

Ozone Solutions

HC-30 OZONE GENERATOR

OPERATOR'S MANUAL

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TABLE OF CONTENTS

SECTION 1 – General Information	3
1A. Description	3
1B. Specifications (Ozone Output)	4
1C. Layout & Accessories	4
1C.1 Ozone Generation	4
1C.2 Required Accessories.....	4
SECTION 2 – Installation	5
2A. Location	5
2B. Electrical	5
2C. Plumbing	5
2D. Gas Connections	5
SECTION 3 – Operation	6
3A. Control Panel Overview	Error! Bookmark not defined.
3B. System Startup	6
3C. System Shutdown	7
3D. Standard Operating Procedures.....	7
SECTION 4 – Maintenance and Service	8
4A. Preventative Maintenance	8
4B. Troubleshooting	8
SECTION 5 – Replacement Parts	9
SECTION 6 – Ozone Overview and Safety Procedures 9	
6A. Ozone Use and Technology Overview	9
6A.1 Relative Strength of Ozone	9
6A.2 Micro-Flocculation and Oxidation.....	9
6B. General Safety Information.....	9
6B.1 Ozone Properties	9
6B.2 Ozone Uses.....	9
6C. Hazards.....	10
6C.1 Health Hazards – Detection Levels	10
6C.2 Health Hazards – Effects on Humans	10
6C.3 Electrical Hazards	10
6C.4 Fire Hazards.....	11
6C.5 Chemical Action.....	11
6D. Precautions for Safe Handling and Use	11
6D.1 Ozone Monitors	11
6D.2 Ventilation	11
6D.3 Emergency Procedure	11
6D.4 Respiratory Protection.....	11
6D.5 Education and Training.....	11
6E. System Operation and Maintenance	11
6E.1 Safety Precautions and Equipment	12
6E.2 Maintenance Requirements	12
6F. Monitoring	12
6F.1 Location of Monitors	12
6F.2 Monitoring Equipment.....	12
6G. First Aid Procedures.....	12
6G.1 General Information.....	12
6G.2 Inhalation.....	12
6G.3 Eye Contact	13
6G.4 Precautions.....	13
6G.5 Emergency Information Form.....	13
Ozone Solutions Three Year Limited Warranty	14

**IMPORTANT SAFETY INSTRUCTIONS.
PLEASE READ AND FOLLOW ALL INSTRUCTIONS.**

- Read this manual completely before operation of HC-30 Ozone Generator Equipment.
- The High Voltage Transformers in this unit creates 7,000 volts, with the outer jacket of the High Voltage lead reaching 3,000 volts.

USE EXTREME CAUTION

- Operate the HC-30 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.

SECTION 1 – General Information

1A. Description

The HC-30 is an Ozone Generator that produces from 3 - 28 grams of ozone per hour with concentration 5-14% by weight or as specified in attached test report.

The HC-30 is designed to produce ozone for variety of applications such as:

- Water Disinfection for Bottled Water Plants, Medical & Pharmaceutical Facilities, Swimming Pools, etc.
- Industrial Processes, Chemical Production and Laboratories, Electronic Production, Mining
- Aquatic Life Support Systems for Marine Mammals, Fish Hatcheries, Large Aquariums...
- Food Processing, Food Processing Facilities Disinfection, Food Preservation
- Soil remediation, Ground Water Remediation
- Wineries Facilities Disinfection, Barrel Disinfection
- Cooling Towers Water Treatment, Technological Processes Water Treatment
- Potable Water Disinfection for Small Communities
- Waste Water Treatment for Industrial Plants, Technological Production Processes, Commercial Facilities Waste Water Treatment, Dangerous Chemical and Bacteria Treatment, etc.

1B. Specifications (Ozone Output)

- Ozone Output (+ 10%): 1 – 28 g/hr for high output units (1 – 20 g/hr for high concentration units)
- Gas Flow Rate (max): 0.05 – 10 SLPM
- % By Weight O₃: 5 – 12%
- Recommended Working Pressure: 20 PSIG
- Power Requirements:
 - Domestic: HC-30 – 115 V AC, 60 Hz, 5.0 A (15 Amp Service)
 - International: HC-30 – 230 V AC, 50 Hz, 2.5 A (10 Amp Service)

1C. Layout & Accessories

The HC-30 could be used with several accessories and safety devices to assure long service life of the Generator.

