





## What is Ozone?

- Ozone (O<sub>3</sub>) is tri-atomic oxygen
- The highly reactive product of energy (electricity or UV) disrupting O<sub>2</sub> molecules
- Most powerful commercially available oxidant





## Safety Data Sheet / Material Compatibility with Ozone

(Produktdatablad) / CAS-NR: 10028-15-6 )

### 

#### SAFETY DATA SHEET

TIFICATION						
Ozone						
O3, Triatomic Oxygen, Trioxygen						
Pacific Ozone Technology						
6160 Egret Court						
Benicia, CA 94510, USA						
Tel: (707) 747-9600						
Fax: (707) 747-9209						
Website: www.pacificozone.com						
Email: info@pacificozone.com						
This SDS is limited to ozone produced in gaseous form on site by an ozone generator, in vaying concentrations, in either air or aqueous solution, for the purpose of disinfection, sanitization, odor abatement, oxidation of organic compounds and in organic compound, or as an antimicrobial intervention, in a variety of applications.						

#### 2. HAZARD IDENTIFICATION



Note: Severe respiratory toxicity will develop before skin or eye irritation go beyond listed categories. Anyone with chronic pulmonary problems, especially asthma, should avoid exposure to ozone.

#### WHMIS Classification (Workplace Hazardous Materials Information System, Canada)

$\mathfrak{S}$	A	Compressed gas
٢	c	Oxidizing material
$\diamond$	D1A	Poisonous and infectious material – Immediate and serious effects – very toxic
$\bigcirc$	D2A	Poisonous and infectious material – Other effects – very toxic
$\bigcirc$	D2B	Poisonous and infectious material – Other effects – Toxic
R	F	Dangerously reactive material

DOC70000\_R1 OZONE SDS.doc

Page 1 of 5

(Ozone Concentration not specified)	material	(Ozone Concentration not specified)
B <sup>1</sup> – Good	Kalrez	A <sup>1</sup> – Excellent
C - Fair	Kel-F®	A - Excellent
B – Good	LDPE	C <sup>1</sup> – Fair
B – Good	Magnesium	D – Severe Effect
B – Good	Monel	C – Fair
D – Severe Effect	Natural Rubber	D – Severe Effect
A - Excellent	Neoprene	C – Fair
C – Fair	Nylon	B – Good
C – Fair	PEEK	A - Excellent
B – Good	Polyacrylate	B – Good
A – Excellent	Polycarbonate	B <sup>1</sup> – Good
A - Excellent	Polypropylene	C – Fair
A - Excellent	Polysulfide	B – Good
A - Excellent	PTFE (Teflon®)	A - Excellent
A - Excellent	PVC	B – Good
A - Excellent	PVDF (Kynar®)	A - Excellent
A <sup>1</sup> – Excellent	Santoprene®	D – Severe Effect
A - Excellent	Silicone	A - Excellent
A - Excellent	Steel - Galvanized	C – Fair (in water)
A - Excellent		A – Excellent (in air)
A - Excellent	Steel – Mild, HSLA	D – Severe Effect
A - Excellent	Stainless Steel - 304	B – Good
C <sup>2</sup> – Fair	Stainless Steel - 316	A - Excellent
A - Excellent	Titanium	A - Excellent
C – Fair	Tygon® (E-3603)	A – Excellent
A - Excellent	Viton®	A – Excellent
	Zinc	D – Severe Effect
	(Ozone Concentration not specified) $B^1$ – Good $C$ – Fair $B$ – Good $B$ – Good $B$ – Good $D$ – Severe Effect $A$ - Excellent $C$ – Fair $C$ – Fair $C$ – Fair $B$ – Good $A$ – Excellent $C$ – Fair $A$ – Excellent $C$ – Fair $A$ – Excellent $C$ – Fair $A$ – Excellent	(Ozone Concentration not specified)         B <sup>1</sup> -Good         Kalrez         C-Fair         B-Good         B-Good         DPE         B-Good         D-Severe Effect         A - Excellent         C-Fair         Polyacrylate         POlycarbonate         Polysulfide         PVC         A - Excellent         PVC         A - Excellent         Santoprene®         A - Excellent         Steel - Galvanized         A - Excellent         Steel - Galvanized         A - Excellent         Steel - Mild, HSLA         Stainless Steel - 304         C <sup>2</sup> - Fair         Stainless Steel - 316         Titanium         C - Fair         Tygon® (E-3603)         Viton®         Zinc

