System Technical Manual
SAFETY, INSTALLATION, OPERATION, MAINTENANCE, SERVICE
610-0113-01  Rev. B  7 May 2007
# Introduction

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1.1 Systems Covered by the Manual

1.1.1 Scope
This manual covers the following IN USA system ODS-9000 Series models only:

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<tr>
<th>Model</th>
<th>Range (sccm O2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ODS-9001-A</td>
<td>0 - 200</td>
</tr>
<tr>
<td>ODS-9003-A</td>
<td>0 - 600</td>
</tr>
<tr>
<td>ODS-9005-A</td>
<td>0 - 1000</td>
</tr>
<tr>
<td>ODS-9010-A</td>
<td>0 - 2000</td>
</tr>
<tr>
<td>ODS-9025-A</td>
<td>0 - 5000</td>
</tr>
</tbody>
</table>

1.1.2 Revision History

<table>
<thead>
<tr>
<th>REVISION</th>
<th>DATE</th>
<th>Changes from previous revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>21 March 2007</td>
<td>New.</td>
</tr>
<tr>
<td>B</td>
<td>7 May 2007</td>
<td>Corrected min. water flow rate: 1.5 lpm for interlock.</td>
</tr>
</tbody>
</table>

1.1.3 Document Expiration
This document expires upon the release of Rev. C.

1.1.4 Purpose
This manual provides the following information for the Model ODS-9000 Series Ozone Delivery System:
- system safety
- system description
- site preparation/installation
- operation
- maintenance

1.1.5 Related Documents

<table>
<thead>
<tr>
<th>Function</th>
<th>System</th>
</tr>
</thead>
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<tr>
<td>Installation</td>
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<td>Pneumatic Diagram</td>
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<td>Electrical Schematics</td>
</tr>
<tr>
<td>Safety</td>
<td>M.S.D.S. Sheets</td>
</tr>
</tbody>
</table>

1.2 General Notes

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1.3 Recommended Training for Operation and Maintenance Personnel

1.3.1 Operator

As with all equipment, basic operation procedures should be reviewed before operating the equipment. While formal training is not required for operators, each operator should read this manual and review the safety items and system shutdown procedures:

- System Safety
- System/Subsystem Descriptions
- System Shutdown

1.3.2 Maintenance Personnel

All maintenance personnel would benefit from a review of the system documentation, and a thorough understanding of the safety considerations and system startup/shutdown procedures. Topics of focus would include:

- System Safety
- System/Subsystem Review
- System Startup
- System Interlock Testing
- System Shutdown
- Lockout/Tagout Procedures
- Lamp Replacement Procedure

All items are covered in detail in this manual or in related documents to ensure that experienced maintenance personnel can safely and efficiently perform each task.
1.4 Obtaining Technical Assistance

If you encounter a problem that you can’t seem to solve, follow the basic steps outlined below.

1. Review all of the information contained in this manual.

2. Consult the appropriate guides listed in Related Documents found earlier in this chapter of the guide.

3. Consult your own internal people about the issue.

4. Contact your local field service office about the issue.

5. Contact IN USA Customer Support about the issue:
   IN USA INCORPORATED
   100 Morse Street
   Norwood, MA 02062
   Tel. 781-444-2929
   for parts, customer support, technical publications, and training.
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<td></td>
</tr>
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<td></td>
</tr>
<tr>
<td>2.17 Electrical and mechanical interlocks</td>
<td>25</td>
</tr>
</tbody>
</table>
2.1 Safety labels and symbols

2.1.1 Safety labels
The following OSHA labels are used throughout the system documentation:

<table>
<thead>
<tr>
<th>Label</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="DANGER" /></td>
<td>High potential for serious bodily injury or death.</td>
</tr>
<tr>
<td><img src="image" alt="WARNING" /></td>
<td>Potential for serious bodily injury.</td>
</tr>
<tr>
<td><img src="image" alt="CAUTION" /></td>
<td>Potential for bodily injury or property damage.</td>
</tr>
</tbody>
</table>

2.1.2 Safety symbols
The following safety symbols are used throughout the system documentation:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="TOXIC GAS/OXIDIZER HAZARD" /></td>
<td>Ensure all safety interlocks including Ozone detectors, safety interlock circuits, exhaust interlocks, and operator notification systems are functioning prior to performing work on the system. Purge then lockout-tagout the system to prevent exposure to any hazardous ozone gas during system maintenance.</td>
</tr>
<tr>
<td><img src="image" alt="SHOCK HAZARD" /></td>
<td>Electrical voltage present. Take appropriate measures to protect yourself from electrical shock.</td>
</tr>
<tr>
<td><img src="image" alt="UV RADIATION HAZARD" /></td>
<td>DO NOT look directly at a UV lamp as irreversible, disabling eye damage can occur. Always wear proper eye protection equipment when calibrating UV lamps to prevent accidental exposure.</td>
</tr>
<tr>
<td><img src="image" alt="FIRE/EXPLOSION HAZARD" /></td>
<td>Non-flammable materials may become flammable in the presence of high oxygen and/or ozone concentrations!</td>
</tr>
<tr>
<td><img src="image" alt="CHEMICAL INHALATION or IRRITATION HAZARD" /></td>
<td>Always purge and lockout/tagout the system before performing maintenance. Always wear protective glasses and gloves, at a minimum, when changing UV bulbs.</td>
</tr>
<tr>
<td><img src="image" alt="BURN HAZARD" /></td>
<td>HOT SURFACE \nWear protective equipment. DO NOT touch.</td>
</tr>
<tr>
<td><img src="image" alt="CRUSH or PINCH HAZARD" /></td>
<td>There is the potential for bodily harm from the equipment. Keep body and limbs clear. Wear protective equipment.</td>
</tr>
<tr>
<td><img src="image" alt="TRIP or FALL HAZARD" /></td>
<td>DO NOT over-extend your reach. Use an appropriate step stool or ladder and follow all of your facility ladder safety program guidelines.</td>
</tr>
</tbody>
</table>
2.1.3 Safety labels: system safety labels and locations

Safety-warning labels are intended to warn the users about the toxicity and danger of ozone gas and electrical dangers. They are applied where appropriate on the outside covers of components and panels.

