



AGW-1500G

Mobile Recirculating Ozone Sanitation System

OWNER'S MANUAL



#124182

EPA Estab. No. 071472-CA-001

TABLE OF CONTENTS

SECTION 1

General Information

1A. Description 1
 1B. Specifications 1

SECTION 2

Installation

2A. Location 1
 2B. Electrical 1
 2C. Plumbing 1

SECTION 3

System Configuration/Installation Diagrams

3A. Tank System..... 2
 3B. Tank Cleaning 3
 3C. Spray System..... 4
 3D. Automatic Barrel Washer (AGW-0200)..... 5
 3E. Automatic Barrel Washer (AGW-0201)..... 6

SECTION 4

Operation

4A. Control Panel Overview 7
 System Component/Connection Locations 8
 4B. Quick System Start-Up 9
 4C. Detailed System Start-Up 9
 4D. System Shut-Down / Freeze Protection 9
 4E. Standard Operating Procedures 9
 4E1. Clean In Place (CIP) Operation 10
 4E2. Facility Washdown 10
 4E3. Wine Barrel Sanitation (2-up/4-up automated) 10
 4E4. Direct Contact 10
 4E5. General Water Purification 10

SECTION 5

Maintenance & Service

5A. PM Schedule..... 11
 5B. Air Compressor Servicing 11
 5C. Digital Flow Meter Servicing 11
 5D. Trouble Shooting 11-12
 5E. Wiring Diagram 13

SECTION 6

Replacement Parts & Order Info

6A. Ordering Information 12
 6B. Standard Replacement Parts List..... 12

SECTION 7

General Ozone Use & Safety Procedures

7A. Ozone Use and Technology Overview 14
 7B. General Safety Information 14-15
 7C. Hazards 15
 7D. Precautions for Safe Handling and Use 16
 7E. System Operation and Maintenance..... 16
 7F. Monitoring 17
 7G. First Aid Procedures 18
 7H. MSDS..... 18

Appendix "A" - Daily Ozone Data Log 19
 Appendix "B" - Emergency Information Form 20
 Appendix "C" - MSDS 21-23

Warranty 24

IMPORTANT SAFETY INSTRUCTIONS

READ AND FOLLOW ALL INSTRUCTIONS.

Read this manual completely before operation of AGW-1500G Ozone Generator Equipment.

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 AGW-1500G on a near level surface with safe access to electrical power.

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 AGW-1500G'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 AGW-1500G Mobile Recirculating 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 DEL AGW-1500G described in this manual recirculates ozone-enriched water through tanks sized from 50 gallons to 2,500 gallons. It is designed to "charge" a given tank of water with ozone for safe and effective clean in place (CIP) and clean out of place (COP), direct contact on food products, and general water sanitation/disinfection.

1B. Specifications

Ozone Output:

Ozone output ($\pm 10\%$): Low: 10 g/hr
 High: 25 g/hr
 Flow rate (max): 14 scfh (6 lpm)
 % weight O₃: Low: 2.0
 High: 5.25
 Applied O₃ Dose: Low: 1.25 PPM
 High: 3.0 PPM

Power Requirements:

240VAC, 50/60 Hz, 1Ø, 15.0 A (20 Amp Service)
 Optional 480VAC, 50/60 Hz, 1Ø, 7.5 A (10 Amp Service)

Water Flow Rate (Approx): 35 gpm

NOTE: The purpose of the pump in the AGW-1500G is to provide the proper pressure and flow rate for the most efficient injector operation. It is designed to circulate cold water only. **The inlet of the AGW-1500G should never be connected directly to a pressurized water source and the outlet should never be throttled or restricted. Please call DEL if further explanation is required.**

Water Requirements:

Temperature: 40°F - 90°F
 Pressure: 0 - 10 psi
 Water Quality: potable, mineral & chemical free water

NOTE: Water passing through the AGW-1500G cools the ozone generator module. Ozone effectiveness, generator efficiency and service life will be improved at water temperatures of 60 - 80°F.

Overall Dimensions:

Length: 58.75" (including handles)
 Width: 29.00" (including tires)
 Height: 53.13"

Shipping Weight w/Crate: Approx. 500 pounds

Dry Weight: Approx. 385 pounds

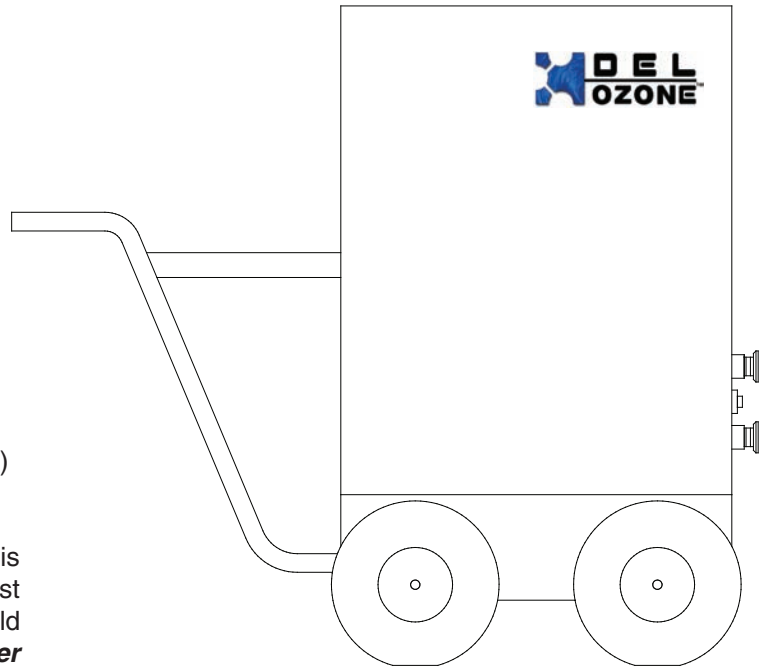
Ambient Temperature:

Operation: Ambient Temperature 40°F - 100°F
Not to exceed 100°F

SECTION 2 Installation

2A. Location

The AGW-1500G cart is designed to be conveniently rolled to a location close to your process. This can be a level location either indoors or outdoors. Allow for access to electrical power and required water connections.



**Figure 1: AGW-1500G
Mobile Recirculating Ozone Sanitation System**

2B. Electrical

Main Power Supply Circuit: The AGW-1500G is supplied with a standard 50 Foot power cord. Plug cord into standard 240 VAC (20 Amp) grounded receptacle.