#### Ratings - Chemical Effects

A Excellent B Good – Minor effect, slight corrosion or discoloration C Fair-Moderate effect, not recommended for continuous use. Softening, loss of strength, swelling may occur D Severe Effect – Not recommended for ANY use N/A Information not available

#### Explanation of Footnotes

- 1. Satisfactory to 72°F (22°C)
- 2. 2. Satisfactory to 120°F (48°C)



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## **General Benefits of Disinfection with Ozone**

In Industrial Applications

#### 1. Saves Time

- Ozone is a very fast sanitizer often reducing microbial counts by 5-6 log in 2-3 minutes.
- 2. No Handling Storage, Purchasing or Waste Discharges
  - Ozone is manufactured and administrated on-site with no handling issues, storage-concerns (reduced risk of accidental release), downtime or waste discharges.
    - We only use air & electricity to produce the ozone gas

### 3. Safe and Controlled

- Effective with very low residual levels
- Safe workplace and exposure limits exist; systems include instruments, feedback, validation, and reporting for automation of safe and controlled operation.
- Quickly destroyed with UV to leave no residual
- An impressive safety record: Over 100 years of usage no human casualties has ever been attributed to overexposure to O3

### 4. Water efficiency & savings

- Dissolved in water able to reach into every part of the water system and then easily removed or decays.
- Excellent destroying TOC, microbials, and endotoxins
- No water loss for cool down of heat system or excessive rinsing for chemicals.

### 5. Saves Money

- Ozone is inexpensive, economically feasible.
- Chemicals are expensive with handling and disposal issues. Heat is expensive using a lot of energy and difficult to work around.
- Less down time faster change-over less out-of-spec conditions
- In-line validation known results and operating confidence

### 6. Approvals

FDA Direct Food Contact, USDA Disinfectant, USDA Organic Guidelines, Part of the EPA Road to Sustainability Program, HACCP compliant and others.



### **O3-History**



# The association between C. F. Wallace and myself began in New York about the middle of 1909. Wallace, an electrical engineer with practical experience - which started with digging post holes for telephone lines - got a job with the Gerard Ozone Process Co., a manufacturer of machinery for producing ozone. I came to New York about two weeks before Wallace's arrival, from Pittsburgh, where I did laboratory work for the Pittsburgh Typhoid Fever Commission. The Gerard Co. hired me as a chemist. I had graduated from the University of Rochester in 1906 and my first job was at the Rochester Water Works on a reservoir job. Wallace and I lived together in New York and this was the beginning of an association which is now of nearly 40 years duration.

THE WALLACE & TIERNAN STORY

By M. F. Tiernan

### **Discovery Phase**

1932 Used as a disinfectant

- 1909 Used to preserve food
- 1896 Nicola Testa designs & patents O3-Generator
- 1893 Used to treat drinking water
- 1857 Werner von Siemens built the first superior induction tube

ATER TECHNOLOGIES

1840 Schonbein names ozone

1785 Martinus van Marum "discovers" Ozone

### Development Phase

### 1986 Pacific Ozone gets established

- 1986 Adoption by EPA of CT Values
- 1982 FDA approval O3 in Bottled Water
- 1979 IOA formed
- 1970 Used in Bottled Water

### **Commercialization Phase**

2018 – Evoqua acquires Pacific Ozone
2007 – Accelerated adoption ongoing
2001 – FDA approval food contact
1997 – Declared GRAS
1996 – USDA approval as disinfectant
1989 – Companies enter market

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## Pacific Ozone

- Established in 1986
- Floating Plate Technology<sup>™</sup> Patented 1997
- Ozone Generating Systems (SGA) 1999
- Moved to Benicia CA 2004
- Emphasis on applications and complete ozone systems 2007
- Modular manufacturing decreases costs of ozone solutions 2012
- Extended Technical Services Group to Field Operations 2013
- Control & Mass Transfer developments 2014 (for precision ozone control and process management)
- Standardization of Packaged Ozone Solutions 2015
- Launch new Core Technology and IP from R&D pipeline 2016
- Over 8,000 installations 2017
- Part of Evoqua 2018



## **Product Lines**



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## **Fundamentals of Ozone**

Commercialized Corona Discharge Ozone System



### O2 Feed Gas Oxygen Dry Air, Compressed Air

AirSep, SeQual & Kaeser:

- Oxygen Generators
- Air Compressors

EVOQUA

WATER TECHNOLOGIES

• Air Dryers



### **The Air Compressor**



- 100 psi / 7 bar capacity
- 3 cfm / 85 lpm
- 0.25 kW
- 230 50Hz / 115v 60Hz
- Oil Free Operation
- 10,000 12,000 hrs. before service
- Rebuild Kits are available
- Can be rebuilt in 30 minutes or less
- Relief Valve @ 30 psi







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### The Pacific Ozone Reactor Cell

THE HEART OF PACIFIC OZONE SYSTEMS IS OUR PATENTED FLOATING PLATE TECHNOLOGYTM (FPTTM) IN THE OZONE REACTION CELLS.





