPLIER: Ozone Solutions
451 Black Forest Road / Hull, Iowa 51239
712.439.6880 / www.ozonesolutions.com / tinfo@ozonesolutions.com

PRODUCT USE: This SDS is limited to ozone produced in gaseous form on site by an ozone generator, in varying concentrations, in either air or aqueous solutions, for the purposes of odor abatement, oxidation of organic compounds or antimicrobial intervention, in a variety of applications.

2. HAZARD IDENTIFICATION

GHS CLASSIFICATIONS

PHYSICAL	HEALTH	ENVIRONMENTAL
Oxidizing Gas	Skin Irritation - Category 3 Eye Irritation - Category 2B Respiratory System Toxicity - Category 1 (Single & Repeated)	Severe

WHMIS CLASSIFICATIONS (WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM, CANADA): C, D1A, D2A, D2B, F
Source: CCOHS CHEMINFO Record Number 774

3. COMPOSITION

CHEMICAL NAME	Ozone
COMMON NAMES	Triatomic Oxygen, Trioxygen
CHEMICAL FORMULA	O_3
CAS REGISTRY NUMBER	10028-15-6

4. FIRST AID MEASURES

ROUTE OF ENTRY		SYMPTOMS	FIRST AID
Skin Contact	Yes	Irritation	Rinse with Water
Skin Absorption	No	NA	NA
Eye Contact	Yes	Irritation	Rinse with Water, Remove Contacts
Ingestion	No	NA	NA
Inhalation	Yes	Headache, Cough, Heavy Chest, Shortness of Breath	Remove to Fresh Air, Provide Oxygen Therapy as Needed

For severe cases, or if symptoms don't improve, seek medical help.

5. FIRE FIGHTING MEASURES

Ozone itself is not flammable. As a strong oxidant if may accelerate, even initiate, combustion or cause explosions. Use whatever extinguishing agents are indicated for the burning materials.

6. ACCIDENTAL RELEASE MEASURES

Turn off the ozone generator and ventilate the area. Evacuate until ozone levels subside to a safe level (<0.1 ppm).

7. HANDLING AND STORAGE

Ozone must be contained within ozone-resistant tubing and pipes from the generation point to the application point.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

OSHA PERMISSABLE EXPOSURE LIMIT	8 hour TWA 0.1 ppm
ANSI / ASTM	8 hour TWA 0.1 ppm, STEL 0.3 ppm
ACGIH	8 hour TWA 0.1 ppm, STEL 0.3 ppm
NIOSH	ELCV 0.1 ppm Light; 0.8 ppm Moderate; 0.5 ppm Heavy; Light, Moderate, Heavy Work TWA <=2 Hours, 0.2 ppm Immediately Dangerous to Life or Health 5.0 ppm

RESPIRATORY PROTECTION: Use full face self-contained breathing apparatus for entering areas with a high concentration of ozone.

ENGINEERING CONTROL: Use ozone destruct unit for off gassing of ozone.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Gas	pH	NA
MOLECULAR WEIGHT	48.0	Decomposition Temperature	NA
APPEARANCE	Clear at Low Concentration, Blue at Higher Concentration	Evaporation Rate	NA
ODOR	Distinct Pungent Odor	Flash Point	NA
ODOR THRESHOLD	0.02 to 0.05 ppm; Exposure Desensitizes	Auto-Ignition Temperature	NA
MELTING POINT	-193° C / -315° F	Relative Density	NA
BOILING POINT	-112° C / -169° F	Partition Coefficient	NA
VAPOR PRESSURE	> 1 atm	Flammability	NA
VAPOR DENSITY	1.6 (Air = 1)	Explosive Limits	NA
SOLUBILITY IN WATER	570 mg / L at 20° C 100% O3; 0.64 at 0° C	Viscosity	NA

10. STABILITY AND REACTIVITY

Ozone is highly unstable and highly reactive. Avoid contact with oxidizable substances. Ozone will readily react and spontaneously decompose under normal ambient temperatures.

11. TOXICOLOGY INFORMATION

ROUTES OF EXPOSURE	Inhalation, Eyes, Skin Exposure
EFFECTS OF ACUTE EXPOSURE	Discomfort; including headache, coughing, dry throat, shortness of breath, pulmonary edema; higher levels of exposure intensify symptoms. Possible irritation of skin and / or eyes.
EFFECTS OF CHRONIC EXPOSURE	Similar to Acute Exposure effects, with possible development of schronic breathing disorders, including asthma.
LC_{50}	Mice 12.6 ppm for 3 hrs / Hamsters 35.5 ppm for 3 hrs
IRRITANCY OF OZONE	Yes
SENSITIZATION TO OZONE	No
CARCINOGENICITY (NTP, IARC, OSHA)	No
REPRODUCTIVE TOXICITY, TERATOGENICITY, MUTAGENICITY	Not Proven
TOXICOLOGICALLY SYNERGISTIC PRODUCTS	Increased susceptibility to allergens, pathogens and irritants

12. ECOLOGICAL INFORMATION

The immediate surrounding area may be adversely affected by an ozone release, particularly plant life. Discharge of ozone in water solution may be harmful to aquatic life. Due to natural decomposition, bioaccumulation will not occur and the area affected will be limited.

13. DISPOSAL CONSIDERATIONS

Off-gassing of ozone should be through an ozone destruct unit which breaks ozone down to oxygen before release into the atmosphere.

14. TRANSPORT INFORMATION

NOT APPLICABLE, as ozone is unstable and either reacts or decomposes and must be generated at the location and time of use.

15. REGULATORY INFORMATION (Source: EPA List of Lists)

SARA TITLE III SECTION 302 EHS TPQ	100 lbs
SARA TITLE III SECTION 304 EHS RQ	100 lbs
SARA TITLE III SECTION 313	> 10,000 lbs used / year

16. OTHER INFORMATION

Half-life of ozone in water at 20° C = 20 minutes; in dry still air at 24° C = 25 hour; decreases significantly with increase in humidity, presence of contaminants, air movement and / or increase in temperature.

Preparer: Tim McConnel and Stacey Eben, Ozone Solutions 5/1/2012 (layout revision (2/13/2018)

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