



MPI-300

Multi-Point Intervention Ozone Sanitation System

OWNER'S MANUAL



#132819

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IMPORTANT SAFETY INSTRUCTIONS

READ AND FOLLOW ALL INSTRUCTIONS.

Read this manual completely before operation of MPI-300 Ozone Sanitation System.

The High Voltage Transformers in this unit create 7,000 volts, with the outer jacket of the High Voltage lead reaching 3,000 volts.

- USE EXTREME CAUTION -

Operate the MPI-300 on a near level surface with safe access to electrical power when using accessory cart.
Connect to a GFCI type receptacle.
Follow all applicable electrical codes.
Do not bury cord.

WARNING: To reduce the risk of electrical shock, replace damaged cord immediately.

ELECTRICAL SHOCK HAZARD: Turn OFF all power switches and disconnect power cord from power source receptacle before performing any service work. Failure to do so could result in serious injury or death.

SAFETY CLAIMS

Performance safety testing was based on the **Hazard Communication Standard** as promulgated through the **Occupational Safety and Health Act** of 1970 and documented in the Code of Federal Regulations, Title 29, Chapter XVII, Part 1910, Section 1910.1200. The inherent low hazard due to the MPI-300's design and construction, coupled with the safety features, monitoring data, and the precautionary directions provided in the owner's manual are sufficient for The Toxicology Group, LLC, a division of NSF International (Ann Arbor, MI), to provide a professional opinion that the MPI-300 Mobile Ozone Sanitation System poses no safety concerns when operated under the prescribed conditions as set forth in the owner's manual.

ANTIMICROBIAL CLAIMS

This device has been determined acceptable for use as an ozone generating device providing sanitization and disinfection of hard, inanimate, pre-cleaned surfaces, in and around food processing areas (P1). A potable water rinse is not required following the use of this device on previously cleaned hard surfaces.

NSF International Registration for this device is based, partially, upon documentation indicating that it meets all necessary requirements including labeling, EPA Establishment Registration, and safety requirements set forth under Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of June 5, 1947, Section 2(q)(1) and Section 7.

Efficacy studies conducted according to AOAC Official Method 961.02; Germicidal Spray Products as Disinfectants Test and AOAC Official Method 960.09*; Germicidal and Detergent Sanitizing Action of Disinfectants provided the following results:

Organism	Applied Dose	Actual Dose (at nozzle)	Spray Duration	Reduction
Trichophyton mentagrophytes (ATCC 9533)	3.0 PPM	1.85-2.25 PPM	30 seconds	6 log (99.9999%)
Salmonella choleraesuis (ATCC 10708)	3.0 PPM	1.85-2.25 PPM	3 minutes	6 log (99.9999%)
Staphylococcus aureus (ATCC 6538)	3.0 PPM	1.85-2.25 PPM	10 minutes	6 log (99.9999%)
Pseudomonas aeruginosa (ATCC 15442)	3.0 PPM	1.85-2.25 PPM	5 minutes	6 log (99.9999%)
Campylobacter jejuni (ATCC 15442)	3.0 PPM	1.85-2.25 PPM	3 minutes	4 log (99.99%)
Listeria monocytogenes (ATCC 7644)	3.0 PPM	1.85-2.25 PPM	3 minutes	4 log (99.99%)
Aspergillus flavus (ATCC 9296)	3.0 PPM	1.85-2.25 PPM	5 minutes	4 log (99.99%)
Brettanomyces bruxellensis (ATCC 10560)	3.0 PPM	1.85-2.25 PPM	3 minutes	4 log (99.99%)
Escherichia coli* (ATCC 11229)	3.0 PPM	2.1 PPM	30 seconds	5 log (99.999%)

SECTION 1 - GENERAL INFORMATION

1A. Description

The MPI-300 is available in three different configurations, MPI-300, MPI-300WM, and MPI-300M. The MPI-300 is the base model system designed for general, in place surface sanitation applications including equipment sanitation of conveyors, slicers, saws, etc. as well as direct contact on food. The MPI-300WM (wall-mounted) and MPI-300M (mobile) are designed as manually-operated surface sanitation systems utilizing the included ozone delivery hose and spray wand.

The systems flow ozonated water at approximately 3.3 GPM with an applied ozone dose of 3-3.5 PPM. Average dissolved ozone concentration at the spray nozzle is 2.0 PPM with clean, potable source water free of chemicals and minerals. **The MPI-300 provides a final sanitizing rinse, leaving no residual.**

The MPI-300 is designed to sanitize wettable surfaces and equipment including conveyors, containers, saws, slicers, walls and floors, in addition to certain foods. Compatible materials include stainless steel, plastics, wood, concrete, cement, cement block, painted and unpainted. The MPI-300 uses interchangeable attachments for spray applications.