In the FPT reactor cell, an electric field is created across an ultra-narrow gap between a fixed titanium plate and a floating titanium- ceramic dielectric plate.

The ultra-narrow gap of our patented FPT reactor cells increases the efficiency of the ozone generation module.

The smaller the gap between the plates, the less energy required to generate ozone

Ultra-narrow gap means Lower voltage, power consumption, and heat generation

Virtually impervious to the stresses of heat, pressure, and vacuum of corona discharge ozone generation

**Air cooling:** Simplifies installation and operation, Lowers complexity and cost, Increases reliability Non-rigid electrode connection



### **MASS-TRANSFER**

## Diffusorer, Injektorer & Microbube Pumper

"Gas-To-Liquid Mass Transfer"



### Gas-To-Liquid Mass Transfer (Pump-Injector) Basic Setup

- Dissolves ozone gas into water using a venturi and pressure differential
- Pressure differential of approximately 30
   PSIG is required to produce suction
- Injector-Pump provides pressure drop across injector
- Use pressure gauges before and after injector to verify pressure differential
- Use **check valves** to prevent water from backing into ozone generator







### **Injector Suction vs. Pressure differential**

Ma	azzei Inje	ector Cor	poration -	- Injector	Perform	nance Tab	ole	1	
Inje	ector Mo	odel		10	78		6/24/04		
Operating Pressure PSIG		Air S	Air Suction		Operating Pressure PSIG		uction		
Injector Inlet	Injector Outlet	Motive Flow GPM	Air Suction SCFH	Injector Inlet	Injector Outlet	Motive Flow GPM	Air Suction SCFH	Differential press	sure: 60 PSI
5	0 1 2 3 4	5.2	24.3 6.4 2.7 1.5	60	0 5 10 15 20	18.2	91.5 76.3 57.6 34.5 24.4	Suction: 91.5 SCF	H (43.18lpm
10	0 2 5 7	7.4	40.1 16.2 4.1 1.6		30 35 40 45		14.0 10.4 7.3 4.5	Differential press	sure: 15 PSI
15	0 5 7 10 12	9.1	48.6 13.1 7.9 3.4 2.2	70	5 10 15 20 30	19.6	81.8 67.5 46.3 31.8 19.7		5111 (2.12)
20	0 5 10 12 15	10_5	55.0 22.2 8.6 5.6 3.2		40 45 50 55 0		12.5 8.8 7.0 4.5		
25	0 5 10 15 20	11.7	60.9 33.3 14.3 7.5 3.4	80	5 10 15 20 30	21.0	89.6 74.9 57.8 39.5 24.7		
30	0 5 10 15 20	12.9	70.6 46.4 20.5 11.2 6.1	-	40 50 60 65 0		17.0 10.2 6.3 4.6 112.7		
35	25 0 5 10 15 20 25	13.9	2.4 74.0 52.9 24.7 13.7 9.1 5.5	90	5 10 20 30 40 50 60	22.3	96.3 81.7 48.9 29.4 20.8 14.9 9.2		
5-30% A	0 5 10	200223	79.9 57.9 31.4		70 75 0	]	5.9 4.3 116.7		



### **MASS-TRANSFER cont.**

### Kontakt & Destruksjon Off-Gas and Ozone Decomposers (Catalytic & Heat Destructs)



## **Mass Transfer + Time**

**Ozone Treatment is a two Step Process for Disinfection** 





### **CONTROL** Safety & Process Control

## **Integrated Control Accessories**

- Dissolved ozone monitor
- PID/PLC Feedback Control
- Ozone off-gas management
- Ambient ozone monitor
- Ethernet/SCADA
- UL Panels











## Instruments

### Monitors, Controls and Safety Ozone Instrumentation and Tools

- Ozone Test Kits
- Dissolved O3 Monitors
- O3 Gas Analyzers
- ORP
- Oxygen Analyzers

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VATER TECHNOLOGIES

- Validation Equipment
- Ambient O3 Sensors





MT

Оз

CN



ANALYZER MAXO2 OXYGEN ANALYZER



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## **Ozone Generators**

CN Оз MT **O**<sub>2</sub>

Generators from 1/2 lbs./day to 120 lbs./day (10 - 2.266 g/hr)