Prior to operating the generator, ensure that ozone detection equipment is properly located to detect any leaks. Ensure that all other safety-monitoring features are functional.
2.2 General safety guidelines

**WARNING**
Always follow established industrial safety practices when operating any production equipment.

**WARNING**
Safety is designed into every IN USA system. When followed, these minimum guidelines provide an acceptable level of safety for operating and maintaining your system. They are not, however, a substitute for determining your own internal safety procedures.

**WARNING**
Use of controls, adjustments, or procedures other than those specified in this manual without consulting a competent safety professional may result in exposure to potential hazards. Always follow established industrial safety practices when operating production equipment.

2.2.1 Unsafe acts

- NEVER let elastomer seals such as Viton® or Buna® N come into contact with ozone.
- NEVER begin operation of the system until the proper process equipment has been linked to the system, and has been signed-off and is ready for processing and receiving inputs from this system.
- NEVER defeat a safety interlock unless you are certified to perform the procedure and have been specifically directed to defeat the interlock.
- NEVER open a system panel when water, or electrical power is turned on to the system.
- NEVER operate or service this system without a thorough knowledge of the dangers involved and the precautions to be followed for safe and efficient operation.
- NEVER disregard instructions to lockout/tagout the system.
- NEVER permit unauthorized or untrained personnel to access, use, or perform maintenance on the system.
- NEVER STAND IN WATER OR ON A WET SURFACE WHILE OPERATING ANY ELECTRICALLY POWERED EQUIPMENT.
- NEVER remove a warning label from the equipment.
- NEVER operate damaged or leaking equipment.
- NEVER allow any foreign material to enter the ozone generator.
- NEVER substitute any feedstock gases not specified in this manual without explicit permission of IN USA, Inc.

**WARNING**
Failure to comply with the safety precautions or warnings indicated in this manual violates the safety standards that form a part of the intended use of the ozone generating equipment. IN USA, Inc. assumes no liability for the user’s failure to comply with these requirements.
### 2.2.2 Recommended practices

- Connect all input gas and electrical lines according to the manufacturer specifications or best commercial practice.
- Always check the fittings of all ozone, oxygen, and water lines before operating.
- USE THE BUDDY SYSTEM: ALWAYS perform maintenance procedures in teams of two or more people; one to monitor the surrounding systems, the maintenance environment, your actions and to ensure all documentation and safety steps are followed.
- ALWAYS observe all warning labels.
- ALWAYS avoid all unsafe acts. “General safety guidelines” on page 10.
- Whenever possible, make sure that both gases and power are turned OFF at the source prior to beginning any maintenance task.

**DANGER**

Use of controls, adjustments, or procedures other than those specified in this manual without consulting a competent safety professional may result in exposure to potential hazards.

### 2.2.3 HELP

Always work in teams of two or more when performing any tasks which require the removal of system panels. Always seek additional help when:
- You are instructed by any procedure.
- You see an emergency or dangerous situation.
- You are not trained or qualified/certified to perform a task.
- You feel uncomfortable performing a task.
- You need assistance lifting heavy or awkward panels or equipment. ALWAYS seek help when lifting any item that weighs more than 40 lbs.

### 2.2.4 Evacuations

In case of an emergency evacuations:
- EXIT the building through the nearest exit and report to your assigned evacuation area.
- DO NOT stop to turn off any machines.
- DO NOT move any carts or equipment during evacuation.
- Obey all commands from the emergency response team.
- Return to the building ONLY AFTER being instructed to do so by the emergency response team.
2.3 System safety guidelines

**DANGER**

Ozone (O₃) is a toxic gas. High concentrations of ozone are dangerous and harmful to humans. Take reasonable steps to avoid exposure. The current maximum 8-hour exposure limit for ozone is 0.1 PPM (according to U.S. OSHA).

Install appropriate safety monitoring equipment wherever high concentrations of ozone are used. IN USA, INC. manufactures several ozone monitors for workplace safety applications.

Materials in contact with high concentrations of ozone should be suitable for such use. Stainless Steel (316L), Teflon®, Chemraz® and Kynar® are recommended.

When performing any maintenance to the unit, make sure all AC power is disconnected from the unit.

The ozone monitor contains an ultraviolet (UV) lamp. Never remove the lamp from its housing while the unit is powered on. Eye exposure to UV light is extremely dangerous.

Certain components may be hot to the touch. Please allow proper cooling time before working with these components.

Never attempt to open ozone catalyst canisters (if supplied). The contents of the canisters can be hazardous if not handled properly.

Use only IN USA, INC. recommended spare parts. Substitution parts could result in damage to the equipment, may create hazardous conditions and will void the warranty.

Use this equipment as recommended in this manual. Use of the equipment in ways other than specified by IN USA may create hazardous conditions.

**CAUTION**

Read the operating manual before operating the unit.

Do not subject the unit to extreme physical or thermal shock.

Use care in handling the unit and any of its components.
2.4 Electrical work type

All maintenance procedures should be performed with the system fully de-energized. In accordance with the Environmental, Health, and Safety Guideline for Semiconductor Manufacturing Equipment (SEMI S2-0703aE), section 13, each maintenance procedure has been assigned an electrical work type code. The codes are from 1 to 4 with 4 being the most hazardous task. See Environmental, Health, and Safety Guideline for Semiconductor Manufacturing Equipment (SEMI S2-0703aE) for additional information.