1B. Specifications

Ozone Output:

Ozone output (+10%):	2.5 g/hr
Applied Ozone Dose:	3.3 PPM
Gas flow rate (max):	3.0 SCFH
% weight O ₃ :	3.0%

Power Requirements:

Domestic: 115VAC, 60 Hz, 1Ø, 7.0 A

Water Flow Rate (Approx): 3.3 gpm

NOTE: Accessories installed on the system must have these flow parameters or the system will not operate. Only DEL attachments may be used (see Figure 1, page 2). Please call DEL if further explanation is required.

Supply Water Requirements:

Temperature:..... 40°F - 80°F (greater than 80°F will damage the MPI-300)
 Pressure: 40 psi (min.)
 Flow: 4.0 GPM (min.)
 Weights & Dimensions: 25.5"H x 24.5"W x11"D. 100 lbs.
 Ambient Temp: ... 40°F - 90°F (not to exceed 90°F)

1C. Layout & Accessories

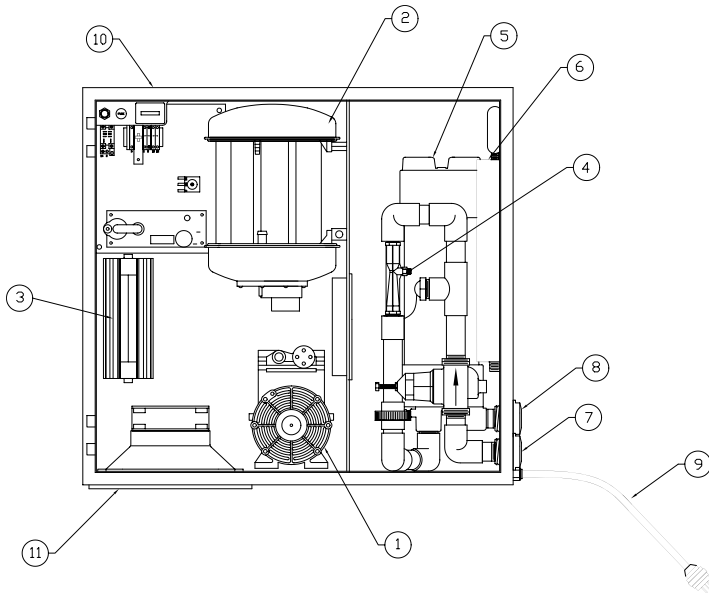
The MPI-300 is a low pressure, ozone enriched cold water surface sanitizer. Internally it is separated into two basic sections – dry and wet – as discussed below and shown in Figure 1, page 2.

1C1. Dry Section - Ozone Generation:

- **Air Compressor:** oilless, piston air compressor pumps ambient air at 2.5 CFM into the oxygen concentrator
- **Oxygen Concentrator:** the oxygen concentrator uses a PSA (pressure swing absorption) molecular sieve to remove dirt, moisture, nitrogen and other trace gases, producing oxygen at greater than 85% purity and less than -60° C dewpoint. Concentrated oxygen feed-gas enables ozone generation at 2-6% (by weight) concentration.
- **Ozone Generation Cell:** the corona discharge ozone generation cell consists of an aluminum housing (ground, two end housings, and fasteners), gaskets, high voltage stainless steel electrode, ceramic dielectric, oxygen inlet fitting, and ozone outlet fitting. Concentrated oxygen gas is pulled into the ozone generation cell under vacuum. The oxygen molecules are split into atomic oxygen which then recombine to form ozone gas.

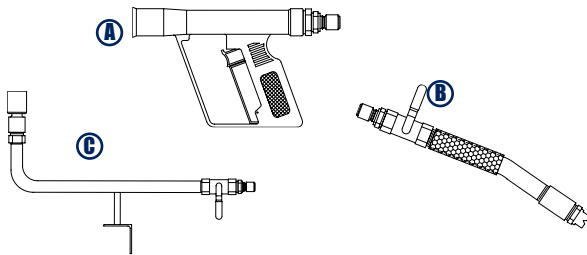
1C2. Wet Section - Ozone Dissolution in Water:

- **Ozone Injector:** Inlet water flows through the ozone injector, creating vacuum that pulls ozone gas from the ozone generation module and injects the ozone into the water flow. The injector is sized and factory preset to dissolve a minimum of 90% of the ozone gas into the water flow continuously.
- **Ozone Degas Chamber:** ozone-enriched water from the ozone injector flows into the degas chamber where the counter-current design forces any undissolved ozone gas through the float valve-protected top vent to the Ozone Destruct.
- **Ozone Destruct:** undissolved ozone gas passes through the heated catalytic ozone destruct which is made of non-consumable manganese dioxide (heat protected from moisture fouling). The manganese dioxide and heat offer redundant ozone destruct capabilities.
- **Ozone-Enriched Water Out:** ozone-enriched water exits the unit through the water outlet fitting. All available hose and hose attachments are specifically sized to provide the exact pressure and flow parameters necessary to allow the system to function correctly. Use of any attachments other than those approved by DEL will result in non-optimum operating ameters