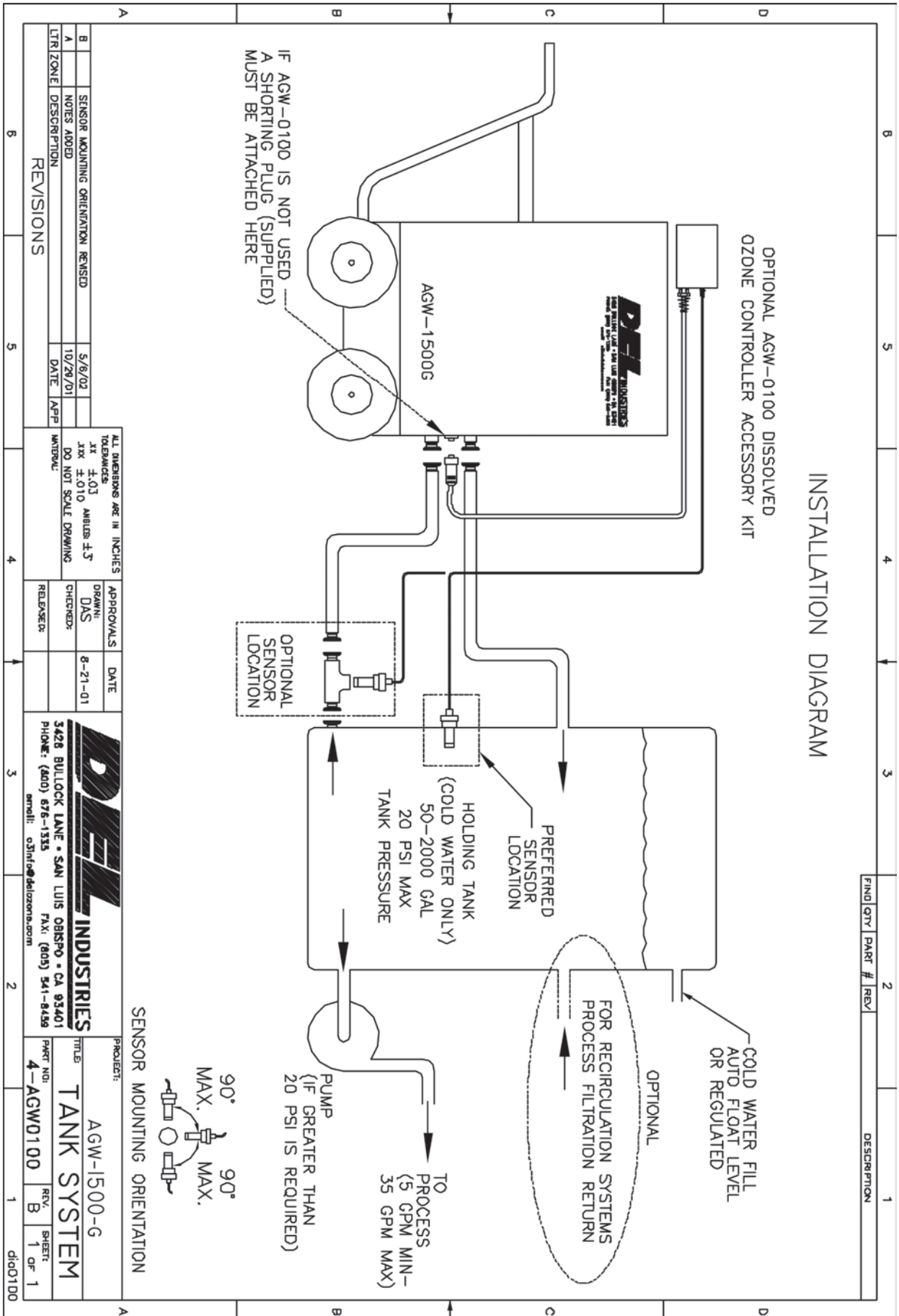
2C. Plumbing

Customer water connection size - 2" tri-clover fitting.

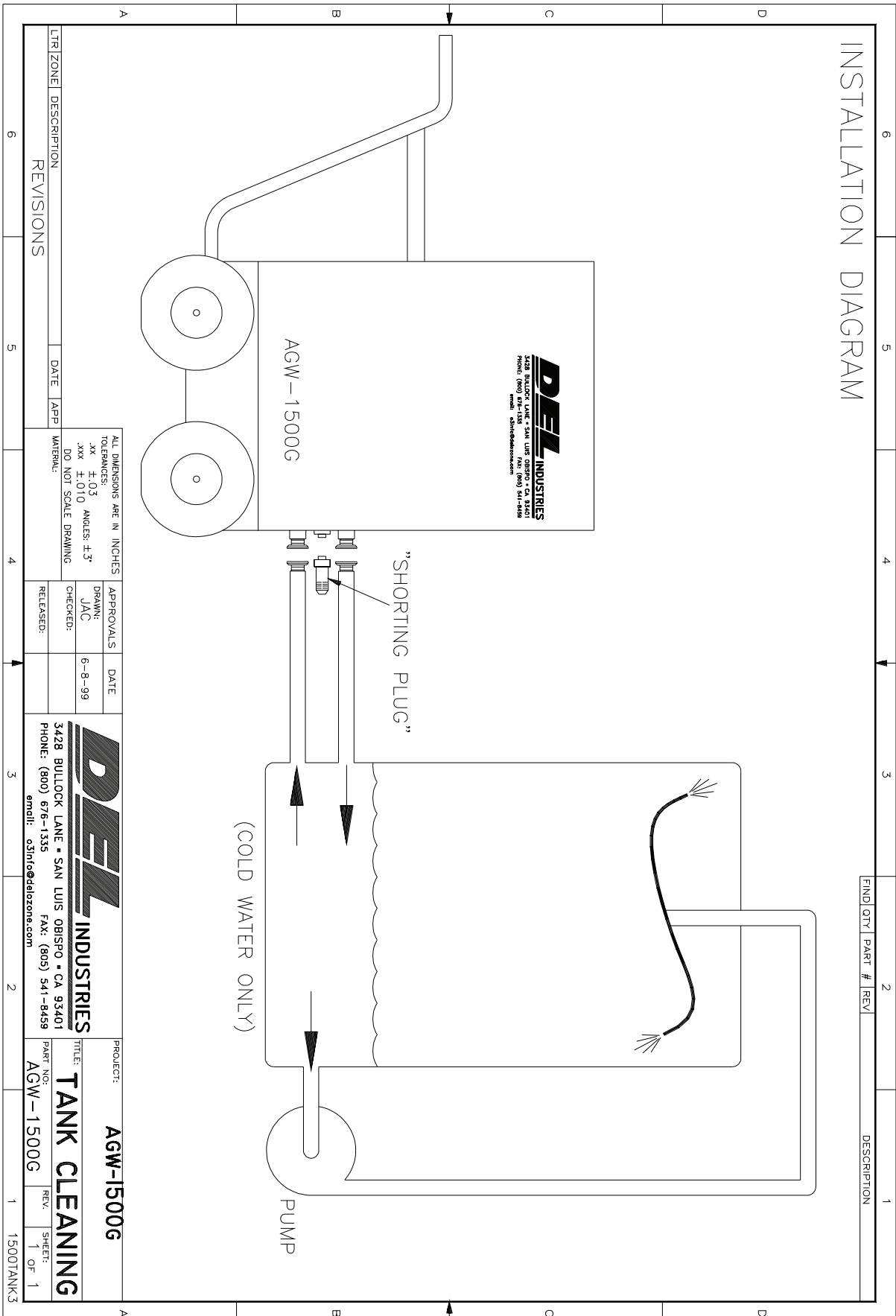
SECTION 3 System Configuration/Installation Diagrams

The following 5 pages include diagrams for the following:

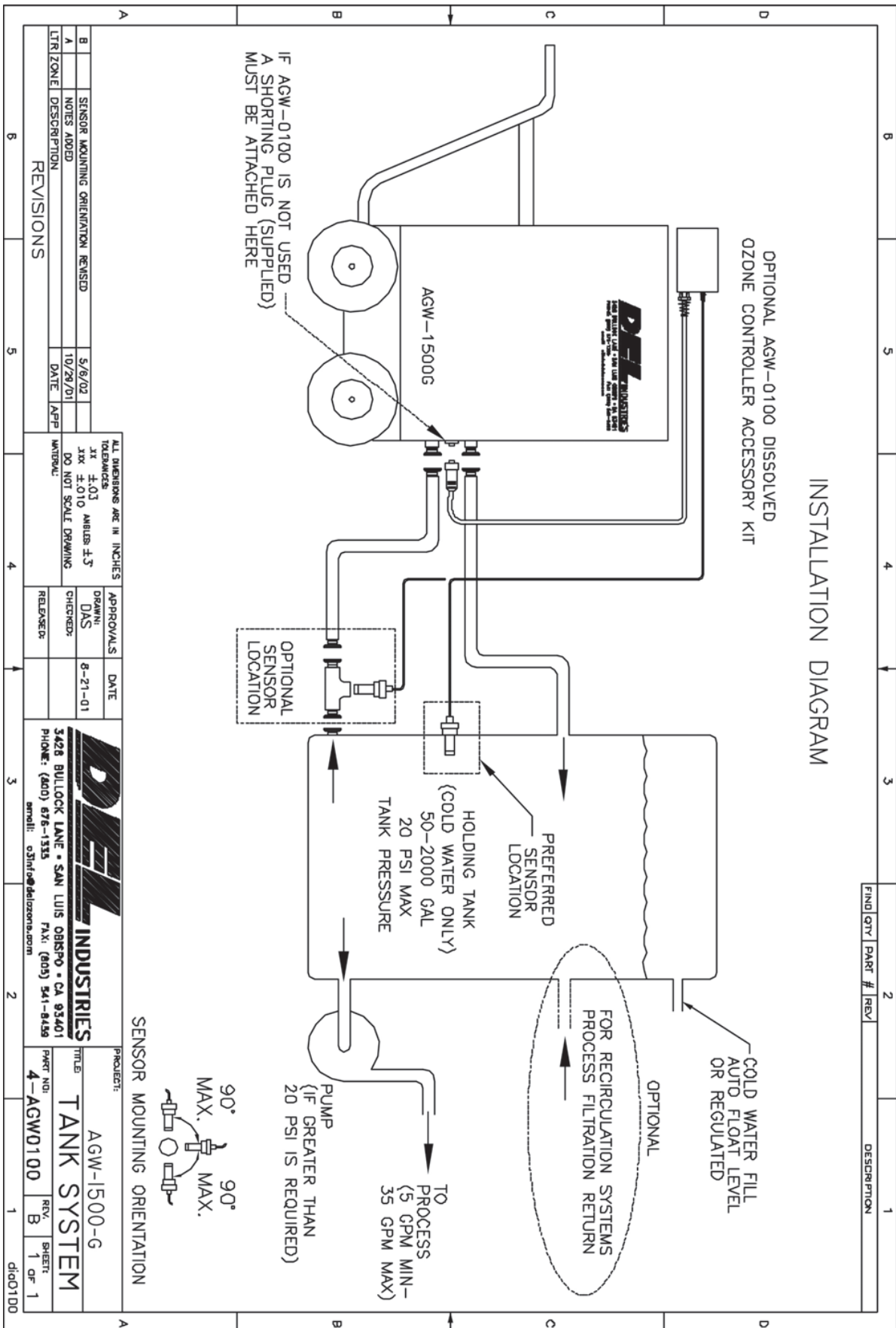
- Tank System with Dissolved Ozone Monitor/Controller (AGW-0100)
- Tank Cleaning
- Spray System
- Automatic Barrel Washer (AGW-0200)
- Automatic Barrel Washer (AGW-0201)



3A. Tank System



3B. Tank Cleaning



REV	DATE	DESCRIPTION
1	5/8/02	SENSOR MOUNTING ORIENTATION REVISED
2	10/29/01	NOTES ADDED

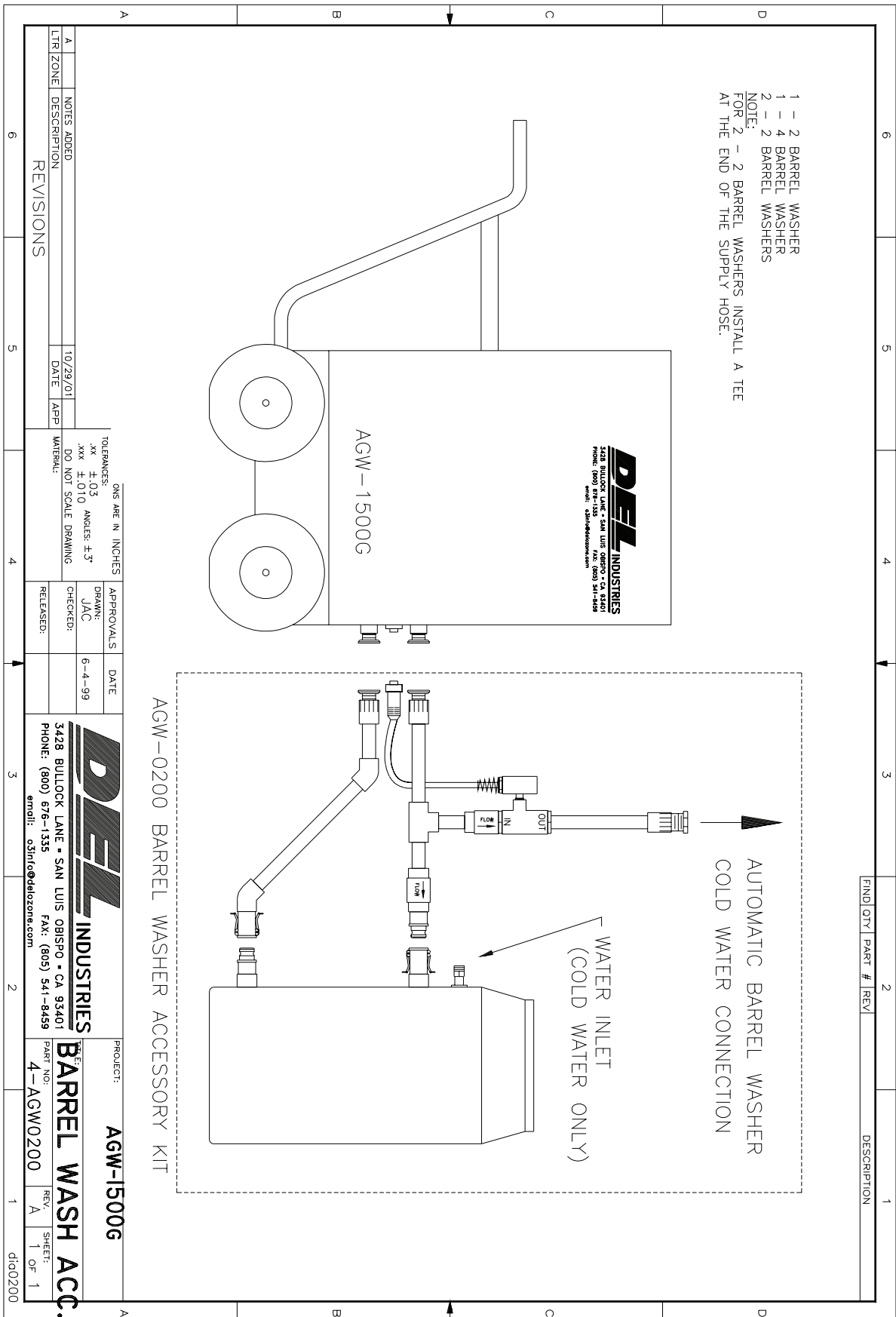
APPROVALS	DATE
DRAWN: DAS	8-21-01
CHECKED:	
RELEASED:	