## **G3 Series – Modular Ozone Production**



- 12 70 g/hr
- Titanium & Ceramic O3 Reactor
- Optimum Dual Air-Cooled Technology
- Compact and Rugged
- Dry Air or Oxygen (FG)
- Feed Gas Flow & Pressure
   Instruments
- Feed Gas Pressure Regulator
- Over Temperature Protection
- Stainless Steel Ozone Fittings
- Ease of maintenance





G3 Ozone Generators

Air-cooled, Modular and Easy to Integrate

Up to 70g/h





### **Fruit & Vegetable Washing**

Rinsing with Ozonated (Flume) Water to improve quality & shelf life / Typical Dose rate 0,2 – 1,2 ppm







sormac

## **M Series – Modular Ozone Production**

O<sub>2</sub> O<sub>3</sub> MT CN

- 135 540 g/hr
- Compact 3M to full 18M
- Oxygen on-site
- Constant production
- System redundancy for critical applications
- Ease of maintenance





## **Installed Systems** Surface Water Disinfection





## **M Series – Modular Ozone Production**





### **SGA-Series Ozone/Oxygen Generator Systems**

<b>O</b> <sub>2</sub>	Оз	MT	CN
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- Fully Integrated
  - Oxygen production
  - Ozone creation
- High Output
  - Up to 240 g/hr (12.7 lbs per day)
- Compact Design
  - 11" by 27.5"
    - (up to 60 g/hr 3.2lbs per day)
  - 29.5" by 35"
    - (up to 240 g/hr 12.7 lbs per day)





## Marine

### **Onboard Industrial Fishing, Factory Trawlers and Well Boats**





120 g/h Ozone generator With complete Feed gas preparation system

In Norway it is mandated that well boats disinfect with ozone. Pacific Ozone onboard 250+ Vessels worldwide

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## Industrial Water Treatment

### Personal Products

Aveda Hair and body care products makeup water.





<u>Consumer Products</u> Procter and Gamble Process water treatment for Swiffer®



### SGC-Series Ozone/Oxygen/Air Generator Systems

## O<sub>2</sub> O<sub>3</sub> MT CN

- O3-Output from 12 25 g/hr
- Stainless Steel Wall Mount Enclosure
- Air-Cooled Ceramic and Titanium Reactor Cell
- Onboard Air Compressor
- Onboard Oxygen Concentrator
- Air-Cooled Ozone Reactor Cell
- Over-Temperature Protection
- Door Safety Switch
- 4-20mA or 0-10VDC Input
- Variable Output Control
- Power Feedback Reference Meter Reactor
- Pressure Control
- Reactor Pressure Gauge
- Feed Gas Flow Control
- Remote On/Off Control



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## **Installed Systems** Wine Barrel Sanitization

- Complete Systems
  - Automatic Barrel Sanitization
  - Higher Concentrations
  - Higher Flow rates







## **Swimming Pools**

- Dissolved Ozone with a residual of 0,4 mg/l during 4 minutes will result in complete elimination of all microorganisms in the water
- Ozone disinfects by a rapid rupture of the cell wall, a very efficient method
- Reduces traditional chemical use between 60 and 80%
- Water consumption can be decreased, because of an increase in water quality
- Improved Comfort & Health No more red eye, rashes, swim suits fading
- Greatly Reduces chlorine smell and off-gassing
- Reduces caustic gases that eat pool infrastructure
- Requires less ventilation while maintaining good air quality
- Ozone act as a flocculent, hence boosts effectives of filtration

