DR SERIES

HIGH OUTPUT SHOCK TREATMENT OZONE GENERATOR

MODEL: DR-10 Plus

INSTALLATION & OPERATIONS MANUAL

OZONE SOLUTIONS

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IMPORTANT SAFETY INSTRUCTIONS, READ AND FOLLOW ALL INSTRUCTIONS.

Read this manual completely before attempting installation.

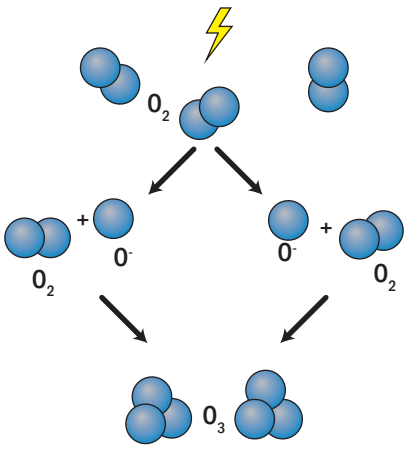
SAVE THESE INSTRUCTIONS.

INTRODUCTION

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

The DR-10 Plus is a complete ozone generation and destruction system. No external compressed air or oxygen supply is required. This system uses ambient air to produce up to 10 grams per hour of gaseous ozone.

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



THEORY OF OPERATION

The DR-10 Plus is an ozone generation and destruct system. It is meant for shock treatment applications. There are three operational steps to a complete treatment cycle: ozone generation, dwell period, and residual ozone destruction.

This system generates ozone from ambient air via corona discharge. Corona discharge is a process where an electrical spark is used to split the molecular bond of natural oxygen molecules (O_2) into a singlet state (O^-). These singlet oxygen atoms then bond to the remaining O_2 molecules to form ozone (O_3). *See diagram for reference.*

The dwell period is an operator prescribed length of time between the ozone generation and destruction modes. More time allows the ozone to attack contaminants and odors more aggressively before the destruct unit begins to return the ambient ozone levels to normal.

In destruct mode, ambient air is sucked into the unit, and any ozone that is present is broken down with proprietary ozone destruct media. Internal fans propel the air through the unit while destroying ozone as it passes through the media. Ozone free air is expelled out the opposite side.

I. SAFETY

PRECAUTIONS

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

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

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

- Ozone is an extremely aggressive and powerful oxidizer. The Occupational Safety and Health Administration (OSHA) 8-hour exposure limit is 0.10 PPM. The OSHA 15-minute exposure limit for ozone is 0.3 PPM. Above 0.3 PPM, there is the risk of damage to respiratory tissues.
- People who have no sense of smell should not operate this equipment.
- Never attempt to verify ozone production by directly breathing or smelling the ozone outlet.
- The Ozone Generator contains high voltages. Tampering can result in serious injury or death. For service instructions, contact Ozone Solutions.
- The Ozone Generator is intended to be used in residential and industrial shock treatment situations. It is not intended for use as a medical device. Do not use it for any medical treatment or “home-remedy” purposes.

Isolating energy sources

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

II. INSTALLATION & OPERATION

REQUIREMENTS

The DR series of ozone generators are intended to produce ozone to treat the immediate ambient surroundings with high concentrations, known as “shock treatment”.

Location

The unit should be placed on a level surface in the room or area where treatment is desired. Ensure that no objects are near the air intake or ozone exhaust to allow optimal air flow across the ozone cell. Make sure that the ozone exhaust is also pointed in a direction that facilitates good ozone circulation throughout the desired treatment area.

Position the unit so that the green and red lights on the control surface can be seen without having to enter the area.

Temperature & Humidity

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

Electrical

This machine requires an electrical input of 120 Volts A/C, single phase. Please refer to the table in section IV for additional specifications.

GUIDELINES FOR USE

Note: This device is to be used for shock treatments only. This system is not meant for continual use or for use with living beings in the affected area.

Ozone is a powerful oxidizer that is extremely reactive with bacteria and other odor sources, as well as some common household materials. This unit is used for shock treatment purposes. Before deploying this unit, please ensure you are aware of materials that may be particularly vulnerable to shock treatment. A material compatibility chart is available on our website at www.ozonesolutions.com.