ALL DIMENSIONS ARE IN INCHES
TOLERANCES: XX ±.01 XXX ±.010 DO NOT SCALE DRAWING

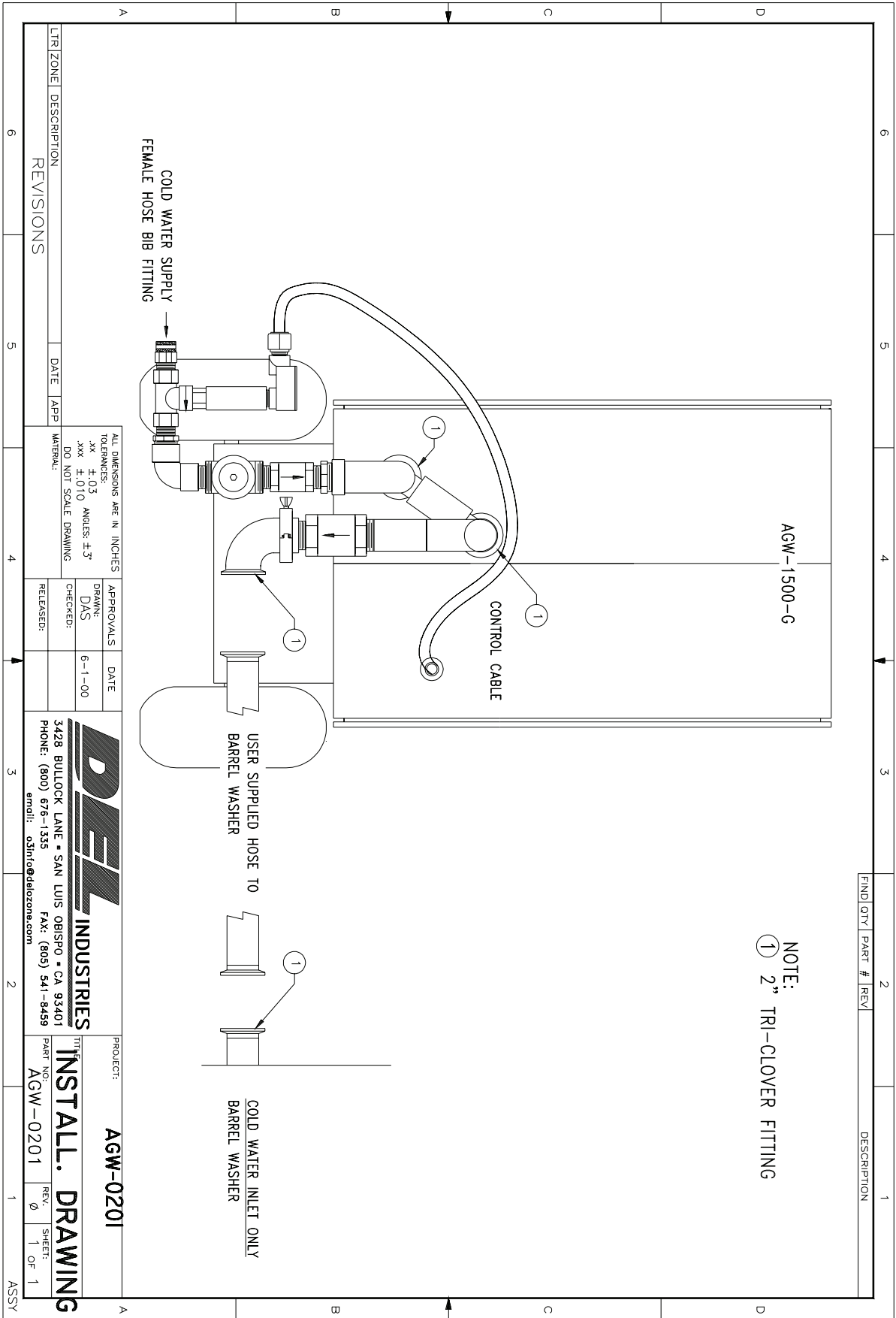
DEW INDUSTRIES
 3428 BULLOCK LANE • SAN LUIS OBISPO • CA 93401
 PHONE: (800) 676-1535 FAX: (805) 541-8459
 email: o3info@dewindustries.com

TITLE	PROJECT
TANK SYSTEM	AGW-1500-G
PART NO: 4-AGW0100	
REV: B	
SHEET: 1	
OF: 1	

3C. Spray System



3D. Automatic Barrel Washer (AGW-0200)



LTR ZONE		DESCRIPTION	DATE	APP	MATERIAL
REVISIONS					
ALL DIMENSIONS ARE IN INCHES TOLERANCES: .XX ±.03 .XX ±.010 ANGLES: ±3° DO NOT SCALE DRAWING					
APPROVALS	DATE	PROJECT: AGW-0201 TITLE: INSTALL. DRAWING			
DRAWN: DAS	6-1-00	3428 BULLOCK LANE • SAN LUIS OBISPO • CA 93401 PHONE: (800) 676-1335 FAX: (805) 541-8459 email: csj@delozone.com			
CHECKED:		PART NO: AGW-0201			
RELEASED:		REV: 0 SHEET: 1 OF 1			

3E. Automatic Barrel Washer (AGW-0201)

SECTION 4 Operation

4A. Control Panel Overview

4A-1. Indicator Lights

- a. Green Lights
 - 1) **System Power**: indicates that power is being supplied to the pump.
 - 2) **Ozone Power**: indicates that power is being supplied to the ozone generator
 - 3) **Ozone Production**: indicates that power is being supplied to the high voltage Corona Discharge circuits and that ozone is being produced.
- b. Red Lights
 - 1) **Vacuum**: indicates that vacuum is out of range. The light will be lit for low vacuum conditions.
 - 2) **High Water Temperature**: indicates that water temperature is over 110 °F. (Refer to TROUBLESHOOTING Section.)
 - 3) **Water Back Flow Detected**: indicates that water back flow from the injector into the generator has been detected. (Refer to TROUBLESHOOTING Section.)

4A-2. Other External Components

- a. **Emergency Stop Switch**: Interrupts power to all circuits.
- b. **System Power Switch**: Activates water pump and fans.
- c. **Ozone Power Switch**: Activates ozone generating equipment.
- d. **Low-High Power Switch**: Selects ozone output from 10 grams/hour (low) to 25 grams/hour (high). Use low when attached to a two-barrel automatic barrel washer or when a lower applied ozone dose is desired.
- e. **System Vacuum Gauge**: Indicates Vacuum/Pressure of the ozone in the injector system.
- f. **Vacuum Adjustment Valve**: Controls Vacuum by adjusting the flow of water to the ozone injector.
- g. **Back-Pressure Gauge**: Indicates back-pressure in the main flow loop (after the injector).
- h. **Remote Control Receptacle (located next to water inlet/outlet ports - see pg 8)**: This receptacle is connected to an External Flow Switch when operated with a Barrel Wash System; a Dissolved Ozone Controller for CIP Applications; or an ORP Controller for General Water treatment.

NOTE: This receptacle must contain a shorting plug (included) or be connected to an external control for the ozone generator to function.