Pool Size in Gallons	G	ĩ	M3	Pacific Ozone (Alt. 1)	Part Number	O3- Prod:	Comments	Pacific Ozone (Alt. 2)	Part Number	O3- Prod:	Comments
0-4,999	5,000	18,927	18.93	G11	R-G1120201	12 g/hr	Requires Feed-Gas (O2 or Dry Air)	SGC11	R-SGC110203	10 g/hr	Onboard Air, 03 & 03
5,000-7,499	7,500	28,391	28.39	G11	R-G1120201	12 g/hr	Requires Feed-Gas (O2 or Dry Air)	SGC11	R-SGC110203	10 g/hr	Onboard Air, 03 & 03
7,500-14,999	15,000	56,781	56.78	G11	R-G1120201	12 g/hr	Requires Feed Gas (O2 or Dry Air)	SGC11	R-SGC110203	10 g/hr	Onboard Air, 03 & 03
15,000-24,999	25,000	94,635	94.64	G11	R-G1120201	12 g/hr	Requires Feed Gas (O2 or Dry Air)	SGC11	R-SGC110203	10 g/hr	Onboard Air, 03 & 03
25,000-34,999	35,000	132,489	132.49	G21	R-G2120201	18 g/hr	Requires Feed-Gas (O2 or Dry Air)	SGC21	R-SGC210203	18 g/hr	Onboard Air, 03 & 03
35,000-57,999	58,000	219,554	219.55	G21	R-G2120201	18 g/hr	Requires Feed-Gas (O2 or Dry Air)	SGC21	R-SGC210203	18 g/hr	Onboard Air, 03 & 03
58,000-74,999	75,000	283,906	283.91	G22	R-G2220201	30 g/hr	Requires Feed-Gas (O2 or Dry Air)	SGC22	R-SGC220203	25 g/hr	Onboard Air, 03 & 03
75,000-99,999	100,000	378,541	378.54	G22	R-G2220201	30 g/hr	Requires Feed-Gas (O2 or Dry Air)	SGC22	R-SGC220203	25 g/hr	Onboard Air, 03 & 03
100,000-114,999	115,000	435,322	435.32	G23	R-G2320201	45 g/hr	Requires Feed-Gas (O2 or Dry Air)	SGA23	R-SGA230202	45 g/hr	03 - Requires Ail Supply
115,000-119,999	120,000	454,249	454.25	G23	R-G2320201	45 g/hr	Requires Feed-Gas (O2 or Dry Air)	SGA23	R-SGA230202	45 g/hr	03 - Requires Air Supply
120,000-150,000	150,000	567,812	567.81	G24	R-G2420201	60 g/hr	Requires Feed-Gas (02 or Dry Air)	SGA24	R-SGA240202	60 g/hr	03 - Requires Alt Supply



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## Packaged Ozone Systems



## Packaged Systems SUMMIT-SERIES



 $\Delta$ 

ATER TECHNOLOGIES

<b>O</b> 2	<b>O</b> 3	MT	CN
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- Complete Ozone System
- System Process Controls
- Off-gas management
- Enhanced Mass Transfer<sup>™</sup>
- Recirculation Compatible

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### **Fundamentals Packaged**

High Purity Water Disinfection & Sanitization Installations - Turning the O3 on & Off!









Adding ultraviolet light (UV) energy to ozone, catalyzing the ozone into harmless oxygen UV light destroys Ozone in water very quickly. The mechanism for removing ozone is dissociation, which occurs when UV energy "breaks" one of the oxygen bonds in an ozone molecule. These ozone destruction units add UV energy to ozone, catalyzing the ozone very quickly into harmless oxygen.





Low Pressure 254nm

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### **Packaged System Validation** (Custom Systems) Uniform Disinfection Assures Product Quality and Safety





## Integrated Contact Systems - VISTA

 $O_2$ 

- Ozone Generator 30 g/hr (high concentration)
- Oxygen Concentrator (medical grade)
- Air Compressor (Oilfree)
- Booster-Injection Pump
- Complete injection-System (gas-to-liquid mass transfer)
- Injector
- Flash Reactor
- Degas separator
- Off-gas vent valve
- Water separator with drain valve
- Ozone destruct system (w/heater)
- Security water back flow prevention with drain valve
- Full Instrumentation & Control Panel
- ORP (Rosemount Analyser)

evoau

ATER TECHNOLOGIES

- PID Control (for automatic operation)
- Completely assembled, configured, QC tested, and ready for installation



MT

 $O_3$ 

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CN



## **Ozone CIP - Benefits**

- Rapid Sanitization
  - Complements initial cleaning
  - No chemical residue no rinse
  - Cold water
  - Less downtime
- Highly Effective at Removing:
  - Color
  - Odor
  - Flavor







## **PC Mobile Ozone System**

**Complete Systems** 



## O<sub>2</sub> O<sub>3</sub> MT CN

- Industrial Mobile Design
- 2-3 ppm Capacity
- Ozone Generator 18 or 30 g/hr alternatives
- Oxygen Concentrator (medical grade)
- Air Compressor (Oilfree)
- Booster-Injection Pump
- Complete injection-System (gas-to-liquid mass transfer)
- Off-gas management w/O3 destruct system
- Security water backflow prevention w/ drain valve
- Full Instrumentation & Control Panel
- Accessories such as DO3, ORP auto-control, hose w/nozzle available