MPI-300 Components

- ① Air Compressor
- ② Oxygen Concentrator
- ③ Ozone Generation Cell
- ④ Ozone Injector
- ⑤ Ozone Degas Chamber
- ⑥ Heated Catalytic Ozone Destruct
- ⑦ Water In
- ⑧ Ozonated Water Out
- ⑨ 110V Power Cord with 3-Prong Plug
- ⑩ Stainless Steel, Waterproof Enclosure
- ⑪ Air Filter (Dry Section)



MPI-300 Accessories

- Ⓐ Trigger Spray Gun
- Ⓑ Short Spray Wand
- Ⓒ Barrel Spray Wand

Figure 1: MPI-300 Components & Accessories

SECTION 2 - INSTALLATION

2A. Location

MPI-300 & MPI-300WM

The MPI-300 and MPI-300WM are designed to be permanently wall or frame-mounted using the mounting tabs on the enclosure. See Figure 2 to the right.

MPI-300M

The MPI-300M mobile cart-mounted system is designed to be conveniently rolled to a location close to your process. This can be a level location either indoors or outdoors.

For all systems, allow for access to protected electrical power and required water connections. **The point of ozonated water discharge from the spray wand, spray gun, or customer-supplied nozzles must NOT exceed 6 feet in height above the water outlet on the MPI.**

2B. Electrical

Main Power Supply Circuit: The MPI-300 is supplied with a standard 1 foot power cord. Plug cord into standard grounded 20 Amp GFCI type receptacle only.

2C. Plumbing

MPI-300

The standard MPI-300 is supplied with 3/4" FPT bulk-head fittings for water inlet and outlet. It is designed to be plumbed on site per the user's requirements. **CAUTION: Back pressure on the system caused from the outlet plumbing must not exceed 10 psi. Contact DEL Ozone or an authorized distributor for assistance with your specific installation.**

MPI-300WM & MPI-300M

The MPI-300WM is supplied with a 3/4" FPT bulkhead fitting for water inlet and is designed to be plumbed on site per the user's requirements. The MPI-300M is supplied with a garden hose adapter at the inlet. Both systems are supplied with a quick connect fitting at the outlet for the ozone delivery hose connection. A standard garden hose (1/2" minimum) can be connected to the water inlet hose adapter on the MPI-300M. For both systems, source water must be a minimum of 4 GPM at 40 psi.

SECTION 3 - OPERATION

3A. Control Panel Overview

3A-1. Front Panel

- a. On/Off Switch (illuminated in ON position)
- b. Ozone Power Indicator Light (only on when unit is producing ozone)

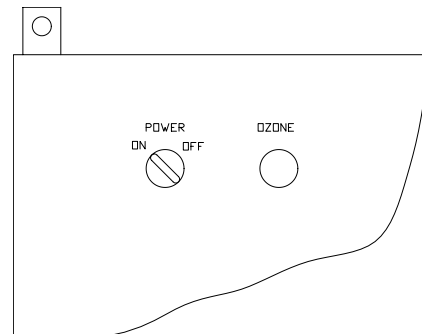
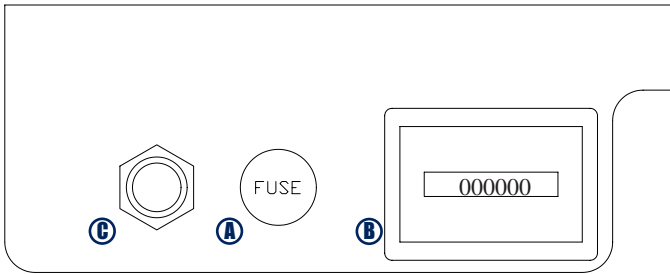


Figure 2: Front Control Panel

3A-2. Inside Panel

- Fuse**
- Hour Meter**
- Door Switch**

**Figure 3: MPI-300 Inside Panel****3B. System Start-Up - MPI-300WM and MPI-300M**

1. Confirm that water supply line is connected to water inlet (refer to Section 2C).
2. Select and install the appropriate attachment. (Short Spray Wand or Trigger Spray Gun)
3. Open Water Control Valve on the end of the spray hose.
4. Turn the source water on.
(Allow 1 minute to purge air from system before turning unit on.)
5. Close the Water Control Valve.
6. Plug the system into a specified receptacle.
7. Turn the system Power Switch ON.
8. Open the Water Control Valve and begin spraying.