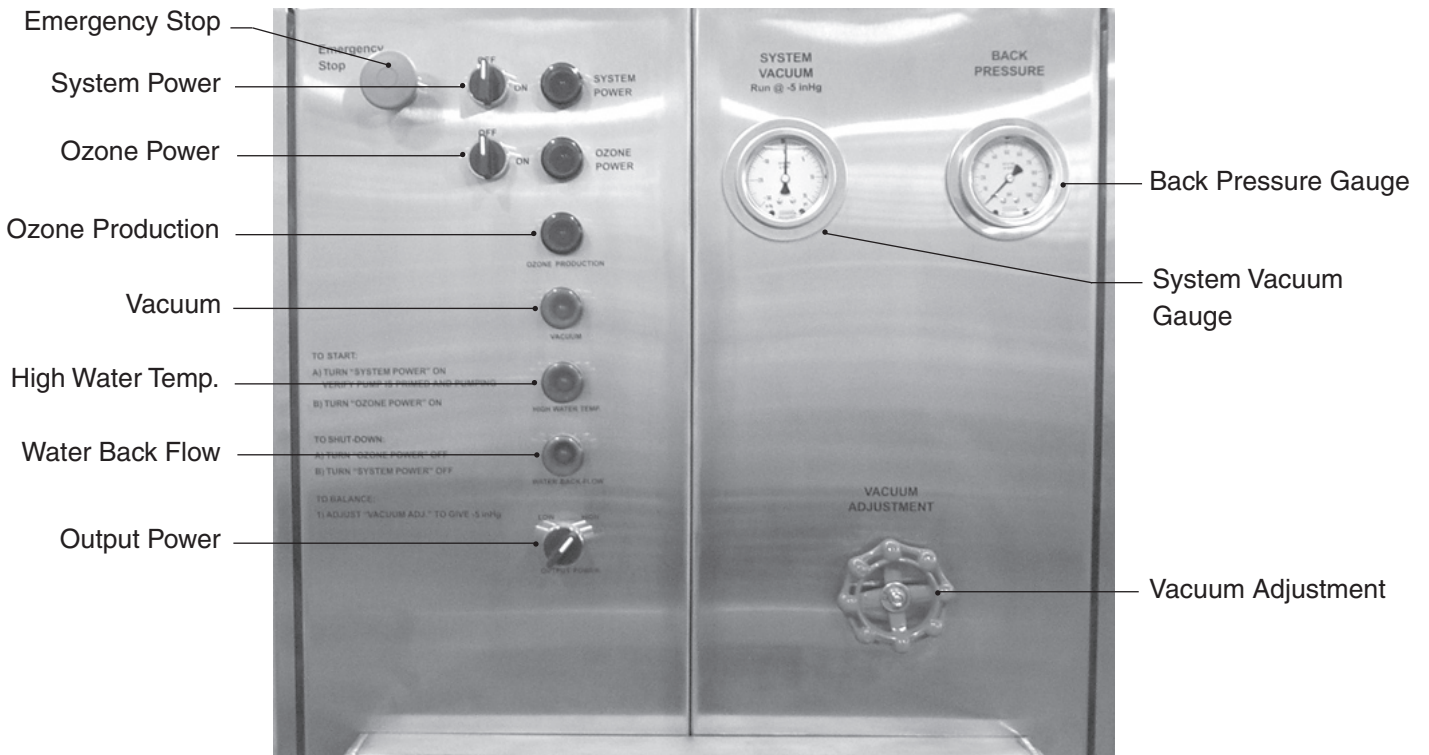
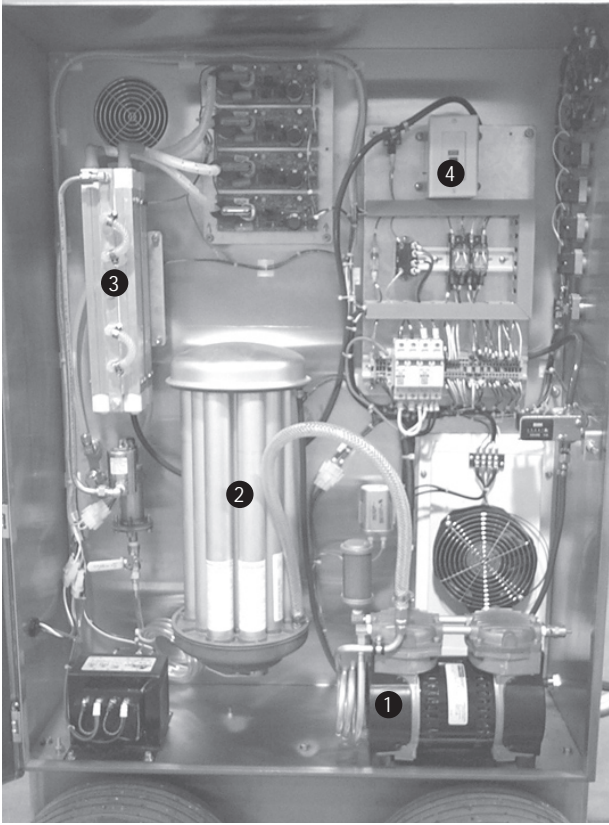
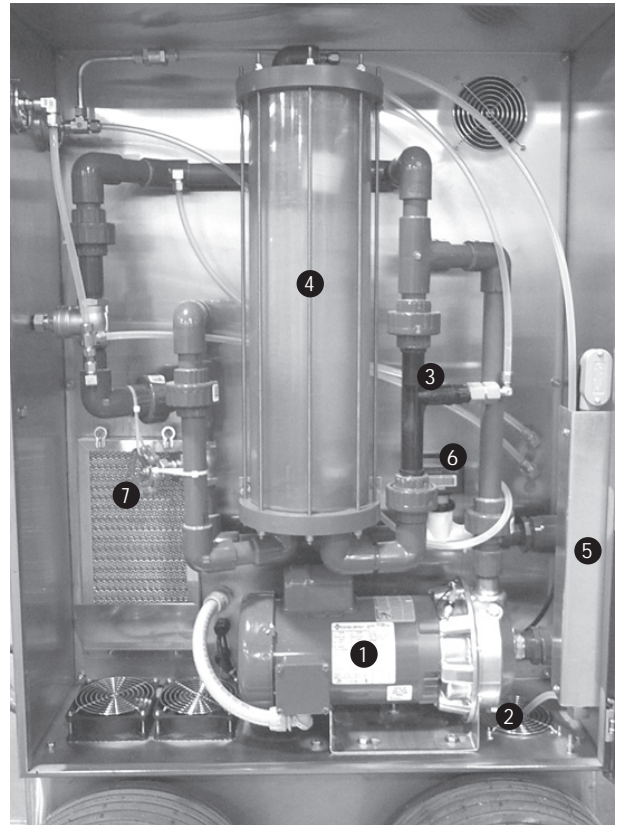


Figure 2: AGW-1500G Control Panel



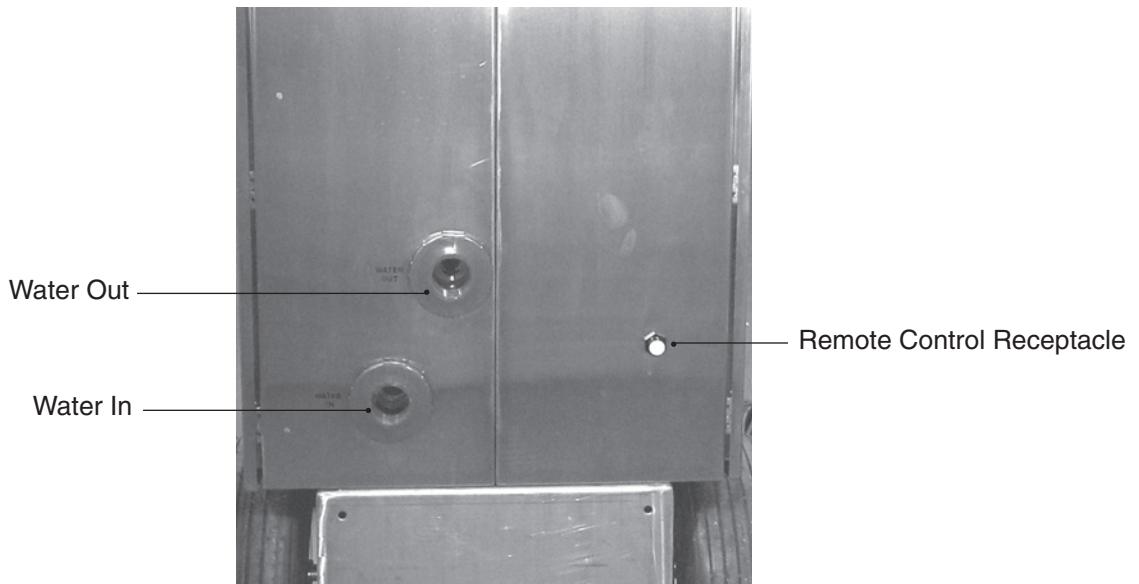
AGW-1500G Ozone Generation Components

- ① Air Compressor
- ② Oxygen Concentrator
- ③ Ozone Generation Cell
- ④ Ground Fault Circuit Interrupt (G.F.C.I.)