## Integrated Contact Systems [92] 93 MT [CN]



## Accessories

### Materials, Devices & Assemblies

- Mass Transfer Components
  - Injectors / Diffusers
- System Protection
  - Backflow protection
- Off-Gas Management
  - Degas Separators
  - Water Separators
- Valves / Fittings

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Ozone Compatible Materials

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OPTIONAL ELBOW

NLET (1/4" FNPT)



### D412 ozone destruct

#### Features

- Excellent Ozone Destruct efficiency
- Complete Conversion from O3 to O2
- 316 Sanitary Stainless Steel Housing
- Destructor Potential 600 SCFH
- Manganese Dioxide/Copper Oxide Catalyst
- Handles High O3 Concentration
- Calibrated Temperature Control
- LED Heat On/Off Light
- Light-weight Product
- . Low Pressure Drop
- Compatible to Most Off-Gas Systems
- · Quick & Easy to Install-Design
- Self-Supporting Unit
- Creates Safe Working Environments

**Complete Integrated Solutions.** 

Single Trusted Source.

- · Complies with OSHSA Safety Regulations
- · Compact and Stylish Design

#### Ozone Destruct Chamber

Destruction of unused ozone gas is an important part in all ozone installations. The D412 Ozone Destruct Chamber (Ozone Decomposer) represents a most efficient, safe and economical method for destroying unused gas after the reaction process.

The D412 Destruct Chamber is designed in a durable 316 stainless vessel, with a 1.5" TRI-Clamp Sanitary Inlet and Outlet connections. It is easily adaptable and attaches to any ozone contact tank, de-gas separator or other ozone contact systems. This helps convert any unused ozone into oxygen before venting it into the atmosphere.

Typical industry applications are ozone contact-tanks with off gas situations, resulting in ozone gas creating dangerous working environments. Our D412 Series of Ozone Destructs uses low-energy heating elements. The heating ensures that the temperature is maintained above dew point at all times and thus avoids condensation of water vapor in the catalyst material. This is a very economical and reliable method of eliminating ozone in off-gas prior to discharge into the atmosphere.



Model: D412

### **D412 ozone destruct** Technical Specifications

#### Product Description Ozone Decomposer INLET, 1.5", SANE R-D41201 115V Model Part Number R-D41202 230V Model SPECIFICATIONS POWER CORD Catalyst Mixture Mn02/Cu0 Construction T316 Stainless Steel $\cap$ Ozone Destruct Potential 600 scfh @ 99 + % Ozone Destruction 1400 mg/l **Ozone Concentration** Operating Temperature 150\*F/65\*C 150.7 cu. inches 21.92 Catalyst Volume +12 sq. inches Catalyst Bed Cross Section 1,5 inch MPT Top Gas Inlet 1.5 inch MPT Bottom Gas Outlet **Power Consumption** 150 watt Power Requirement 115v or 230v 50/60 Hz 18 inches Height 4 inches Diameter 14 lbs Weight Power Connection US or Europe-Options an or without cord Serviceable OUTET, 1.5", SANI 04.00 Catalyst Chamber

4" tri-clamp connection allows easy access to catalyst bed for quick, simple maintenance



6160 Egret Court Benicia, California 94510 p: (707) 747.9600 £ (707) 747.9209 www.pacificozone.com

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**EVOQUA** WATER TECHNOLOGIES

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## **Sizing Systems**

Request Date:			ic Ozone Rep:	6			Territory:	Cust		
Quote Required Date				Outs	ide Sales Rep:	vč-		R	equested Delivery:	Proj
Customer Informat	tion			2.4.740				2		
Account Name/Locat	ion:						Account	Contact:	2	
ntegrator:							E	nd User:		
Project Information	n									
Opportunity Name:										
F Opportunity Link:	- 1									
Application Data										
Process Type:					Water Type:				Water Temp (°F):	
Flow Rate (GPM):				Makeu	p Rate (GPM):				pH:	
Hot CIP:	Cł	nemical CIP:								
**If bottled water, co	omplete bo	ottom section	201 - C	27						
Process Loop Data										
Flow (GPM):		Pressure:	2		Le	ngth (in Feet):		Di	iameter (in inches):	
Tank Data						6				
Existing/New:			CFD Req	uested:	3					
**If existing tank, co	mplete ne	xt section and	tank config	gurator	form	2				
Volume:		Height:	20	1. M. S	Width:		30 	Di	iamater (In inches):	
Material:			Та	ink Destr	ruct Required:		(if p	ressurize	d, this is suggested)	
Sizing Data										
Customer Requested	Sizing:		g/hr			mg/l (ppm)				
O Suggested Sizing:			g/hr			mg/l (ppm)				
Packaged System D	ata									1.
Series:			(reau	Sampl ired for	e Remix Loop: precision DO3				Available Power:	
Senerator Data	2	_				35 32	_			2.
Series:					Generator:				Feed Gas:	3
click here to view produ	ucts)		_							5.
003 Channels					BP Channels	6		0	AO3 Channels	4.
Additional I/O:					via chamiels.				Aug channels.	5.
Destruct Data										6.
ntegrated on skid:			Loose for	Tank:		Voltage		UV	Destruct Required:	7.
3W Application Da	ta	_	Contract Contract	0.73352		Ber		100		8
										0.