3C. System Shut-Down

1. Close the Water Control Valve.
2. Turn the Power Switch OFF.
3. Unplug the system from the power source.
4. Turn the source water off.
5. Open the Water Control Valve to relieve pressure and drain excess water.
6. Disconnect the garden hose from the fitting. (Some water will drain out.)

3D. Standard Operating Procedures

NOTE: The MPI-300 provides a final sanitizing rinse, leaving no residual.

3D-1. Surface Sanitation

The spray can be directed on all wettable wood, metal, concrete, and plastic surfaces including: floors, drains, walls, conveyors, containers, external or internal tanks; tables, trays, bowls, and general equipment. (If the ozone spray is being applied in a very small, enclosed, poorly ventilated area, it may be necessary to wear a standard ventilator to avoid the inhalation of ozone gas.

CAUTION: Exposure to greater than 0.1 PPM ozone gas can irritate eyes and sensitive lung tissue. Please see the **Safety Section 6** for further details)

Based on industry experience, the amount of time necessary to attain sanitation depends on the amount of debris found in the area to be cleaned. Sweep or remove heavy surface dirt first to expedite the ozone sanitation process. Time estimates for proper sanitation are difficult to predict due to the variety of areas, surface materials and contaminants. However, experience and studies support that **0.5 to 2 minutes** of spray time is generally all that is necessary for complete sanitation. DEL recommends that end-users utilize their own sanitation efficacy testing protocol to determine necessary spray time.

3D-2. Wine Barrel Sanitation

Ozone is anti-microbial. Based on industry experience, the following chart provides ozonation time estimates for typical wood barrel sanitizing used in conjunction with a hand-held Barrel Spray Wand:

Sanitation Recommendations	STEP1	STEP2
	Hot Water	Ozone Enriched Cold Water
1.Total reduction of Acetobacter (which contributes to Volatile Activity)	None	1.0-3.0 Minutes
2. Total Reduction of Brettanomyces (or all wild yeasts)		
3. Overall barrel freshening		
4. Light	1.0 Minute	1.5 Minute
5. Heavy	2.0 Minutes	2.0 Minutes

3D-3. Direct Food Contact - Spray Nozzles

Applications vary. Please contact DEL Ozone for advice/consultation at 800-676-1335.

3D-4. Testing Dissolved Ozone Level (HACH) in System Effluent Water Flow**Materials Required**

1. HACH Indigo Blue AccuVac high range dissolved ozone test kit (DEL P/N 6-0116)
2. 5 gallon plastic pail (pre-cleaned)
3. Cold potable supply water for MPI-300

Procedure

1. Familiarize self with HACH AccuVac test kit.
2. Start-up MPI-300, place and hold spray wand in 5 gallon pail, and allow to flow for three to four minutes (NOTE: ensure the tip of the spray wand is approximately two inches above the bottom of the pail).
3. Thoroughly rinse hands, ampule, and plunger under the pail's overflow for one minute.
4. Immediately take a water sample using the ampule (following the HACH instructions) from the middle of the pail at least one inch below the water surface.
5. Gently shake the ampule.
6. Immediately compare the color of the ampule to the supplied color wheel with thumb covering the numerical readings. Once a color match is determined, move thumb and take numerical reading.

SECTION 4 - MAINTENANCE AND SERVICE

4A. Preventative Maintenance Schedule

DAILY:

1. Check ozone generator for proper operation.
 - Make sure green indicator lights are lit during operation.

MONTHLY:

1. Turn off system, unplug from power.
2. Remove and clean air filter located under "dry section."
 - Remove plastic cover.
 - Rinse filter in warm, soapy water and allow to dry.
 - Replace filter. (DEL P/N 7-1153)
3. Perform general cleaning of cabinet exterior.
4. Using clean/dry compressed air, blow out the interior of cabinet, taking special care around small components and wiring.
5. Check for debris in the debris screen located in the source water inlet fitting. Clean & reinstall.
6. Check air in the tires and their general condition.

ANNUALLY:

1. Remove and replace compressor air filter cartridge using DEL P/N 7-1132.

EVERY 10,000 HOURS:

1. Rebuild compressor.
 - Purchase compressor rebuild kit. (DEL P/N 2-1007 - See Section 5B for ordering information)
 - Follow instructions in compressor rebuild kit.

EVERY 18,000 HOURS:

1. Replace ozone generation cell. (DEL P/N 9-0925)

4B. Trouble Shooting

Knowledge of electrical applications is required for trouble shooting. Contact a certified electrician if you are unsure of your ability to service the equipment. If any condition persists, call 800-676-1335 or for international call 805-541-1601 for technical assistance.