<table>
<thead>
<tr>
<th>Electrical Work Type</th>
<th>Energy Magnitude</th>
<th>Condition</th>
<th>Safety Buddy Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 volt amps</td>
<td>Fully de-energized and locked and tagged out.</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Energized with covers in place</td>
<td>Energized, but live circuits are covered or insulated to prevent accidental shock. Type 2 work includes tasks where the energized circuits are or can be measured by placing probes through suitable openings in the covers or insulators.</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>&lt;240 Volt amps and &lt;60 Volts</td>
<td>Equipment is energized. Energized circuits are exposed and inadvertent contact with uninsulated energized parts is possible. Potential exposures are no greater than 30 Vrms, 42.4V peak, 60 VDC or 240 VA in dry locations.*</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>&lt;240 Volt amps and &lt;60 Volts</td>
<td>Energized and live circuits are exposed and accidental contact is possible at greater than 30 Vrms, 42.4V peak, 60 VDC or 240 VA in dry locations.* Potential exposure to radio-frequency currents.</td>
<td>Qualified Energized Electrical Work Buddy</td>
</tr>
</tbody>
</table>

*A dry location can be considered to be one that is not normally subject to dampness or wetness.

2.5 Recommended safety and personal protective equipment

2.5.1 Safety equipment

All safety equipment should be clearly marked, easily accessible, and located in the immediate vicinity of the equipment. We recommend that you have the following additional safety equipment readily available to you:

- First aid kit
- Fire protection equipment (proper fire extinguisher, etc.)
- Protective clothing including glasses rated for UV protection as noted in the system maintenance procedures.

Also make sure that all personnel are both familiar with and trained in the use and handling of the safety equipment in your area.

NOTE: Approval of these items for use at the customer facility is not the responsibility of IN USA. The procurement, installation, operation, and maintenance of all safety equipment is the sole responsibility of the customer.

The safety equipment described in this guide is not intended to provide protection for all hazards. Protection of the customer’s property, employees, and guests is the sole responsibility of the customer.

2.5.2 Personal protective equipment

The following personal protective equipment is required for the safe maintenance of this equipment:

- Safety goggles with permanent side shields meeting ANSI Z87.1 requirements.
- Safety goggles with UV protection rated for up to 40 µW/cm²
2.6 Safety summary for handling emergency situations

This section of the guide provides you with some information that could help in handling various emergency situations. Also included are suggestions for where to get assistance.

2.6.1 Disabling power to the system

And EMERGENCY OFF (EMO) button is recommended for installation by the end-user to remove power from the system in an emergency situation. If an EMO is not installed on your equipment, turn OFF the power switch on the ozone generator to stop ozone generation.

**DANGER**

**SHOCK HAZARD**

If the IN USA components are installed in a system where an EMO is activated, power may remain on the input side of a main contactor, and within any surge protectors and any power distribution boxes. Consult the on-site installation/equipment engineer for custom installation and requirements.

2.6.2 Availability of Material Safety Data Sheets

You must make sure that Material Safety Data Sheets (MSDS) covering all hazardous material used in the system are prominently displayed in the immediate vicinity of the equipment. These include: Ozone, Oxygen, Nitrogen, and Mercury.

2.6.3 Standard First Aid for toxic exposure

If exposure to a toxic substance occurs:

1. Protect yourself from the hazard by wearing appropriate protection equipment before assisting others.

2. Contact an emergency assistance partner, group or agency to assist you.

3. Remove the victim from the immediate area and place him/her in an uncontaminated area.

4. If the victim has stopped breathing, administer artificial respiration.

5. Administer oxygen if required.

6. Contact the local poison control center or other emergency medical assistance (identify, if possible, the chemical that the person was exposed to).

7. Keep the victim calm and warm until medical assistance arrives.

8. Describe the chemical or gas that the person was exposed to, to the attending physician or medical personnel.
2.6.4 Emergency telephone contacts

Make sure that you have a list of emergency telephone numbers for your locality displayed outside of the immediate area of the equipment. The list should contain emergency numbers for the following:

<table>
<thead>
<tr>
<th>Contact</th>
<th>Telephone Number(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poison Control Center</td>
<td></td>
</tr>
<tr>
<td>Ambulance</td>
<td></td>
</tr>
<tr>
<td>Hospital</td>
<td></td>
</tr>
<tr>
<td>Fire Department</td>
<td></td>
</tr>
<tr>
<td>Internal Safety Personnel Contact</td>
<td></td>
</tr>
</tbody>
</table>

*NOTE:* Since your local poison control center is more familiar with the toxic substances used in the semiconductor industry, this should be your primary contact for these types of situations prior to a local physician or hospital.
2.7  Mechanical hazards

2.7.1  Mechanical hazard locations

There are no moving parts in the system that can cause crush or pinch hazards.

Mechanical hazards locations include all system panels (sides and rear), and the removal of any system component. Pinch hazards or drop hazards can exist with panels and with rack mounted system components, should the components be mounted in a rack by the end-user.

**WARNING**

You MUST be trained on the use the system to prior to attempting to install, operate or perform maintenance on the system. Your training must include:

- a review of all applicable industry safety procedures and standards
- a review of all system safety recommendations
- a thorough understanding each subsystem and its operation
- a detailed explanation of the specific tasks and responsibilities of each person involved in the use of the ozone generator system
- the person or persons (by name, location and phone number) to contact when the actions required are beyond the training and responsibility of the person being trained

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

- identification of the recognized hazards associated with each task
- identification of, and appropriate responses to, usual operating conditions, and any emergency situations, including the use of all system controls, and any EMO buttons
- an explanation of the functions and limitations of all safeguards and their design characteristics
- an explanation for function testing or otherwise assuring the proper functioning of safeguarding devices.