Some materials may have a small amount of residue left behind on them after long or high concentration exposure. Excessive and/or frequently repeated treatment of these particular items should be avoided.

For safety purposes, a shock treatment session should not be excessively long in relation to the size of the room. When ozone treatment takes place, a chemical reaction is taking place where the odor source or surface is being oxidized. If there is nothing left for ozone to react with, concentration of ozone in the area will begin to rapidly climb. Please consult with Ozone Solutions to determine the best treatment plan based on the size of the room and the problem you intend to address.

Destruct Mode

Ambient ozone levels 100 parts per billion (PPB) or less will be reduced to less than 5 PPB at the outlet. Ambient ozone levels greater than 100 PPB will result in elevated ozone levels from the outlet.

To test the ozone levels before and after the installation of the DR series unit, Ozone Solutions recommends a high accuracy monitor. For monitor inquiries, please contact Ozone Solutions.

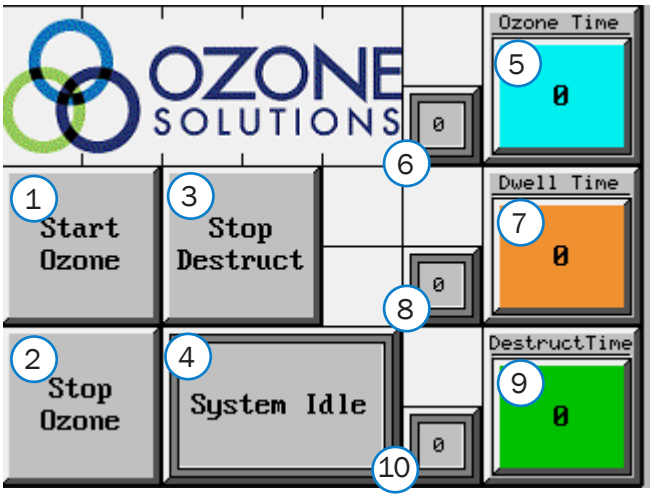
OPERATOR INSTRUCTIONS

IMPORTANT: Read and understand the Safety section of this manual before operating the ozone system.

1. Place the unit where the control surface can be seen from a window or other area that does not require entering the shock treatment area.
2. Plug the unit into a standard 120 Volt A/C 60Hz power source. The destruct cycle will begin as part of initial startup process.
3. Use the HMI screen to set the parameters for the DR-10 plus treatment time (see Section III). There is a table in this manual with recommended treatment times based on room area (see Appendix D).
4. Start the unit by pressing the “Start Ozone” button on the HMI, and wait for the red light to illuminate.
5. When the light turns red, leave and close off the shock treatment area. A green light indicates that the cycle has finished and you may re-enter the room safely.
6. The unit may be turned off using the HMI screen, or by waiting for the cycles to run to completion.

Note: If the destruct process does not run after shock treating a room, allow the ozone to decay for at least 12 hours before re-entering the room.

III. HUMAN-MACHINE INTERFACE (HMI)



1. Start Ozone: Starts ozone production, and runs system process with the cycle times input on the right side of the screen.
2. Stop Ozone: Stops ozone production and begins the ozone destruct step of the process. The destruct step will continue until the set time has expired or the system can no longer detect ozone, whichever is longer.
3. Stop Destruct: Stops the ozone destruct cycle and sets the system to “System Idle” status.
4. System Status: Displays the current step in the system’s process.
5. Ozone Time: Run time for the ozone production step, in minutes.
6. Displays the time remaining in ozone production step, in minutes.
7. Dwell Time: Run time for the dwell step, in minutes.
8. Time remaining in the dwell step, in minutes.
9. Destruct Time: Run time for the destruct step, in minutes.
10. Time remaining in the destruct step, in minutes.