AGW-1500G Plumbing Components

- ① Water Pump (1.5 HP)
- ② Pump Drain Plug (1/2")
- ③ Ozone Injector
- ④ Ozone Degas Chamber
- ⑤ Heated Catalytic Ozone Destruct
- ⑥ Digital Flow Meter
- ⑦ Flow Adjustment Valve (red)



AGW-1500G External Connections

4B. Quick System Start-Up

Presumes unit is tuned to its present application. (Follow detailed start up section 4C).

1. Verify Red Emergency Stop Switch is in the run position.
2. Turn Pump Power switch to ON. Top green light will illuminate. Allow one minute for system to stabilize.
3. Turn Ozone Power switch to ON. Second green light will illuminate.
4. Check System Vacuum Gauge. Adjust Vacuum Adjustment valve until gauge reads approximately -3 to -7 in.Hg. vacuum.

4C. Detailed System Start-Up

Read completely before starting system.

1. Check for proper electrical and water connections.
2. Verify Red Emergency Stop Switch is pulled out, in run position.
3. Switch Pump Power ON (top green light will illuminate), allow pump to run for one minute as water level in mixing tower fills and stabilizes.
4. If the mixing tower doesn't fill with water then the pump needs priming. Turn off the Pump Power, DO NOT RUN PUMP DRY (pump seal failure will result). Insure the water supply hose is full of water and the water source has sufficient flow capacity for the pump. Turn on the Pump Power. Repeat until the mixing tower has filled, stabilized and water is circulating.
5. Switch Ozone Power ON (Second green light will illuminate).
6. Check System Vacuum Gauge. Adjust Vacuum Adjustment valve until gauge reads approximately -5 in.Hg. vacuum. Ensure that back pressure gauge reads approximately 16 psi. **NOTE: Applications with elevated head pressures will raise bypass and back pressures. The above values are minimum operating pressures. If the system is out of specified operating parameters, see Flow Adjustment Instructions below.**
7. Turn Low-High switch to "Low" if operating in conjunction with Two-Barrel Automatic Barrel Washer. Turn switch to "High" for most other applications.

System Flow Adjustment Instructions

To make water flow adjustments to the AGW-1500G to enable optimum ozone mass-transfer, please follow these steps:

1. With the unit running, open "plumbing side" door and observe the digital flow meter readout (see pg. 8).
2. Adjust the red flow adjustment valve located on the left until the flow meter is reading approximately 35 gpm.
3. Next, adjust the vacuum valve to read -5 in. Hg.
4. While adjusting the vacuum valve observe the back pressure gauge.
5. The optimal back pressure is approximately 16 psi.
6. As the flow adjustment valve is opened the back pressure will drop. The back pressure and flow rate, in some cases, might need to be balanced (i.e. both as close to optimum as possible).

4D. System Shut-Down / Freeze Protection

1. Turn OFF Ozone Power switch.
2. Turn OFF System Power switch.
3. Remove hoses and allow water to drain from system (a small amount of water will remain in the ozone degas chamber).
4. **Freeze Protection:** It is recommended that the AGW-1500G be protected from freezing temperatures. If this is not possible, the pump must be drained by removing the 1/2" drain plug located underneath the pump (see page 8). **WARNING: Pump damage will occur if pump is not drained before unit is stored in freezing temperatures or for extended periods of time.** A small heater may be used to prevent remaining water in the system from freezing.

4E. Standard Operating Procedures

The following chart provides ozonation time estimates to charge tanks ranging in size from 300 to 2,000 gallons using the AGW-1500G:

Ozone Tank Charging Guidelines

Tank Size (gallons)	Charge Time (minutes)	Ozone Dose (PPM)
300	10	1
300	20	2
300	30	3
300	40	4
400	40	3
500	50	3
600	60	3
700	70	3
800	90	3
900	100	3
1000	120	3
1100	140	3
1200	160	3
1300	180	3
1400	200	3
1500	220	3
1600	240	3
1700	260	3
1800	280	3
1900	300	3
2000	320	3

There are two ways to measure and/or control the amount of ozone in the water:

Dissolved Ozone Monitor/Controller (AGW-0100)

By far the most accurate way to measure and control the ozone in the water, a dissolved ozone monitor/controller may be used to ensure that the water is completely charged before starting the timing of the cycle, as well as providing a continuous monitor for observation. In addition, it can be used to control the ozone system so that the tank of water can be maintained continuously and stays charged at the exact amount determined by the adjustable set-point; it will cycle the ozone system on and off as needed to maintain the set-point.

Indigo Blue Ampules with Colorimeter (Hach AccuVac Test Kit)

This method can be used to determine the amount of ozone at the discharge of the CIP (at the end of the cycle). It cannot be used to determine the amount of ozone in the *ozone charge tank* because the highest range of detectability is **1.5 PPM**. Therefore, refer to the *Ozone Tank Charging Guidelines*, charge the *ozone charge tank* for the proper amount of time and then begin the CIP. After 30 minutes, test the discharge water with the Hach AccuVac Ampule. If there is 1.0 - 1.5 PPM ozone in this discharge water, it can be safely determined that the system is sanitized.

4E-1. CIP - USE HIGH SETTING

4E-1a. Refer to the *Ozone Tank Charging Guidelines*. Determine the amount of water in the ozone charge tank. Operate the AGW-1500G for the proper amount of time based on the amount of water in the ozone charge tank, and charge the water to approximately 3 PPM. The time necessary to accomplish this is dependent on the volume of water in the tank. Once the water is charged with 3 PPM ozone, CIP operation can begin. Experience dictates that 15 - 30 minutes of CIP operation with an applied dose of 3 PPM is an acceptable amount of time to attain a zero microbial count. A longer duration will not cause any harm. Individual preferences vary, but 30 minutes is the recommended optimum.

4E-1b. General Tank Sanitation - See page 3, drawing 3B. Wash debris and rinse the tank with clean water. Connect the AGW-1500G to the tank and recirculate the system while spraying with any standard spray ball. Approximate spray time is 15-30 minutes.

4E-2. Facility Washdown - USE HIGH SETTING

Refer to the *Ozone Tank Charging Guidelines*. Determine the amount of water in the ozone charge tank. Operate the AGW-1500G for the proper amount of time based on the amount of water in the *ozone charge tank*, and charge the water to approximately **2-3 PPM**. The time necessary to accomplish this is dependent on the volume of water in a given tank. Once the water is charged with **2-3 PPM** ozone, a spray rig can draw this ozone charged water from the *ozone charge tank*. **CAUTION: Maximum pressure 22 psi - higher pressure will result in excessive ozone off-gas!** The spray can be directed on floors, drains, walls, wettable equipment, external or internal tanks, clean rooms, etc. (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

ozone gas can irritate eyes and sensitive lung tissue. Please see the **Safety Section 7** for further details and a Material Safety Data Sheet on ozone.)

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 cleaning 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 **30 sec 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.

4E-3. Wine Barrel Sanitation - USE LOW SETTING

The following chart provides ozonation time estimates (preferences vary) for typical barrel washing used in conjunction with an automated barrel wash system.

Sanitation Requirements	STEP 1 Hot Water	STEP 2 Ozone Enriched Cold Water
1. Total reduction of Acetobacter (which contributes to Volatile Acidity) 2. Total reduction of Brettanomyces (or all wild yeasts) 3. Overall barrel freshening	None	1.5 - 2.5 Minutes
4. Light Tartrates (+ 1, 2, 3)	1.0 Minute	1.5 Minutes
5. Heavy Tartrates (+ 1, 2, 3)	2.0 Minutes	1.5 Minutes

AGW-0201 Automatic Barrel Washer Attachment:

It may be necessary to perform a vacuum adjustment when the AGW-1500G is connected to an automated barrel washer using the AGW-0201 (see page 6). **This adjustment should ONLY be made when the barrel washer is running in the cold rinse cycle (the green Ozone Production Light on the AGW-1500G should be illuminated).** The vacuum should be adjusted, if necessary, so the Vacuum Gauge reads approximately -5" Hg.