Symptom: "OZONE ON" green indicator light out when switch is in the "ON" position and "PUMP ON" light is on.

1. Check inside control panel for fault lights.
 - a. See Low Vac & Hi Temp fault light sections.
2. Check internal fuse.
 - a. Replace if blown. (3 amp - AGC 3)
3. Cabinet door ajar.
 - a. Close and latch door.

SECTION 5 - REPLACEMENT PARTS AND ORDER INFORMATION

5A. Ordering information:

For replacement parts call DEL at **1-800-676-1335** or for international call **805-541-1601**.

Be prepared with the following information:

- Customer Name · Customer Address
- DEL Model Number · DEL Serial Number
- Date Purchased · Proof of Purchase

5B. Standard replacement parts list:

1. Compressor rebuild kit2-0875-01
2. Cabinet Intake Air Filter Element7-1153
3. Cabinet Exhaust Air Filter Element7-1152
3. Compressor Air Filter Cartridge.....7-1132
4. Ozone Generation Cell9-0925

SECTION 6 - OZONE OVERVIEW AND SAFETY PROCEDURES

6A. Ozone Use and Technology Overview

6A-1. Relative Strength of Ozone

The following compares the strengths of several common oxidizing reagents:

Oxidizing Reagent	EOP vs. Cl ₂
Elemental Fluorine	2.25
Hydroxyl Radical.....	2.05
Ozone	1.52
Hydrogen Peroxide	1.30
Hypochlorite	1.10
Chlorine	1.00
Chlorine Dioxide	0.93
Bromine	0.57

The following compares the CT values for water of ozone versus forms of chlorine:

Microorganism	Disinfectant			
	Ozone (pH 6 - 7)	Preformed Chloramine (pH 8 - 9)	Chlorine Dioxide (pH 6 - 7)	Free Chlorine (pH 6 - 7)
<i>E. coli</i>	0.02	95-180	0.4-0.75	0.034-0.05
Polio 1	0.1-0.2	770-3740	0.2-6.7	1.1-2.5
Rotavirus	0.006-0.06	3810-6480	0.2-2.1	0.01-0.05
<i>G. lamblia</i> cysts	0.5-0.6	--	--	47->150
<i>G. muris</i> cysts	1.8-2.0	1400	7.2-18.5	30-630

6A-2. Materials Selection

Materials	Aqueous Ozone 0-3 ppm Freshwater
<u>Metals:</u> Copper Brass 316L Stainless Steel	* * ****
<u>Plastics:</u> ECTFE (Halar) PTFE (Teflon) PVC (rigid) PVC (flexible) PVDF (Kynar)	**** **** *** *** ****
<u>Elastomers:</u> FPM (Viton)	*** (gasket)
LEGEND: * = Not Recommended ** = Fair *** = Good **** = Very Good	

6A-3. Micro-Flocculation and Oxidation

Ozone oxidizes the following metals (know as micro-flocculation), enabling their removal via filtration:

- Iron
- Copper
- Manganese
- Zinc
- Arsenic

Ozone neutralizes "nuisance" compounds - most commonly, hydrogen sulfide.

6A-4. Factors Affecting Sanitation

The following factors will affect the ability of ozone to effectively act as a sanitizer:

- Type and level of contaminant
- Physical/chemical parameters of the environs
- Exposure time
- Temperature
- Concentration
- Water chemistry and pH
- Cleanliness
- Microbial attachment

6B. General Safety Information

6B-1. Ozone Properties

- Colorless to blue gas (greater than -169°F)
- Characteristic odor often associated with electrical sparks or lightning in concentrations of less than 2 PPM
- Severe irritant above 1-2 PPM
- Generally exists as a gas
- Highly chemically reactive
- Non-flammable, non-carcinogenic
- Hazardous polymerization can occur
- Spontaneously decomposes to oxygen gas

6B-2. Ozone Uses

- Air and water disinfection
- Surface sanitation
- Water treatment plants
- Bottled water, irrigation, community water supplies, swimming pools/spas, etc.
- Aquariums/life support
- Agricultural wash water
- Wastewater treatment
- Mold and bacteria control in cold storage

6B-3. MPI-300 Safety Features

The MPI-300 has a water-proof, stainless steel enclosure, inside which ozone is automatically and immediately injected into the water flow. Any ozone which does not dissolve into the water is separated off in the degas chamber and eliminated in the heated catalytic ozone destruct. The design of this enclosed, self-contained system eliminates the release of gaseous ozone from the unit. In addition to ozone safety, the following general safety features are built-in to the MPI-300:

- Door safety interlock switch - disables high voltage power supply when open or improperly latched
- Circuit Breaker, Fuse
- Vacuum Switch - stops operation in the event of low water flow
- Flow Switch - stops operation in the event of low water flow
- Ozone cell high temperature switch
- Interlocked sensors and regulating devices
- Startup/shutdown sequences and fault protection
- Ozone is supplied under negative pressure (induction - i.e. a leak will draw air into the system).