2.8  Exhaust hazards

All ozone generating equipment should be housed in an area with proper exhaust and with proper sweep of the installation location/cabinet and an ozone leak detector should be installed to detect any leaks. A flow sensor with interlock on an exhaust port should be installed to ensure that insufficient exhaust will trip the exhaust interlock and turn off the ozone generators.
2.9 **High-voltage hazards**

### 2.9.1 High-voltage hazard locations

High voltages are used in the process of generating ozone, however all circuits of the generator are either covered or isolated. The generator cannot be opened without tools. The ozone generator power connection is also covered. The ozone generator does not need to be opened for any routine maintenance. In the event that the unit needs to be serviced, all work should be completed by trained/certified and authorized personnel only. Prior to working on the ozone generator, remove electrical power by switching off the Circuit Breaker located on the generator’s front panel.

**WARNING**

Personnel working with or near high voltage equipment should be thoroughly familiar with emergency equipment, procedures, and resuscitation methods as well as electrical safety work practices and procedures for the control of hazardous energies.

Observe all safety precautions including adherence to OSHA electrical safety and lockout/tagout regulations (29 CFR-1910331, 1910147). Lockout the main breaker to the equipment prior to servicing this area of the machine.

### 2.9.2 High-voltage hazards table

<table>
<thead>
<tr>
<th>High-voltage hazard</th>
<th>Location</th>
<th>Voltage</th>
<th>Description/Safety Interlocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCI-TURBO Controller</td>
<td>Cabinet or Rack-Mount Components</td>
<td>200-240 VAC</td>
<td>Power-cord plug-in component.</td>
</tr>
<tr>
<td>Ozone Generator A</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2.9.3 System power ratings

System Controller: Input: 90 to 240VAC, 50/60 Hz

Ozone Generator: 200-240VAC 1 phase, 50/60 Hz
2.10 Chemical hazards

2.10.1 Required process chemicals

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (N₂)</td>
<td>Facility supplied, rear of system</td>
</tr>
<tr>
<td>Oxygen (O₂)</td>
<td>Facility supplied, rear of system</td>
</tr>
<tr>
<td>Ozone (O₃)</td>
<td>Created by the system.</td>
</tr>
<tr>
<td>Mercury</td>
<td>Trace amounts in the system UV lamps.</td>
</tr>
</tbody>
</table>

### 2.10.1.1 Ozone Safety

Ozone has the potential to injure humans and damage the equipment and facilities by corrosion or explosion. IN USA, Inc.’s O.D.S. uses high voltages that can cause injury or death by electrical shock. Once should also be aware of chemical and physical risks.

- **WARNING**
  - Understand and implement the OSHA and locally required safety laws involving the generation of ozone gas using high-voltages. Failure to do so may lead to personnel injury. IN USA, Inc. assumes no liability for the user’s failure to comply with these requirements. Ensure that every action is done under attention of all safety regulations!

- **DANGER**
  - Ozone has a readily identifiable odor recognizable in extremely minute quantities. Concentrations above 0.1 ppm can cause headaches, eye irritation, respiratory problems, dizziness, and nausea. At much higher concentrations it can cause death.
  - An alternative methodology to locate small leaks on tubings and fittings which contain ozone, is the use of potassium iodine/starch paper. It is a commercially available indicator paper for ozone. After wetting the paper with water, it shows a color change in contact with ozone.

- **DANGER**
  - Do not use the system without the ozone leak monitor. Failure to do so may lead to personnel injury.
  - Observe the safety thresholds for ozone concentration that apply in your country. (In the USA, the maximum permissible workplace concentration is 0.1 ppm = 0.2 mg/m³). Failure to do so may lead to personnel injury.

Please observe the necessary safety measure when working with high ozone concentrations. (In the USA, the ACGIH TLVs are defined as 0.1mg/m³ for Heavy Work, 0.16mg/m³ for Moderate work, and 0.2mg/m³ for light work. The OSHA PELs are: 8-hr TWA= 0.2mg/m³ (0.1 ppmV), STEL:0.6mg/m³ (0.3 ppmV).NIOSH REL lists a ceiling of 0.2mg/m³ (0.1 ppmV)

Gaseous ozone may decay exothermally. At higher concentration the exothermal and volume increasing decay of ozone might result in increased pressures. The decay can by catalytically induced. Therefore, never use materials which catalyze the decay of ozone within the gas lines. DO NOT use silver plated gaskets for VCR fittings since they catalyze the decay of ozone severely. Use non-plated stainless steel gaskets only.

### 2.10.1.2 Oxygen Safety
The feed gas for the ozone generator is oxygen gas spiked with traces of nitrogen. If the exhausting of the cabinet fails, an accumulation of oxygen may occur if there is a leak in the oxygen tubing. Install the required flow-limiting device in your facility oxygen tubing as described in the installation diagram.

**FIRE/EXPLOSION HAZARD.**
Non-flammable materials may become flammable in the presence of high oxygen and/or ozone concentrations!

### 2.10.1.3 Nitrogen Safety

If there is a leak in N₂ tubing, an accumulation of N₂ may occur may occur near or adjacent to the leak location or at a remote area where the gas is allowed to flow.

**DANGER**
Inhalation of nitrogen in high concentrations leads to asphyxia!

### 2.10.2 Chemical warnings

#### 2.10.2.1 Chemical Residues

**WARNING**
CHEMICAL INHALATION or IRRITATION HAZARD.
Ensure that they system is properly purged and shutdown prior to performing maintenance.
Protective glasses and gloves, at a minimum, should be worn when replacing UV bulbs which contain trace amounts of mercury.

#### 2.10.2.2 Cleaning chemicals

No cleaning chemicals are required or recommended for use with this system. Wipes may, however, be used to clean or removal dust from external panels.