1C.1 Ozone Generation

- Air Compressor: Oil-less, piston air compressor pumps ambient air at 2.5 cfm into the oxygen concentrator
- Ozone Generation Cell: The corona discharge ozone generation cell consists of an aluminum housing (ground, two end housings, and fasteners), gaskets, high voltage stainless steel electrode, ceramic dielectric, oxygen inlet fitting, and ozone outlet fitting. Concentrated oxygen gas is pushed into the ozone generation cell under pressure 20 PSIG (50, 80 or 10-60 PSIG for other models). Oxygen molecules are split into atomic oxygen which then recombines to form ozone gas.

1C.2 Required Accessories

- Oxygen Concentrator: The oxygen concentrator uses a PSA (pressure swing adsorption) molecular sieve to remove dirt, moisture, nitrogen and other trace gases, producing oxygen at greater than 85% purity and less than –60°C dew-point. The air compressor pumps ambient air into the oxygen concentrator. Concentrated oxygen feed-gas enables ozone generation at 5 - 14% (by weight) concentration. The AirSep AS-12A Oxygen Concentrator works well with HC-30 generators.
- Oxygen Filter Upstream from Ozone Generator to protect ozone-generator from sieve particles in case of oxygen generator failure.
- Ozone Flow Control Valve: Downstream from ozone generator to maintain working pressure across ozone cell as specified (i.e. 20-80 PSIG depending on your unit).
- Ozone Injector for Water Treatment Applications: Inlet water flows through the pump and through the ozone injector, creating vacuum that pulls ozone gas from the ozone generation module and injects the ozone into the water flow. The injector should be sized to dissolve a minimum of 90% of the ozone gas into the water flow continuously.
- Ozone Degas Chamber: Ozone-enriched water from the ozone injector flows into the degas chamber where the counter-current design forces any undissolved ozone gas through the float valve-protected top vent to the Ozone Destruct.
- Ozone Destruct: Undissolved ozone gas passes through the heated catalytic ozone destruct that is made of non-consumable manganese dioxide (heat protected from moisture fouling). The manganese dioxide and heat offer redundant ozone destruct capabilities.

SECTION 2 - Installation

2A. Location

The HC-30 ozone generators are designed to be install on the wall in convenient location mobile cart or skied. Allow for access to protected electrical power and required gas connections and cooling air to the ozone generator. Unit could be installed indoors & outdoors if protected from weather element. Ambient working temperature from -50°C to $+50^{\circ}\text{C}$.

2B. Electrical

Main Power Supply Circuit: The HC-30 is supplied with a standard 6 Feet power cord. Connect the power cord to a standard grounded 15 Amp (10 Amp International) power source, according to a local electrical code only.

2C. Plumbing

When injecting Ozone in to water all measures should be taking to protect the Generator Cell from water exposure, which may cause internal cell damage. A small tank with an automatic drain system is recommended.

2D. Gas Connections

The Ozone generator should be connected by tubing made from material appropriate for ozone and oxygen applications. Connect to the generator according indications on input and output bulkheads. All efforts should be made to protect the generator from exposure to vacuums, which may lead to the damage of electronic circuitry. For applications where vacuum exposure is possible we strongly recommend installation of a buffer tank downstream from ozone generator with an appropriate low-pressure switch. It is **VERY IMPORTANT** to protect the Generator from any possible contamination from the Oxygen Concentrator, by installing air (oxygen compatible) filter upstream of the Generator.