#### Tank Flow Configuration Data sales@pacificozone.com

Project:



Date Completed:



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### **Markets and Applications**

#### Beverage



#### **Applications:**

- Clear & Near Clear (BW)
- Product water process
- Clean-in-place (O3-CIP)
- Tank, equipment sanitization
- Bottle and cap sanitizing
- Source water treatmentEquipment and surface







WATER TECHNOLOGIES



#### **Applications:**

- Storage & distribution
   system sanitization
- High-purity water
   production
- Surface and equipment sanitization
- Clean-in-place (O3-CIP)

**Horizon Series** 

**8**.8i=

**PACIFIC** 





#### **Applications:**

- Equipment and surface sanitization
- Fresh produce & fruit sanitizing
- Meat & Seafood
   sanitization
- Continuous loop process



Tank Platform





#### Applications:

- Bio-security
- Incoming water treatment
  Wastewater management and disinfection
- System sanitization
- Product Processing
- Marine and on-board



**M** Generator Series

### Industrial Water



#### **Applications:**

- Cooling and boiler water treatment
- Industrial water production
- •Textile manufacturing
- Industrial laundry



SGA Gen/Sys Series



## Beverage and Bottled Water SUMMIT-SERIES



90% of Bottled Water worldwide is disinfected with ozone

- Improve taste, odor & color while disinfecting product water
- Disinfection of bottles prior to filling
- Disinfection of bottling
   equipment
- Disinfection of bottle & cap
- Disinfection against airborne microorganisms in the air gap





## **Installed Systems**

BW, 120gpm 2000gallon Dasani IN



## **Disinfection of Pure Water Systems**

Commissioning & Qualification for Pharmaceutical Water Systems

#### Complete Packaged Ozone Systems Benefits

- Supports Commissioning
   & Qualification
- Established Performance Characteristics
- Integrates Tightly with UV Destruct
- Offers Superior Reliability
- Uses Science Based Approach
- Includes Analyzers & Instruments
- Delivers State-of-the-Art Tank Mixing Technology
- Reduces Process Variables
- Highest Level of Safety



Fully automated packaged ozone system

Simple • Proven Ozone Technology Ozone advantages in Pure Water Systems:

- No Handling, No Storage, No Purchasing
- Used in disinfection of water systems for over 120 years
- Excellent destroying TOC, microbials, and endotoxins
- Dissolved in water able to reach into every part of the water system and then easily removed or decays.
- Generated on-site from compressed air and electricity.
- Powerful at room temperature eliminates expensive and complex heating systems and heat tracing on pipes.
- Quickly destroyed with UV to leave no residual.
- Safe to use with integrated instruments and controls.

### Advantages of Ozone Disinfection at 24/7 Administration

- 85% less expensive than hot water sanitization five times a week
- 20% less expensive than once-weekly hot water sanitization
- Tens of thousands of dollars less than twice yearly chemical sanitization [1, 2]

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## FOOD Installed Systems Surface Disinfection



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## Marine, Aquaculture & Aquatics Segment

Markets and Applications

- Marine (Onboard Vessels)
  - Well boat Aquaculture supply chain disinfection
  - Refrigerated Salt Water system sanitization
  - Trawler seafood processing
  - Water treatment
  - Wastewater treatment
- Aquaculture
  - Fish farming disinfection and water treatment
  - Hatchery and lab systems
- Aquatics
  - Aquariums, zoos life-support systems
  - Pools
  - Water features



## **Aquaculture - Fish Farming**







Ozone reduces virus and bacterial threats to fish farms and the environment.