### 2.10.3 Material Safety Data Sheets

Material Safety Data Sheets (MSDS) for each hazardous chemical should be consulted in case of exposure. The MSDS covering all hazardous materials used in the process must be prominently displayed in the immediate vicinity of the machine.

MSDS information for this equipment can be found within the system documentation binder, including:
- Ozone
- Mercury
2.11 Ultraviolet (UV) light hazards

**WARNING**

**UV HAZARD**
DO NOT look directly at a UV light as permanent eye damage may result.

2.11.1 UV hazard location(s) and specifications
A UV lamp is located inside the gFFOZ detector.
- Lamp life is typically 12-24 months.

The lamps are shielded by multiple cabinet and component covers and present no exposure hazards to the operator during system operation. Follow lamp replacement instructions to avoid exposure to any UV light during system maintenance.

**WARNING**

**UV HAZARD**
The Threshold Limit Value (TLV) for Ultraviolet (UV) radiation at this wavelength (254 nm) is 0.1 µW/cm².

2.12 Ozone Generator Electrical Hazards

The ozone generator produces high voltages inside its housing. An ozone generator cannot be opened without tools. Its electrical connections are also covered. The ozone generator does not require maintenance and should never be opened except by service technicians who are specifically trained/certified and authorized to serve the generators.

**ELECTRICAL HAZARD.**
Wait at least 10 minutes before you touch any part inside the generator after de-energizing! Electrical charge may be stored in capacitors.

2.13 Ergonomic height hazards

**WARNING**

**TRIP or FALL HAZARD**
Never install the system components in a location which is difficult or dangerous to reach.

2.14 Noise hazards

The system emits less than 50db and presents no noise hazard.
2.15 Chemical (gas) Lockout/Tagout procedure

If you do not lockout and tagout the system, you risk serious injury or death from contact with or exposure to hazardous energies, including suffocation hazards.

A lockout/tagout program helps to prevent injury from unexpected energization, start-up, or release of stored energy from the equipment during maintenance or service. A lockout/tagout program controls hazardous energies (electrical, mechanical, chemical, physical, etc.). The lockout/tagout procedure isolates the energies from the service area and locks the isolation device to ensure that the energy is not reapplied to the equipment during maintenance and service. You must use lockout/tagout procedures (or an alternative which provides effective protection) whenever a safety device is bypassed. You must also use lockout/tagout procedures when any part of your body is close to any point of operation or associated danger zone of the equipment.

You are responsible for your own safety. If you are authorized to perform maintenance, you must apply your own personal locks and tags at required energy isolation points prior to working on the equipment. You must not share locks and tags. If more than one person is performing maintenance on the equipment, each person's lock and tag must be placed at each energy isolation device. If necessary, use a lock-extender clamp which can typically support up to six individual locks.

You are not required to lockout/tagout cord-and-plug connected equipment provided that the plug remains under your control at all times.

1. Notify Affected Personnel
   Before starting the maintenance procedures, notify anyone who may be affected.

2. Prepare for Shutdown
   Before shutting down the equipment, determine the energies present, their hazards, and the means for controlling them. Also, collect the following:
   • Any written maintenance procedures
   • Proper maintenance tools
   • Appropriate locks, tags, and other energy isolating devices

3. Apply the Lockout/Tagout
   If you are working on the equipment, apply your own lock and tag to each energy isolating device. Always make sure lockout devices are tagged with the name of the individual who is applying the lock as well as the reason for the maintenance procedure. Apply the lockout so that the energy isolating devices are held securely in the “SAFE” or “OFF” position.
4. Release Stored Energy
   Dissipate any hazardous energy which remains in the equipment after you have applied the isolating device and the locks and/or tags. Make sure you are authorized to release the energy and you release it in a safe manner. Gas hazardous energies can include pressure, suffocation potential, poison potential, etc. Ensure that hazardous energies do not re-accumulate.

5. Verify the Isolation
   Before beginning work on a locked-out equipment, verify that the equipment is in a zero energy state by attempting to turn ON the controls designed for that purpose. You may also wish to verify the isolation with an appropriate meter. After verifying that the lockout/tagout is working, return the system to the “OFF” or “NEUTRAL” position.

6. Perform the Task
   ![DANGER]
   Perform work on the equipment in a safe manner. Only complete work on the system if you are authorized and if you have applied your own lockout/tagout device.

7. Inspect the Equipment
   Following completion of the work, inspect the equipment to ensure that it has been properly reassembled and is fit for operation. All guards, interlocks, and other safety devices must be in place. Verify that all tools, used parts, cleaners, and wipes have been removed from the equipment.

8. Notify Affected Personnel
   Clear the area of all personnel before re-starting the equipment.
   Inform anyone affected that the locks and/or tags are about to be removed from the equipment.

9. Remove your lock(s) and tag(s)
   Remove the locks and/or tags only if:
   - You are authorized to remove them
   - You applied the locks and tags
   - Energy isolating devices are ready to be restarted

10. Re-start the Equipment
    Monitor the start-up of the equipment for malfunctions from an appropriate, safe position. If a the system malfunctions, you must shut down the equipment and repeat the lockout/tagout process.

2.15.1 Gas Lockout/Tagout sites
   The following table shows the lockout/tagout sites:

<table>
<thead>
<tr>
<th>Gas</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>Facilities</td>
</tr>
<tr>
<td>Oxygen</td>
<td>Facilities</td>
</tr>
</tbody>
</table>
2.16 Electrical Lockout/Tagout procedure

**DANGER**

**ELECTROCUTION HAZARD.**

If you do not lockout and tagout the system, you risk serious injury or death from contact with or exposure to hazardous energies such as electricity, hazardous materials, and moving mechanisms.