SECTION 3 - Operation

3A. System Startup

1. Make sure the cabinet is securely attached to an appropriate frame or wall.
2. Make sure all connections to the generator, power and gas are made according to local codes and regulations.
3. Purge the generator with >90% conc. Oxygen and assure free flow of oxygen through the system. Conduct system leak test applying working pressure +/-10% using Oxygen only. Adjust gas pressure across the cell according to specifications using downstream Control Valve and pressure gage (supplied by the installer).
4. Turn the potentiometer on the front panel fully counterclockwise.
5. Plug the system into a specified receptacle.
6. Flip the ozone production switch in to "ON" position.
7. Turn the potentiometer clockwise slowly, to reach optimum power setting according to supplied "Ozone Generator Performance Test" chart. Now the generator is in optimum production mode, and ozone should be flowing through the system

3B. System Shutdown

1. Turn the potentiometer fully counterclockwise.
2. Turn the Ozone Production switch in to "OFF" position. (No ozone is produced at this time.)
3. Unplug the system from the power source if required.
4. Turn the oxygen source off.
5. Close the Control Valve off (optional, supplied by installer) to protect unit from accidental flooding.

3C. Standard Operating Procedures

NOTE: To assure a long trouble-free service life of the HC-30 Ozone Generator, provide following operating conditions:

- Make sure that the oxygen concentrator is maintained properly and is producing oxygen at greater than 85% purity and less than -60°C dew point. Check sieve conditions and replace it as often as recommended by manufacturer
- Install air filter between oxygen concentrator and the ozone generator, check condition and replace a cartridge as to protect ozone-generator from sieve particles in case of oxygen generator failure.
- Make sure to maintain working pressure across ozone cell as specified 5-15 PSIG, 10-60 PSIG, 50 PSIG or 80 PSIG for high-pressure units for the generator protection and most efficient ozone production.
- When injecting ozone in to water make sure to protect the generator from flooding by installing device capable in case of water backup to automatically drain it and to prevent water from entering the ozone cell.
- Protect internal components of the ozone generator from water, snow, excessive dust and humidity, make sure that there is a sufficient amount of clean air is available for the unit cooling and air inlet and outlet are not obstructed by other equipment or elements.
- Check that electrical power fluctuations are within normal and install power-conditioning devices if necessary.

SECTION 4 – Maintenance and Service

4A. Preventative Maintenance

Generally the HC-30 is maintenance-free although it is useful to check the ozone generator for proper operation:

- a. Make sure green indicator lights are lit during
- b. Operation and red light is off

On a monthly basis:

1. Make sure that all system equipment (oxygen concentrator, air compressor, etc.) is maintained according to manufacturer recommendations.
2. Remove and replace or clean filter cartridges and other devices if installed and required.
3. Perform general cleaning of cabinet exterior prior disconnecting the equipment from electrical source.
4. Using clean/dry compressed air, blow out the interior of cabinet, taking special care around small components and wiring.

4B. Troubleshooting

Knowledge of electrical applications is required for troubleshooting. Contact a certified electrician if you are unsure of your ability to service the equipment. If any condition persists, call 780-486-3761. We will have one of our system engineers discuss your situation with you over the phone.

Symptom: Green and Red indicator lights "OFF", POWER switch 4 (See Page 6) is in the "ON" position and the cooling fan is not running.

1. Check the circuit breaker at the facility power distribution box.
2. Check for loose connections or wiring breaks from the power distribution box to the generator.
3. G.F.C.I. has tripped.
4. Check power cord for breaks in insulation. Repair. Reset G.F.C.I.
5. Circuit breaker has tripped. *Check for source of power overload on the circuit. Correct. Reset circuit breaker.

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

Symptom: Green and Red indicator lights "OFF". POWER switch #4 (See page 6) is in the "ON" position and the cooling fan is running. Generator has internal failure. Please contact our service department. (See page 15)

Symptom: Green indicator light is "ON", Red indicator light is "ON", Internal over-current shutoff;

1. Please check the following;
 - a. Presence of moisture inside the tubing and the generator. If moisture is present, dry it out by running oxygen through the generator without power (that could take from a few hours to several days). Do not power the generator unless absolutely sure that it is dry. Running the generator with moisture inside will cause serious damage to the internal components and costly repair.
 - b. High oxygen pressure and adjust according to the specifications.
2. If the above conditions are not present, please turn the Power potentiometer on the front panel 5 (See page 6) 1/2 of a turn down and switch the Power switch #4 "ON" again. If the Red indicator light is still "ON" – Please contact our Service Department (See page 15)