Slight off-gassing of ozone can occur from the spray water that is produced by the MPI-300 (the physical properties of ozone make this unavoidable). Laboratory and field testing in varying environments indicate that ozone off-gas levels from the spray water produced by the MPI-300 do not exceed 0.1 PPM (the permissible exposure level (PEL) or time weighted concentration for gaseous ozone to which workers may be exposed averaged over 8 hours, 5 days a week (OSHA)). Gaseous ozone concentrations above 0.02 PPM are detectable by humans.

Inasmuch, sections 6C through 6H of this manual discuss relative issues regarding safety and monitoring of gaseous ozone.

6C-2. Health Hazards - Effects on Humans

Gaseous ozone acts as a primary irritant, affecting mainly the eyes, upper respiratory tract and the lungs. Inhalation produces various degrees of respiratory effects from irritation to pulmonary edema (fluid in lungs). Short exposure to 1-2 PPM concentrations causes headache as well as irritation to the respiratory system but symptoms subside when exposure ends. High concentrations of ozone produce severe irritation to the eyes and respiratory system. Exposure above the ACGIH/OSHA limits may 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. There is no threshold limit and so no exposure (regardless of how small) is theoretically without effect from ozone's strong oxidative ability.

TOXIC EFFECTS OF GASEOUS OZONE	
OZONE	
CONCENTRATION (PPM)	EFFECT
0.01 - 0.10 Range of odor threshold
0.1 Permissible concentration (8 hour work day)*
0.3 Permitted short-term exposure (15 min.)*
0.01 - 1.0 Headaches, irritation to respiratory tract, severe irritation to eyes
1.0 - 10.0 Nausea, chest pain, coughing, fatigue, reduced visual acuity, pulmonary edema
5.0 Immediately Dangerous to Life or Health (I.D.L.H.)*
>20.0 Can be fatal after 1 hour
>50.0 Can be fatal after 1/2 hour
<i>*Regulatory Levels</i>	

6C-3. Hazards - Electrical

Turn OFF all power switches and disconnect power cord from power source receptacle before performing service work. Failure to do so could result in serious injury or death. Operate the MPI-300 on a near level surface when using accessory cart with safe access to electrical power. Connect the MPI-300 to a GFCI type receptacle. Do not bury the electrical cord. To reduce risk of electrical shock, replace damaged cord immediately.

6C-4. Hazards - Fire

Ozone is nonflammable. Decomposition of ozone into oxygen gas, O₂, can increase strength of fire. Ozone is unstable at room temperature 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.

6C. Hazards

6C-1. Health Hazards - Detection Levels

Gaseous ozone can be detected in air by its distinctive odor at concentrations of about 0.02 PPM. Although each nose varies, olfactory fatigue occurs quickly. Initial small exposure may reduce cell sensitivity and/or increase mucous thickness producing a resistance to low gaseous ozone levels. As a result, DO NOT RELY ON ODOR AS A WARNING OF HIGH OZONE CONCENTRATIONS.

The permissible exposure level (PEL) or time weighted concentration for gaseous ozone to which workers may be exposed is 0.1 PPM averaged over 8 hours, 5 days a week (OSHA). The short term exposure limit is 0.3 PPM averaged over 15 minutes. The concentration of 5.0 PPM ozone in air is generally accepted as Immediately Dangerous to Life or Health (IDLH).

6D. Precautions for Safe Handling & Use

6D-1. Ozone Monitors

Ambient ozone monitoring equipment should be installed in the areas where ozone is being generated or applied. See Monitoring section 6G.

Self-adhesive ozone monitor badges, such as the Chromair® System by K&M Environmental (Virginia Beach, VA, www.kandmenvironmental.com), may be used for personal or area monitoring for exposure times ranging from 5 minutes to 10 hours.

6D-2. Ventilation

It is mandatory that general and local exhaust ventilation be provided to dilute and disperse small amounts of ozone into the outside atmosphere. Federal, state, and local regulations must be followed.

6D-3. Emergency Procedure

Due to the short life of ozone, evacuation and ventilation is all that is generally required in the event of a high ambient ozone alarm. All ozone generating and delivery equipment should be shut down (manually or automatically by alarm) and a high speed fan activated to dilute and disperse ozone to the atmosphere. Personnel should evacuate the affected area until levels are returned to below 0.1 PPM.