A lockout/tagout program helps to prevent injury from unexpected energization, start-up, or release of stored energy from the equipment during maintenance or service. A lockout/tagout program controls hazardous energies (electrical, mechanical, chemical, physical, etc.). The lockout/tagout procedure isolates the energies from the service area and locks the isolation device to ensure that the energy is not reapplied to the equipment during maintenance and service. You must use lockout/tagout procedures (or an alternative which provides effective protection) whenever a safety device is bypassed. You must also use lockout/tagout procedures when any part of your body is close to any point of operation or associated danger zone of the equipment.

You are responsible for your own safety. If you are authorized to perform maintenance, you must apply your own personal locks and tags at required energy isolation points prior to working on the equipment. You must not share locks and tags. If more than one person is performing maintenance on the equipment, each person’s lock and tag must be placed at each energy isolation device.

You are not required to lockout/tagout cord-and-plug connected equipment provided that the plug remains under your control at all times.

1. **Notify Affected Personnel**
   Before starting the maintenance procedures, notify anyone who may be affected.

2. **Prepare for Shutdown**
   Before shutting down the equipment, determine the energies present, their hazards, and the means for controlling them. Also, collect the following:
   - Any written maintenance procedures
   - Proper maintenance tools
   - Appropriate locks, tags, and other energy isolating devices

3. **Apply the Lockout/Tagout**
   If you are working on the equipment, apply your own lock and tag to each energy isolating device. Always make sure lockout devices are tagged with the name of the individual who is applying the lock as well as the reason for the maintenance procedure. Apply the lockout so that the energy isolating devices are held securely in the “SAFE” or “OFF” position.
4. **Release Stored Energy**
Dissipate any hazardous energy which remains in the equipment after you have applied the isolating device and the locks and/or tags. Make sure you are authorized to release the energy and you release it in a safe manner. Hazardous energies can be stored in the form of electrical capacitance, gravity, heat, etc. Ensure that hazardous energies do not re-accumulate.

5. **Verify the Isolation**
Before beginning work on a locked-out equipment, verify that the equipment is in a zero energy state by attempting to turn it ON using the controls designed for that purpose. You may also wish to verify the isolation with an appropriate meter. After verifying that the lockout/tagout is working, return the system to the “OFF” or “NEUTRAL” position.

6. **Perform the Task**

![DANGER]
Perform work on the equipment in a safe manner. Only complete work on the system if you are authorized and if you have applied your own lockout/tagout device.

7. **Inspect the Equipment**
Following completion of the work, inspect the equipment to ensure that has been properly reassembled and is fit for operation. All guards, interlocks, and other safety devices must be in place. Verify that all tools, used parts, cleaners, and wipes have been removed from the equipment.

8. **Notify Affected Personnel**
Clear the area of all personnel before re-starting the equipment. Inform anyone affected that the locks and/or tags are about to be removed from the equipment.

9. **Remove your lock(s) and tag(s)**
Remove the locks and/or tags only if:
- You are authorized to remove them
- You applied the locks and tags
- Energy isolating devices are ready to be restarted

10. **Re-start the Equipment**
Monitor the start-up of the equipment for malfunctions from an appropriate, safe position. If a the system malfunctions, you must shut down the equipment and repeat the lockout/tagout process.

### 2.16.1 Electrical Lockout/Tagout sites

The following table shows the lockout/tagout sites for the power distribution panel.

<table>
<thead>
<tr>
<th>Circuit Breaker</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main</td>
<td>Facilities</td>
</tr>
</tbody>
</table>
2.17 Electrical and mechanical interlocks

2.17.1 Required safety interlocks

The system should be installed with appropriate safety interlocks and ozone monitoring equipment.

At a minimum, interlocks should include:

- EMO button interlocks for operator protection
- ozone leak detection
- cooling water flow
- panel/covers/equipment access

IN USA highly recommends the use of our Model IN2000 Ozone Leak Detector system with FFOZ leak detectors as well as our Model CAT-03 Ozone Destruct Unit.

2.17.2 Interlock Table

NOTE: All interlocks latch when they are triggered, and the system requires a reset signal (through interface connection) to clear the latching, and the RESET switch on the FRONT panel must be pressed.

<table>
<thead>
<tr>
<th>Interlock</th>
<th>Location</th>
<th>Requirement</th>
<th>Interlock Method</th>
<th>Consequence if tripped</th>
<th>Operator Notification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host tool connection</td>
<td>Cable connection at rear of system.</td>
<td>24 VDC interface connection</td>
<td>hardware trip switch</td>
<td>shuts off system power</td>
<td>• all system power is removed</td>
</tr>
<tr>
<td>Cooling water flow</td>
<td>internal to the ozone generator</td>
<td>minimum of 1.5 gpm per generator</td>
<td>hardware trip switch</td>
<td>Turns off the ozone generator by opening the interlock loop</td>
<td>• visual indicator on control panel</td>
</tr>
</tbody>
</table>
WARNING
Read this manual carefully before applying power, oxygen, nitrogen or water to the Ozone Delivery System. Verify that a process valve (i.e. PROCESS A) is turned ON before applying oxygen or nitrogen to the system.

WARNING
Ozone Delivery System is shipped with the ozone output ports capped-off. Remove these caps and connect the system to appropriate plumbing before running the system.
3.1 System overview

The IN USA Model ODS-9000 Series ozone delivery system consists of two main components:
- a ODS-9000 Series high-purity ozone generator
- a SCI-TURBO-L controller

The ozone generator contains ozone generating equipment and controls including an oxygen and nitrogen MFCs, an in-line ozone concentration sensor (gFFOZ), and a remote pneumatically-controlled diverter switch to direct ozone to the process tool or to bypass (ozone destructor).