NOTE: Flow adjustment is not necessary as it has been preset at the factory.

The AGW-1500G automatically changes to "stand-by mode" when the cold water rinse cycle is completed. The green Ozone Production Light will turn off, and the red Vacuum Indicator Light will illuminate and the system Vacuum Gauge will indicate a slight positive pressure reading.

4E-4. Direct Contact - Spray Nozzle, Flume, Cascade

Applications vary. Please contact DEL's agricultural division for advice/consultation at 800-676-1335.

4E-5. General Water Sanitation/Disinfection

Applications vary. Please contact DEL's agricultural division for advice/consultation at 800-676-1335.

SECTION 5

Maintenance and Service

5A. Preventative Maintenance Schedule

DAILY:

1. Check ozone generator for proper operation.
 - Make sure no red indicator lights are lit.

MONTHLY:

1. Remove and clean cabinet air filter.
 - Rotate hold-down wing-nuts to access filter.
 - Rinse filter in warm, soapy water and allow to dry.
 - Replace filter and tighten hold-down bracket.
2. Perform general cleaning of cabinet exterior.
3. Using clean/dry compressed air, blow out the interior of both the electrical and pump cabinets taking special care around small components and wiring.
4. Check air in the tires (14 PSI max. recommended) and their general condition.
5. Disassemble and clean check valve. Replace poppet as required using DEL P/N 8-0333.

EVERY 10,000 HOURS:

1. Remove and replace compressor air filter cartridge using DEL P/N 8-0061.
2. Rebuild compressor. See COMPRESSOR SERVICING section 5B.
3. Replace circulation pump seal using DEL P/N 5-0987.

EVERY 18,000 HOURS:

1. Replace the 4 CD ozone cells, DEL P/N 9-0927.

5B. Air Compressor Servicing

Air compressor requires rebuild every 10,000 hours of operation.

- a. Purchase Compressor Rebuild Kit using DEL P/N 2-1025. See Section 6B for ordering information.
- b. Follow instructions in Compressor Rebuild Kit to rebuild compressor.

5C. Digital Flow Meter Servicing

The digital flow meter batteries should be replaced every 12 months. Two AAA batteries are required.

- a. Remove the flow meter by loosening the union nut.
- b. To replace the batteries, open the rear panel by removing the two Phillips screws. Be sure the foam insert is in place before closing the rear

5D. 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.

I. Symptom: "PUMP POWER" green indicator light out when PUMP POWER switch is in the "ON" position.

1. *No power to the AGW-1500G from the power supply.*
 - a. Check the circuit breaker at the facility power distribution box.
 - b. Check for loose connections or wiring breaks from the power distribution box to the AGW-1500G.
2. *G.F.C.I. has tripped.**
 - a. Check power cord for breaks in insulation. Repair. Reset G.F.C.I.
3. *Circuit breaker has tripped.**
 - a. Check for source of power overload on the circuit. Correct. Reset circuit breaker.

**If G.F.C.I. or breaker continue to trip after reset, call for technical assistance.*

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

1. *If optional External Flow Switch is connected to the Remote Control Receptacle, the cable to the switch may have become disconnected.*
 - a. Check cable & connectors. Reconnect if in good condition.
 - b. Check flow switch. Replace as required.
2. *If optional ORP is installed, ORP module may have shut-down the ozone generator when the ORP level reached set point.*
 - a. Wait for ORP to come down below set point. Generator will restart when ORP is below set point.
3. *Abnormal operating conditions exist.*
 - a. Check red fault lights. Refer to corresponding symptom and corrective action.
4. *Electrical cabinet door ajar.*
 - a. Close and latch door.

III. Symptom: "NO VACUUM" red indicator light is on indicating out of range vacuum is being supplied.

1. *Injector not supplying adequate vacuum.*
 - a. Check pump and ensure water is flowing through injector.
 - b. Check vacuum gauge & adjustment valve. Adjust if necessary to obtain proper reading on vacuum gauge (-5 in. Hg).
2. *Injector supplying too much vacuum.*
 - a. Check vacuum gauge & adjustment valve. Adjust to proper pressure to obtain correct vacuum (approx. -5 in. Hg).
 - b. Check system back pressure gauge to insure back pressure is approximately 16 psi.

3. *Another abnormal condition exists causing the ozone output solenoid to be closed.*

- a. Check red fault lights. Refer to corresponding symptom and corrective action.
- b. Check hose connections.
- c. Solenoid valve may be stuck in closed position. Free plunger and return system to normal operation.

IV. Symptom: "HIGH WATER TEMP" red indicator light is on indicating ozone generator temperature is over 110°F.

1. *Coolant water flow has been interrupted.*
 - a. Check all tubing connections insuring tight leak-free connections
 - b. Trace tubing and look for flow blockage.
 - c. Re-establish proper coolant water flow.
2. *System is left in self-recirculation mode too long.*

V. Symptom: "WATER BACKFLOW DET." Red indicator light is on indicating possible water in ozone line.

1. *Water has flowed back from injector to the ozone generator module.*
 - a. Re-establish proper water flow through injector and correct vacuum.
 - b. Drain Back Flow Preventer by first routing drain tubing out of the cabinet and opening ¼" stainless steel ball valve.
 - c. After water has completely drained, close valve, secure cabinet door and restart system.

VI. Symptom: CD Module is not operating. Ozone output has dropped.

1. *No power to the generator module from the power supply.*
 - a. Check high voltage (HV) cables for breaks or loose connections, replace if required.
 - b. Check for power at input terminals of the HV power supplies.*
 - c. Check ozone power relay for loose connections or faulty operation.

***CAUTION:** HIGH VOLTAGE (7,000 V)

VII. Symptom: No oxygen flow through the ozone generator.

1. *Air compressor is not operating properly.*
 - a. Listen for air compressor operation.
 - b. Check all tubing connections from the air compressor through the system for leaks. Repair as

VIII. Symptom: Low dissolved O₃ level. System is operational but measured O₃ level in water is lower than it should be.

1. *See VII.*
2. *Ozone is not dissolving efficiently into water.*
 - a. Check back pressure gauge - gauge should read approximately 16 psi.
 - b. Check water flow rate through unit - should be 30-35 gpm.

SECTION 6

Replacement Parts and Order Information

6A. Ordering information:

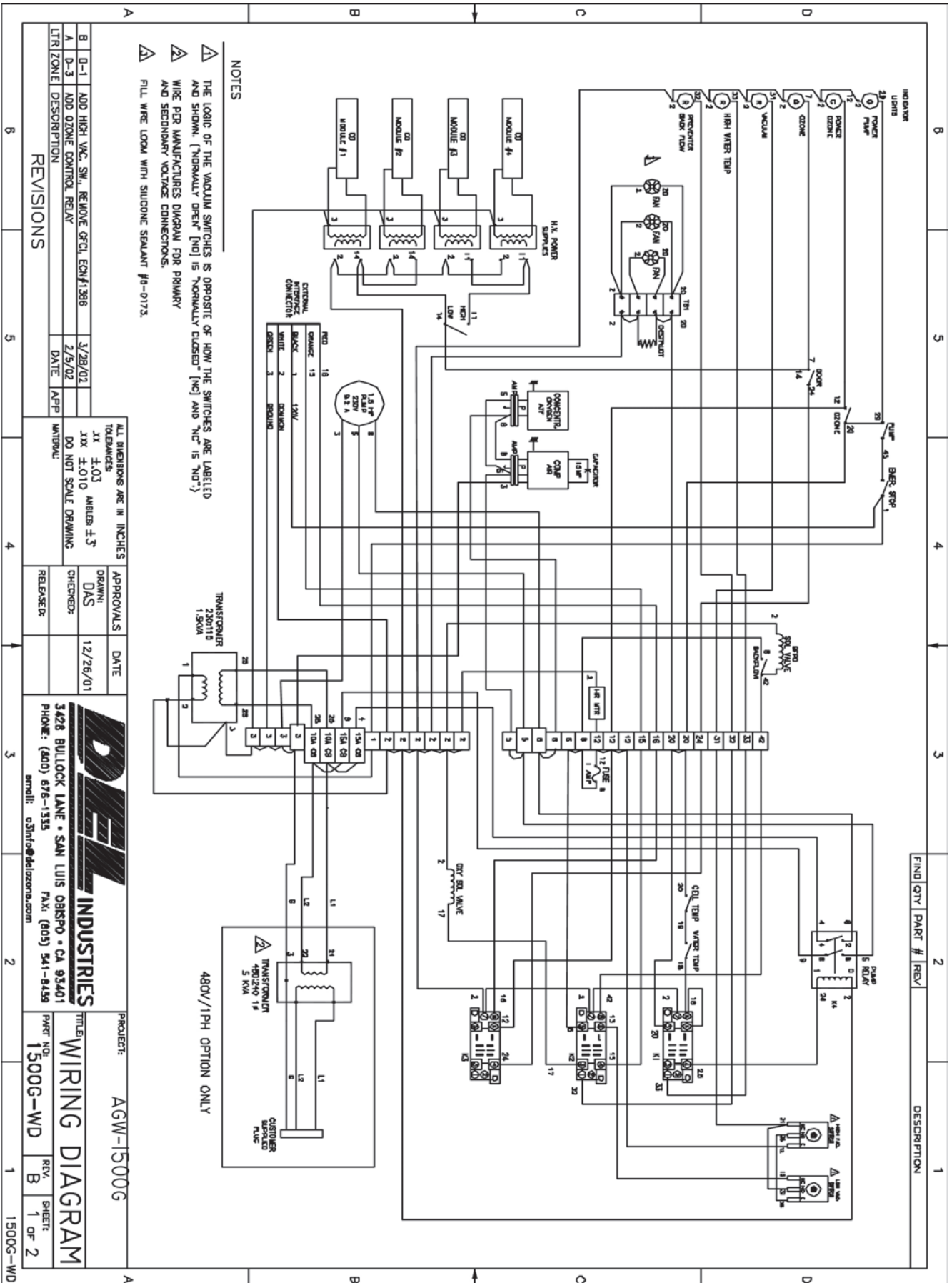
For replacement parts call DEL at **1-800-676-1335** or for international call **805-541-1601**.

Be prepared with the following information:

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

6B. Standard replacement parts list:

1. CD Ozone Cell (4 required)9-0927
2. Compressor rebuild kit, AGW-15002-1025
3. Cabinet Air Filter Cartridge7-0615
4. Compressor Air Filter Cartridge7-1132
5. Ozone Tubing, Teflon.....7-0126
6. Power Cable, 50 Ft (240V only)5-0898
7. Shorting Plug9-0290
8. Pump Seal5-0987
9. Check Valve Rebuild Kit8-0333



NOTES

- ⚠ THE LOGIC OF THE VACUUM SWITCHES IS OPPOSITE OF HOW THE SWITCHES ARE LABELED AND SHOWN. ("NORMALLY OPEN" [NO] IS "NORMALLY CLOSED" [NC] AND "NC" IS "NO".)
- ⚠ WIRE PER MANUFACTURERS DIAGRAM FOR PRIMARY AND SECONDARY VOLTAGE CONNECTIONS.
- ⚠ FILL WIRE LOOK WITH SILICONE SEALANT #8-0173.

REV.	DESCRIPTION	DATE	APP.
B	D-1 ADD HIGH VAC. SW., REMOVE CTRL. EQM#1386	3/28/02	
A	D-3 ADD OZONE CONTROL RELAY	2/5/02	

REVISIONS	
6	5
4	3
2	1

APPROVALS	DATE
DRAWN: DAS	12/26/01
CHECKED:	
RELEASED:	

DEL INDUSTRIES
 3428 BULLOCK LANE • SAN LUIS OBISPO • CA 95401
 PHONE: (800) 676-1333 FAX: (805) 541-9459
 email: o3h@delcorp.com

PROJECT: AGW-1500G	
TITLE: WIRING DIAGRAM	REV. B
PART NO: 1500G-WD	SHEET: 1 OF 2

FIND QTY	PART #	REV	DESCRIPTION
2			
1			

SECTION 7 Ozone Overview & Safety Procedures

7A. Ozone Use and Technology Overview

7A-1. Relative Strength of Ozone

The following compares the strengths (electron oxidation potential) 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 Chloride (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

7A-2. Materials Selection

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

7A-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.

7A-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

7B. General Safety Information

7B-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

7B-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

7B-3. AGW-1500G Safety Features

The AGW-1500G 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 AGW-1500G:

- Door safety interlock switch - disables high voltage power supply when open or improperly latched
- Circuit Breaker, GFCI Breaker, Fuse
- Vacuum Switch - stops operation in the event of low water flow
- Ozone cell high temperature indicator
- Interlocked sensors and regulating devices
- Startup/shutdown sequences and fault protection
- Multistage water pump to control flow rate
- 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 water that is produced by the AGW-1500G (the physical properties of ozone make this unavoidable). Laboratory and field testing in varying environments indicate that ozone off-gas levels from the water produced by the AGW-1500G 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 7C through 7H of this manual discuss relative issues regarding safety and monitoring of gaseous ozone.

7C. Hazards

7C-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 ppm ozone in air is generally accepted as Immediately Dangerous to Life or Health (IDLH).

7C-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

**Regulatory Levels*

7C-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 AGW-1500G on a near level surface with safe access to electrical power. Connect the AGW-1500G to a GFCI type receptacle. Do not bury the electrical cord. To reduce risk of electrical shock, replace damaged cord immediately.

7C-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.

7C-5. Hazards - Chemical Action

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

7D. Precautions for Safe Handling & Use

7D-1. Ozone Monitors

Ambient ozone monitoring equipment should be installed in the areas where ozone is being generated or applied. See Monitoring section 7G.

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.

7D-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.

7D-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.

7D-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.

7D-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.

7E. Monitoring

7E-1. Location of Monitors

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

7E-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 AGW-1500G.

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.kandmenvironmental.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.

7E-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 - Appendix A).**

7F. First Aid Procedures

7F-1. General

First Action:

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

Second Action:

1. Ensure there is no more danger to yourself or the victim.
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.

7F-2. Inhalation

First Action:

1. Assess patient's breathing.
2. All unconscious patients 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 breathing and/or pulse is not detected, begin cardiopulmonary resuscitation (CPR).

7F-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 enroute to hospital.

7F-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.

7F-5. Emergency Information Form

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

7G. MSDS

See Appendix C for full MSDS

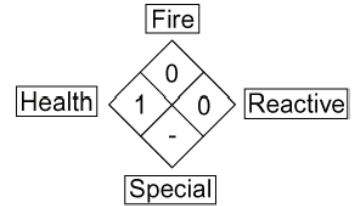
Material Safety Data Sheet

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

DEL Ozone
3428 Bullock Lane
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				

Material Safety Data Sheet Cont.Product Name **AQUEOUS OZONE SOLUTION**

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 Hazardous Polymerization <input type="checkbox"/> MAY OCCUR <input checked="" type="checkbox"/> WILL NOT OCCUR

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 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 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 10/14/03				
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.				

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.