6D-4. Respiratory Protection

A disposable respirator (3M #N95 8214/8514 - Minneapolis, MN, www.3m.com) is recommended for relief against ozone levels up to 10 times the OSHA PEL or applicable government occupational exposure limits, whichever is lower.

6D-5. Education & Training

The education and training of workers is the responsibility of the employer. An effective training program must be practical, based on written work procedures and be specific to both the job-site and the tasks to be performed. Training shall also include the responsibilities and responses of workers in an emergency. The employer shall ensure, through the education and training program, that all workers are able to work without risk to themselves or others around them. All workers must clearly understand their responsibilities with regard to not only specific work procedures, but also the need to report all hazards, accidents or incidents and injuries.

All routine work and emergency procedures shall be reviewed jointly by management and employees at least annually.

6E. Monitoring

6E-1. Location of Monitors

Ambient ozone detection monitors shall be located to monitor ozone room air and production/plant room air for indoor applications.

6E-2. Monitoring Equipment

OZONE IN AIR

Electronic Ambient Ozone Monitor

- a. Shall measure the level of ozone present in the room where ozone equipment is located.
- b. The monitor shall include both visible and audible alarms. The EcoZone™ Model EZ-1 portable ambient ozone analyzer by EcoSensors, Inc. is recommended for use with the MPI-300.

b-1. EcoZone™ Model EZ-1 features:

- Constantly monitors work environment
- O₃ concentration shown by a multi-color display from green (safe) to yellow (caution) to red (danger)
- No installation required
- Easily understood by non-technical personnel
- Field work and "walk around" analyses possible via power from internal rechargeable batteries
- Compatible with EcoSensor VOC and O₃ sensing, monitoring, and control products

b-2. EcoZone™ Model EZ-1 specifications:

- Range: 0.02-0.14 PPM O₃
- Bar graph display: normally green, yellow at 0.05 PPM (caution), red at 0.1 PPM (danger)
- Response time: with a few seconds of O₃ reaching the sensor
- Accuracy: within 20% in the 0.05-0.1 PPM range
- Recommended calibration check annually
- Temperature Range: 18-37°C (65-100°F)
- Measurement principle: HMOS (Heated Metal Oxide Semiconductor) sensor
- Size: 85 x 35 x 60 mm (3 1/4" x 1 3/8" x 2 3/8")
- Weight: 154 grams (6 oz.)
- Power Requirements: 12-24 volts DC at 300-500 mA. AC adapters available worldwide.
- Batteries: self-contained NiMH. Approximately 2 hour capacity. Recharged by AC adapter overnight.

Badge-Type Ambient Ozone Monitor

- a. Shall measure the level of ozone present in the room where ozone equipment is located.

b. The ChromAir® System ozone badge (K&M Environmental P/N 380010-10; www.kandmenviro.com; 1-800-808-2234) may be used for personnel or area monitoring for exposure times ranging from 5 minutes to 10 hours. For higher resolution, the ChromAir ozone badge may be used in conjunction with the ChromAir ozone color comparator.

b-1. ChromAir System features:

- Constantly monitors work environment
- Accurate measurements
- Ease of use - requires minimal training
- Cost effective - offers the most inexpensive air sampling solution available

b-2. ChromAir System specifications:

- Color change: blue to white
- Exposure range: 0.08–1.6 PPM/hr
- Max. sampling time: 10 hours
- Min. sampling time: 5 minutes
- Relative humidity range: 20% - 90%
- Face velocity range: 10-165 cm/sec
- Temp. range: 16°C - 30°C (61°F - 86°F)
- Light effect - sunlight: not recommended
- Light effect - visible: no effect
- Dimensions: 10.5 cm x 5.5 cm x 0.25 cm
- Weight: 11 g
- Refrigerated shelf life: 1 year

Other ambient ozone monitors are also available. Contact DEL for further information.

OZONE IN WATER

The ozone concentration in water can be measured in different ways.

1. Oxidation Reduction Potential (ORP) monitor measures the effective biocidal activity of dissolved ozone in water in millivolts and can be converted to mg/l (PPM). NOTE: ORP is an **ineffective** measurement of ozone concentrations greater than about 0.5 PPM.

2. Dissolved Ozone monitors measure levels of dissolved ozone in water (mg/l or PPM). The HACH Indigo Blue AccuVac high range dissolved ozone test kit (DEL P/N 6-0116) is an inexpensive colorimetric test. Electronic, in-line dissolved ozone monitors are also available. Contact DEL for further information.