The SCI-TURBO-L controller connects to the ozone generator and controls the flowrate of each process gas, ensures safety interlocks are met, and displays ozone concentrations.

The system is designed for installation in a standard 19-inch rack mount location. IN USA highly recommends the use our Model IN2000 Ozone Leak Detector system with FFOZ leak detectors as well as our Model CAT-03 Ozone Destruct Unit for use with all of our ozone generator systems.

3.1.1 Generator Overview

3.1.1.1 Generator Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (W x H x D)</td>
<td>19” x 10.5” x 18” (48 cm x 27 cm x 45 cm)</td>
</tr>
<tr>
<td>Oxygen Flow</td>
<td>0.25 to 5 slpm</td>
</tr>
<tr>
<td>Ozone Outlet Pressure</td>
<td>Internally set to 30 PSIG</td>
</tr>
<tr>
<td>Proof Pressure</td>
<td>80 PSIG</td>
</tr>
<tr>
<td>Ambient Temperature</td>
<td>5 – 35 °C</td>
</tr>
<tr>
<td>AC Power</td>
<td>200-240VAC 1 φ, 50/60 Hz</td>
</tr>
<tr>
<td>Cooling Water Temperature</td>
<td>18 °C ± 3 °C (do not cool below local dew point)</td>
</tr>
<tr>
<td>Cooling Water Flow</td>
<td>2.0GPM at 60 PSIG</td>
</tr>
<tr>
<td>Weight</td>
<td>70 Lbs. (37 kg)</td>
</tr>
</tbody>
</table>
### 3.1.1.2 Generator Facility Requirements

<table>
<thead>
<tr>
<th>Gas Service</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>Grade 6 or better. Less than 1 PPM water, hydrocarbon and halocarbons. 20 – 75 PSIG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N₂ (Spiking Gas)</td>
<td>0.5% N₂ (Grade 5 or better) (% of total feed gas volume)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feedgas Inlet Ports</td>
<td>¼&quot; VCR male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ozone Outlet Ports</td>
<td>¼&quot; Compression, 60 PSI Typ (80PSI Max)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cooling Water</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>18 °C ± 3 °C (keep water temperature above local dew point)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommended Flow</td>
<td>2.0 GPM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Flow</td>
<td>1.5 GPM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max Inlet Pressure</td>
<td>80 PSIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filtration</td>
<td>20 Microns or better (Customer Supplied)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>Demineralized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal Load</td>
<td>2.0 KW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Supply/Return Port</td>
<td>1/2&quot; Compression (female)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical Service</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Power Current</td>
<td>200-240VAC, 50/60 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1φ 10 AMP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.1.1.3 Generator Connections

- Interface to controller
- FFZOZ Ozone Sensor Connection
- CDA inlet
- Water inlet/outlet ports
- Main inlet power
- Gas inlet ports
- Ozone outlet ports
The rear panel consists of:

Three Electrical Connectors as follows:
- Main power input,
- DB-25 electrical connector, “Remote Interface”, for interfacing with the Controller Model SCI-Turbo-L
- DB-15 electrical connector, “FFOZ Sensor”, associated to the internally mounted gFFOZ ozone sensor, for connection to the Controller, Model SCI-Turbo-L

Two Cooling Water Connector Ports as follows:
- Cooling Water Inlet Port
- Cooling Water Outlet Port

Three Inlet Gas Ports as follows:
- Feed Gas Inlet Port, Oxygen
- Feed Gas Inlet Port, Nitrogen
- Compressed Dry Air (CDA)

Two Outlet Gas Ports as follows:
- Divert Outlet Port, Ozone
- Process Outlet Port, Ozone

3.1.1.4 Generator, Controls and Indicators

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER BREAKER SWITCH</td>
<td>This breaker is used to switch the AC power to the unit. When the switch is in the ON position  (breaker UP) the main AC power is applied to the unit. When the switch is in the OFF position (breaker down) no AC power is present.</td>
</tr>
<tr>
<td>OZONE ON – OFF/RESET SWITCH</td>
<td>When the switch is set to the OZONE ON position the control electronics will attempt to deliver the set-point power to the generating cells. When the switch is set to the OFF/RESET position, the control electronics will remove power from the generating cells</td>
</tr>
<tr>
<td>LOCAL – REMOTE SWITCH</td>
<td>In the LOCAL position it selects Local operation from the Front Panel Controls, in the REMOTE position it selects remote-controlled operation via the connector located in the Rear Panel</td>
</tr>
<tr>
<td>SET POINT POTENTIOMETER</td>
<td>This potentiometers controls the amount of power delivered to the generating cells (and ultimately the amount of ozone being generated)</td>
</tr>
<tr>
<td>OZONE ON LED</td>
<td>This indicator is ON when power is applied to the generating cells, and no alarm conditions are present</td>
</tr>
<tr>
<td>STANDBY LED</td>
<td>This indicator is ON when the generator is ready to make ozone and there is no alarm condition detected</td>
</tr>
<tr>
<td>LOCAL LED</td>
<td>This indicator is ON when the Local Mode of Operation has been selected</td>
</tr>
<tr>
<td>REMOTE LED</td>
<td>This indicator is ON when the Remote Mode of Operation has been selected.</td>
</tr>
<tr>
<td>SYSTEM FAULT LED</td>
<td>This indicator is ON when the control electronics detects an over-temperature condition in either the High Voltage Power Supply’s switching transistors; the power magnetic components; or the generating cells. The control electronics shuts off the HVPS and the unit remains in this state until a reset signal is detected</td>
</tr>
<tr>
<td>OVERVOLTAGE LED</td>
<td>This indicator is ON when an over-voltage condition is detected at the high voltage power supply (HVPS). The control electronics shuts off the HVPS and the unit remains in this state until a reset (2) signal is detected</td>
</tr>
<tr>
<td>EXT. INTERLOCK LED</td>
<td>This indicator is ON when the EXT. INTERLOCK signal (Pin #12 in the REMOTE-INTERFACE CONNECTOR) is HIGH.</td>
</tr>
<tr>
<td>INT. INTERLOCK LED</td>
<td>This indicator is ON when the control electronics detects that the internal interlock conditions are not met. This indicator is ON if there is not enough chilled water flow or if the top cover has been removed.</td>
</tr>
</tbody>
</table>
3.1.2 Controller Overview