**EVOQUA** 

WATER TECHNOLOGIES



Typical Applied Dose Range 0.4ppm To 1.2ppm

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## Marine Aquaculture Biotech – Algae Facility

## OZONE GENERATOR OXYGEN CONCENTRATOR

EVOQUA

WATER TECHNOLOGIES

### Horizon Series System

- 114 m3/hr (500 gpm) Disinfection
- 600 g/h 9M Ozone Generator
- 320scfh ASG Oxygen
- 15HP 53cfm Compressor
- Ozone Control Panel





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## **Shrimp Farm Relies on Ozone**

### **Ozone Sanitization Market Potential**

The Use of Ozone to Cleanse and Purify Water in Shrimp Farms for Sustained High Productivity



Ozone is increasingly used in aquaculture due to its numerous advantages over traditional water treatment methods. The primary application is removal of fish pathogens. It also effectively removes organics, pesticides, discoloration, and nitrates and unconsumed ozone reverts back to oxygen, leaving no harmful residuals behind. Ozone oxidizes long chain molecules, which are unaffected by bio filtration and involves far lower risk of accidental pollution in comparison to other water treatment methods. Finally, ozone improves the effectiveness of biological and particulate filtration.

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## Trade Organizations, Affiliations & Regulatory Approvals



#### Your Worldwide Ozone Resource

We're only beginning to discover ozone's potential. As a powerful disinfectant with a positive environmental footprint, ozone is used worldwide to improve how we live.

#### Learn more

The International Ozone Association is a nonprofit educational and scientific organization dedicated to the collection and dissemination of information on, and to promote research in, any and all aspects of ozone and related oxygen species technologies. As a member, you'll gain access to the most cutting edge information on ozone technology.

- Ozone: Science & Engineering
- Ozone News
- Conferences





VATER TECHNOLOGIES





- Int. Society for Pharmaceutical Engineering (ISPE) Typical ISPE Good Practice Guide Ozone Sanitization of Pharmaceutical Water Systems
  - 20~200ppb continuous normal dissolved ozone concentration in storage tank
  - ≥ 50ppb periodic/loop sanitization up (250ppb typical)
  - 200~2000ppb biofilm removal (time dependent)

European Agency for Evaluation of Medical Products:

 "routine sanitization using ozone...essential to prove that the agent has been removed...ozone effectively removed using UV."

- FDA Direct Food Contact
- USDA Disinfectant
- EPA Sustainable Technology Platform
- USDA Organic Guidelines
- Approved for Halal Processing



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## **Ozone Sanitization Good Practices**

- Good Practice Guide from ISPE demystifies application
- Ideal sanitizing agent for pure water distribution systems
- Significant operating and cost advantages

Figure 62: Corona Discharge with Air Supply Configuration Example







## **Technical Support**

Prompt Factory Technical Support + Factory Trained Partner Technicians

Technical support is available by telephone directly from Pacific Ozone at (707) 747-9600. When calling, please be prepared to provide the following information:

- Modelnumber ٠
- Serial number
- Brief description of equipment issue ٠
- Line voltage ٠
- Inlet air quality and flow ٠
- Water source, guality and incoming pressure and flow rate ٠
- Location ventilation ٠
- Number of hours per day the machine is used & length of time t ٠

Requests for parts or service may also be faxed to (707) 747-9209 or sen

#### **Online Technical Support**

Technical Online Support is available through the Pacific Ozone web site at www.pacificozone.com/support Registered users will have access to:

- Basic start up procedures ٠
- Trouble shooting guides
- Product specifications
- Service bulletins

### **Response Now Service**



### **Technical Service Videos**





The Pacific Ozone Channel

Home Videos Playlists Channels Discussion About Q



Get an overview of the complete and fully Integrated Ozone Systems from Pacific Ozone. All four elements of ozone are included in a complete integrated ozone systems: Ozone Generator, Oxygen Concentrator, Mass Transfer and Gas Management, Controls and



## **Commissioning & Qualification**

Complete wet test facilities\* with full suite of ozone analysis instrumentation and test equipment.



\* FAT's, training and customer qualification







## Summary

- Ozone is the most powerful commercially available disinfectant
- Destroys all known microorganisms & pathogens
- A "green" technology, which is Safe, Conserves Water, Replaces Dangerous Chemicals, and saves Energy, Time and Money
- Pacific Ozone manufactures the widest variety of products for industrial applications
- Our application expertise can be leveraged across many markets.
- We offer on-site and factory service for all products we manufacture/sell
- We are committed to your success.



## Thank you!



Designed and built to optimize efficiency and energy use, Pacific Ozone's range of generators and systems reduce costs and bring a wealth of benefits to the environment.

pacificozone.com





707-747-9600

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