6E-3. Ozone Detection Data Log

In addition to automatic chart recorders, operators should log ozone monitor output. Record ozone output data twice per shift (maximum 12 hour shift). If system does not have an automatic chart recorder, record data every 4 hours, regardless of shift changes. **(See Daily Data Log - page 10).**

6F. First Aid Procedures

6F-1. GENERAL

First Action:

1. DO NOT PANIC.
2. If exposure to gaseous ozone causes headaches or shortness of breath, immediately remove the worker to a fresh air environment.

Second Action:

1. Ensure there is no more danger to yourself or the worker.
2. Workers who have been exposed to low concentrations of ozone should be given oxygen to breathe while under the observation of trained personnel.
3. If exposure is severe, send for medical assistance immediately.

6F-2. INHALATION

First Action:

1. Assess worker's breathing.
2. All unconscious workers must be placed in the drainage position (on their sides), so that fluids can drain from the airways once breathing has been restored.
3. Check pulse.

Second Action:

1. If breathing has ceased, start artificial respiration (rescue breathing is the most effective) method until breathing has been restored.
2. Send for medical assistance immediately.
3. If absent, begin cardiopulmonary resuscitation (CPR).

6F-3. EYE CONTACT

First Action:

1. Effective irrigation should start immediately. Eyes should be irritated for 30 minutes by the clock with running tap water or preferably normal saline.

Second Action:

1. Effective irrigation must be continued while en-route to hospital.

6F-4. PRECAUTIONS

Workers with a previous cardiopulmonary (heart and lung) condition must consult their physician prior to working in an area in which they may be exposed to ozone. Significant alterations in cardiopulmonary functions have been documented when such workers have been exposed to low concentrations of ozone.

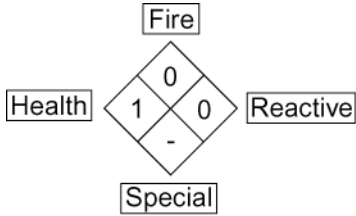
6F-5. EMERGENCY INFORMATION FORM

An emergency information form (see page 10) should be filled out prior to operation of ozone generator.

6G. MSDS

See pages 12-14 for full MSDS.

NFPA 704 Designation
Hazard Rating



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

Material Safety Data Sheet

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

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					

Material Safety Data Sheet

This MSDS complies with OSHA's Hazardous Communication

Standard 29 CFR 1910.1200 and OSHA form 174.

IV HEALTH HAZARD DATA	
Threshold Limit Value NOT DETERMINED	
Route of Exposure <input type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Skin <input checked="" type="checkbox"/> Eye <input checked="" type="checkbox"/> 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 <input checked="" type="checkbox"/> STABLE <input type="checkbox"/> UNSTABLE	

Material Safety Data Sheet

This MSDS complies with OSHA's Hazardous Communication

Standard 29 CFR 1910.1200 and OSHA form 174.

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		<p>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 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.</p>		
Precautions To Be Taken In Handling		<p>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 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.</p>		
Rev. Date 10/14/03				
<p>This material safety data sheet is provided as an information resource only. It should not be taken as a warranty or representation for which the preparer assumes legal responsibility. While we believe the information contained herein is accurate and compiled from sources believed to be reliable, it is the responsibility of the user to investigate and verify its validity. The buyer assumes all responsibility of using and handling the product in accordance with applicable federal, state, and local regulations.</p>				

DEL OZONE TWO YEAR LIMITED WARRANTY

The limited warranty set forth below applies to products manufactured by DEL OZONE – 3428 Bullock Lane, San Luis Obispo, California 93401, and sold by DEL OZONE and 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.

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 from data of original purchase. Parts are covered under the two (2) year warranty when and only when required maintenance is performed. Compressor(s) must be maintained per operation and maintenance manual. Required maintenance includes a compressor rebuild after one (1) year or every 10,000 hours, which ever is reached first. See owner's manual for complete maintenance details. Warranty does not include parts for compressor(s) rebuild kit(s). 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 OZONE AUTHORIZED REPLACEMENT AND MAINTENANCE PARTS. USE OF ANY OTHER PART(S) WILL AUTOMATICALLY 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, or 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 caused by hot water passing through unit; (e) ANY IMPLIED WARRANTY OF MERCHANTABILITY OR IMPLIED WARRANTY OF FITNESS FOR PARTICULAR PURPOSE, AND SUCH WARRANTIES ARE HEREBY DISCLAIMED; AND (f) DEL INDUSTRIES SHALL NOT BE LIABLE UNDER ANY CIRCUMSTANCES FOR LOSS OF USE OF SUCH PRODUCTS, LOST 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 details.

TO OBTAIN WARRANTY SERVICE: DEL Ozone CD Department
3428 Bullock Lane, San Luis Obispo, CA 93401
Customer Service Number: (800) 676-1335
Fax Number: (805) 541-8459

PROVIDE:

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