IV. ADDITIONAL INFORMATION

SPECIFICATIONS

Ozone Production (g/hr)	Flow Rate (CFM)	Power Supply (VAC)	Power Consumption (Watts)	Current (Amps)	Dimensions (L x W x H)	Weight (lbs)
10	75	120 - Single Phase	300	2.5	19” x 12” x 17”	45

WARRANTY

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

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

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

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

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

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

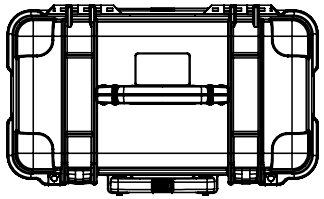
The term “original purchaser,” as used in this warranty, means whom the product was originally sold to by Ozone Solutions or by an authorized dealer. Ozone Solutions reserves the right to make changes in its products without notice. Because of this, Ozone Solutions is not obligated to replace warranty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

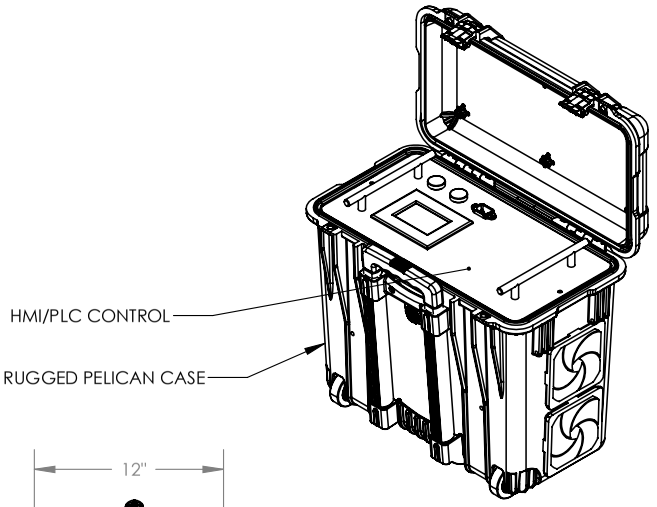
CONTACT INFORMATION

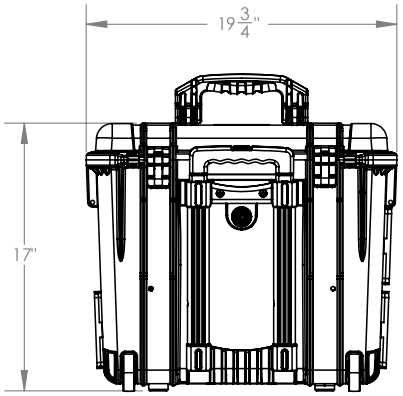
Ozone Solutions, Inc.
451 Black Forest Road
Hull, IA 51239 USA

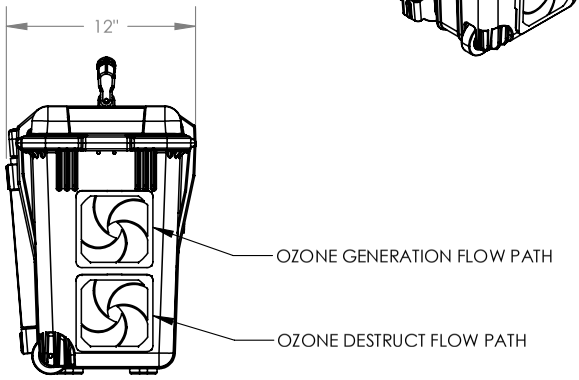
Phone: 712.439.6880
Fax: 712.439.6733
Email: sales@ozonesolutions.com
Website: www.ozonesolutions.com

Ozone Production	10 g/hr
Ozone Flow Capacity	200 cfm
Destruct Flow Capacity	70 cfm









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PROPRIETARY AND CONFIDENTIAL

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UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± 1/4
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±0.125
THREE PLACE DECIMAL ±0.0625

INTERPRET GEOMETRIC TOLERANCING PER: ASME Y-14.5-09

MATERIAL

DO NOT SCALE DRAWING

COMMENTS:

	NAME	DATE
DRAWN	CC	9/16/2020
CHECKED		
OPERATIONS		
CONTROLS		
MFG APPR.		
Q.A. APPR.		