If the above conditions are no longer present, please turn the power to "OFF" position, turn the potentiometer to 0 position, wait 10 seconds and turn the power switch "ON". Adjust the

potentiometer according to the instructions. Should the problem persist, please contact our service department. (See page 16)

SECTION 5 – Replacement Parts

HC-30 Generators are repaired at Ozone Solutions. On a rare occasion (when authorized by Ozone Solutions), if any of the parts have to be replaced in the field Ozone Solutions will provide those parts to the customer. Please contact our service department. (See page 15)

SECTION 6 – Ozone Overview and Safety Procedures

6A. Ozone Use and Technology Overview

6A.1 Relative Strength of Ozone

The following compares the strengths of several common oxidizing reagents (EOP vs. Cl₂)

- 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)

6A.2 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.

6B. General Safety Information

6B.1 Ozone Properties

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

6B.2 Ozone Uses

- Air and water disinfection

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

6C. Hazards

6C.1 Health Hazards – Detection Levels

Gaseous ozone can be detected in air by its distinctive odor at concentrations of about 0.02 ppm. Although each nose varies, olfactory fatigue occurs quickly. Initial small exposure may reduce cell sensitivity and/or increase mucous thickness producing a resistance to low gaseous ozone levels.

DO NOT RELY ON ODOR AS A WARNING OF HIGH OZONE CONCENTRATIONS. The Permissible Exposure Level (PEL) or time-weighted concentration for gaseous ozone to which workers may be exposed is 0.1 ppm averaged over 8 hours, 5 days a week (OSHA). The short-term exposure limit is 0.3 ppm averaged over 15 minutes. The concentration of 5.0 ppm ozone in air is generally accepted as Immediately Dangerous to Life or Health (IDLH).

6C.2 Health Hazards – Effects on Humans

Gaseous ozone acts as a primary irritant, affecting mainly the eyes, upper respiratory tract and the lungs. Inhalation produces various degrees of respiratory effects from irritation to pulmonary edema (fluid in lungs). Short exposure to 1-2 ppm concentrations causes headache as well as irritation to the respiratory system but symptoms subside when exposure ends. High concentrations of ozone produce severe irritation to the eyes and respiratory system. Exposure above the ACGIH/OSHA limits may produce nausea, chest pain, coughing, fatigue, reduced visual acuity and pulmonary edema. Symptoms of edema from excessive exposure can be delayed one or more hours. There is no threshold limit and so no exposure (regardless of how small) is theoretically without effect from ozone’s strong oxidative ability.

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

6C.3 Electrical Hazards

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 HC-30 with safe access to electrical power. Connect the HC-30 to a G.F.C.I. type receptacle or as required by local electrical code & regulations. Do not bury the electrical cord. To reduce risk of electrical shock, replace damaged cord immediately.

6C.4 Fire Hazards

Ozone is nonflammable. Decomposition of ozone into oxygen gas (O₂) can increase strength of fire. Ozone is unstable at room temperature and spontaneously decomposes to oxygen gas. Avoid ignition sources such as heat, sparks, and open flame. Keep away from strong reducing agents and combustible materials such as grease, oils, and fats.

6C.5 Chemical Action

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

6D. Precautions for Safe Handling and Use

6D.1 Ozone Monitors

Ambient ozone monitoring equipment should be installed in the areas where ozone is being generated or applied. (See Monitoring section 6G.) Self-adhesive ozone monitor badges, such as the Chromair® System by K&M Environmental (Virginia Beach, VA, www.kandmenvironmental.com), may be used for personal or area monitoring for exposure times ranging from 5 minutes to 10 hours.

6D.2 Ventilation

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

6D.3 Emergency Procedure

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

6D.4 Respiratory Protection

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

6D.5 Education and 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. Management and employees shall review all routine work and emergency procedures jointly at least once annually.