DWG. NO.

DR-10-Plus Overview

SIZE **A**

TITLE DR-10-Plus Customer Drawing

SCALE: 1:10 | REV 1 | SHEET 1 OF 1

APPENDIX B - MAINTENANCE

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

Maintenance Table

Component	Action	Time Period	Part Numbers
Ozone Cell	Clean	1 month or as needed	N/A
Inlet Filter	Clean/Replace	3 months or as needed	Foam Filter Replacement
Ozone Sensor	Replace	Annually	RME-1.0

The DR-10 Plus is designed to operate continuously with little maintenance. Once a month, after heavy use, after using in high humidity, or if the unit does not produce its maximum ozone output, the following cleaning process can be performed:

- Unplug the DR-10 Plus from its power source. Remove control panel assembly, set this to the side. Remove control panel mount brackets from each side of the case. Disconnect the two white connectors containing red and black wires, unplug the power cord which is plugged into the power supply on the back of the white PVC tube. Grasp the PVC tube, lift up to remove the tube and mid-plate assembly from the case, disconnect the destruct fan power connector from the lower PVC tube when that becomes accessible. Move this assembly to a suitable work area, remove the four nuts securing the PVC tube to the mid-plate, separate the two parts, and flip over the PVC tube to access the ozone cell for the cleaning procedure.
- Use a compressed air source of no more the 100 PSI to remove any debris from the ozone block. Keep the wand six inches away to prevent damage. Isopropyl alcohol can be used to clean off any light debris or build-up from the glass tubes. A razor blade can be used to lightly scrape off any acidic crust that may have built up on the ozone block tubes. Once a month, after heavy use, or after using in high humidity, this cleaning procedure will need to be followed.
- The same air source can then be used to clean the two 3 ¼ inch stainless filter screens located on the sides of the unit. If the filter screens need replacement, contact Ozone Solutions.
- A razor blade can also be used to lightly scrape off any acidic crust that may have built up on the ozone block tubes.

The ambient ozone destruct unit contains the ozone sensor, which needs to be replaced annually. To replace this item:

- Remove the control panel assembly, and set aside.
- Remove the PVC/mid-plate assembly by following the cleaning procedure above.
- Remove the two nuts holding the PVC destruct unit cover to the bottom plate, pull that up slowly to gain access to, and disconnect, the electrical connectors for the fans.
- Remove the clear polycarbonate cover from the ozone sensor board, pull the ozone sensor straight up to remove, and carefully install the replacement sensor element.

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

APPENDIX C - RECOMMENDED TREATMENT TIMES

Treatment Area (ft^2)	Suggested Ozone Production Time (min)	Suggested Ozone Destruct Time (min)
10-100	15	10
101-250	30	15
251-500	60 (1 hour)	15
501-1,000	120 (2 hours)	30
1,001-1,500	240 (4 hours)	60 (1 hour)
1,501-2,000	360 (6 hours)	60 (1 hour)
2,001-2,500	480 (8 hours)	120 (2 hours)
2,501-3,000	720 (12 hours)	120 (2 hours)

APPENDIX D - SAFETY DATA SHEET

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SAFETY DATA SHEET FOR OZONE

FORMERLY MSDS

1. PRODUCT IDENTIFICATION

PRODUCT NAME: Ozone

COMMON NAME / SYNONYMS: Triatomic Oxygen, Trioxygen, O3

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

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

2. HAZARD IDENTIFICATION

GHS CLASSIFICATIONS

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

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

3. COMPOSITION

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

4. FIRST AID MEASURES

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

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

5. FIRE FIGHTING MEASURES

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

6. ACCIDENTAL RELEASE MEASURES

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

7. HANDLING AND STORAGE

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

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

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

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

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

9. PHYSICAL AND CHEMICAL PROPERTIES

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

10. STABILITY AND REACTIVITY

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

11. TOXICOLOGY INFORMATION

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

12. ECOLOGICAL INFORMATION

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

13. DISPOSAL CONSIDERATIONS

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

14. TRANSPORT INFORMATION

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

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

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

16. OTHER INFORMATION

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

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

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