6E. System Operation and Maintenance

6E.1 Safety Precautions and Equipment

Repair and maintenance of the ozone system shall be done under the direction of qualified personnel. Qualification shall consist of instruction and training by the equipment supplier in the safeguards and procedures necessary for safe performance of the work. A certificate of completion of such training shall be provided. Repair of ozone generator could be performed only at Ozone Solutions facilities unless authorized and instructed otherwise by Ozone Solutions personal.

All equipment in an ozone plant (ozone generator, piping, pumps, tanks...) coming in contact with gases containing ozone must be maintained free of oil and grease. Monitoring equipment and alarm system shall be tested and serviced according to the manufacturer's instructions. The planned maintenance of all safety equipment is essential to worker safety.

6E.2 Maintenance Requirements

It is the joint responsibility of the designer, supplier and installer of the ozone generating and handling equipment to conduct the commissioning to determine whether or not the system is working properly. The operation and maintenance manual provided with the equipment outlines the operating procedures and maintenance requirements.

6F. Monitoring

6F.1 Location of Monitors

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

6F.2 Monitoring Equipment

Proper Ozone Monitoring equipment should be use to protect personnel from dangerous levels of ozone exposure.

6G. First Aid Procedures

6G.1 General Information

1. DO NOT PANIC. If exposure to gaseous ozone causes headaches or shortness of breath, immediately remove the worker to a fresh-air environment.
2. Ensure there is no more danger to yourself or the worker.
3. Workers who have been exposed to low concentrations of ozone should be given oxygen to breathe while under the observation of trained personnel.
4. If exposure is severe, send for medical assistance immediately.

6G.2 Inhalation

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

Ozone Solutions One Year Limited Warranty

Ozone Solutions warrants that Ozone Solutions will repair or replace, at Ozone Solutions option, any part of such products proven to be defective in materials or workmanship within one (1) years from data of original purchase. Parts are covered under the one (1) year warranty when and only when required operating conditions and procedures as described in this manual are performed and provided. This Warranty specifically excludes any components not manufactured by Ozone Solutions that are external to the products covered, such as pumps, air compressors, monitors, tanks, or related components. Ozone Solutions will assist with warranty claims for such components purchased through Ozone Solutions; limited to the extent of the manufacturer's standard warranty. ANY REPAIR OR REPLACEMENT WILL BE WARRANTED ONLY FOR THE BALANCE OF THE ORIGINAL ONE (1) YEAR WARRANTY PERIOD.

NOTE: ANY WORK PERFORMED ON OZONE SOLUTIONS PRODUCTS WITHOUT PRIOR AUTHORIZATION FROM OZONE SOLUTIONS WILL AUTOMATICALLY VOID THIS WARRANTY. ANY OZONE SOLUTIONS PRODUCT MUST BE RETURNED TO OZONE SOLUTIONS PREPAID, FOR WARRANTY EVALUATION. **THE OZONE CELL CONTAINS TAMPER PROOF DEVICE. ANY ATTEMPT TO OPEN THE CELL WILL NOT ONLY VOID THE WARRANTY, BUT WILL VOID A POSSIBILITY OF OBTAINING ANY SERVICE BY OZONE SOLUTIONS.**

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 operating procedures and conditions, 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 water passing through unit;
- (e) Damage caused by operating below or above specified working pressure;
- (f) ANY IMPLIED WARRANTY OF MERCHANTABILITY OR IMPLIED WARRANTY OF FITNESS FOR PARTICULAR PURPOSE, AND SUCH WARRANTIES ARE HEREBY DISCLAIMED; AND
- (g) OZONE SOLUTIONS 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.

TO OBTAIN WARRANTY SERVICE:

Ozone Solutions, Inc.
789 7th St NW
Sioux Center, IA 51250 USA
Ph: 712-722-0337
Fax: 712-722-1787
Web: www.ozonesupplies.com
Email: info@ozonesupplies.com

Please provide the following information:

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
6. **All shipping documents should clearly state "Warranty Repair" and indicated RMA number.** Ozone Solutions is not responsible for double taxes or duties resulted from improper shipping documentation.