3.1.2.1 Controller Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (W x H x D)</td>
<td>19” x 3.47” x 18” (48 cm x 8.8 cm x 45 cm)</td>
</tr>
<tr>
<td>Display</td>
<td>2 x 20 character, alphanumeric, vacuum fluorescent</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01% w/w</td>
</tr>
<tr>
<td>Cycle Time</td>
<td>Continuous measurement, refreshed every 2 sec or 0.5 Hz</td>
</tr>
<tr>
<td>Digital I/O</td>
<td>RS-232-C, bi-directional</td>
</tr>
<tr>
<td>AC Power</td>
<td>90 to 240VAC, 50/60 Hz</td>
</tr>
<tr>
<td>Weight</td>
<td>10.9 Lbs. (4.94 kg)</td>
</tr>
<tr>
<td>Display Resolution</td>
<td>0.01% w/w</td>
</tr>
<tr>
<td>Cycle Time</td>
<td>Continuous measurement, refreshed every 2 sec or 0.5 Hz</td>
</tr>
<tr>
<td>Digital I/O</td>
<td>RS-232-C, bi-directional</td>
</tr>
<tr>
<td>AC Power</td>
<td>90 to 240VAC, 50/60 Hz</td>
</tr>
<tr>
<td>Weight</td>
<td>10.9 Lbs. (4.94 kg)</td>
</tr>
</tbody>
</table>

3.1.2.2 Controller Facility Requirements

<table>
<thead>
<tr>
<th>Electrical Service</th>
<th>Voltage</th>
<th>Power</th>
<th>Fuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>90 to 240VAC, 50/60 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td>75W MAX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuse</td>
<td>1 AMP</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.1.2.3 Controller Connections

Additional connections include:
- Valve Interface connector
- Field Wiring connector
- Analog Output connector
- Alarm connectors
- Interlock Connections

NOTE: Only the RS-232 and the Analog Output Connectors are used. The other connectors are for future expansion.
### 3.1.2.4 Controller, Controls and Indicators

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCROLL KEY</td>
<td>This key is used to scroll through the menus.</td>
</tr>
<tr>
<td>ENTER KEY</td>
<td>This key is used for confirmation of menu choice.</td>
</tr>
<tr>
<td>D KEY</td>
<td>This key is used for entering and scrolling through the hidden menus.</td>
</tr>
<tr>
<td>LEFT ARROW KEY</td>
<td>This key is used to change digits or toggling.</td>
</tr>
<tr>
<td>UP ARROW KEY</td>
<td>This key is used to select a digit.</td>
</tr>
<tr>
<td>DISPLAY LCD</td>
<td>Used to display pertinent information for the Sci-Turbo L.</td>
</tr>
</tbody>
</table>

### 3.1.2.5 Controller RS-232 Connector (9-Pin)

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Signal</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>RX</td>
<td>Input</td>
<td>Receive line</td>
</tr>
<tr>
<td>3</td>
<td>TX</td>
<td>Output</td>
<td>Transmit line</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Power</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.1.2.6 Generator, Analog Output Connector (10-Pin)

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Signal</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FFOZ A</td>
<td>Output</td>
<td>0-10 VDC corresponding to 0-26%w/w or 0-1000 g/Nm³ or g/m³ (according to selected units of measurement)</td>
</tr>
<tr>
<td>2</td>
<td>ANALOG GND</td>
<td>Power</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>FFOZ B</td>
<td>Output</td>
<td>0-10 VDC corresponding to 0-26%w/w or 0-1000 g/Nm³ or g/m³ (according to selected units of measurement)</td>
</tr>
<tr>
<td>4</td>
<td>ANALOG GND</td>
<td>Power</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>MFC A</td>
<td>Output</td>
<td>0 to 10 VDC corresponding to the full range of the MFC*</td>
</tr>
<tr>
<td>6</td>
<td>ANALOG GND</td>
<td>Power</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>MFC B</td>
<td>Output</td>
<td>0 to 10 VDC corresponding to the full range of the MFC*</td>
</tr>
<tr>
<td>8</td>
<td>ANALOG GND</td>
<td>Power</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>ANALOG GND</td>
<td>Power</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>ANALOG GND</td>
<td>Power</td>
<td></td>
</tr>
</tbody>
</table>

* See Model and Range Chart below:

<table>
<thead>
<tr>
<th>Model</th>
<th>Range (sccm O2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ODS-9001-A</td>
<td>0 - 200</td>
</tr>
<tr>
<td>ODS-9003-A</td>
<td>0 - 600</td>
</tr>
<tr>
<td>ODS-9005-A</td>
<td>0 - 1000</td>
</tr>
<tr>
<td>ODS-9010-A</td>
<td>0 - 2000</td>
</tr>
<tr>
<td>ODS-9025-A</td>
<td>0 - 5000</td>
</tr>
</tbody>
</table>
## Installing the System

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<td>4.2 Mounting and Service Space Requirements</td>
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<td>4.3 Site Preparation</td>
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<td>4.4 Environmental Considerations</td>
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<td>4.5 Exhaust system requirements</td>
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<td>4.6 Receiving the system</td>
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<tr>
<td>4.10 System Interlock Testing</td>
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</table>
4.1 System Dimensions

Front View (Controller mounted above Generator)
Top View, ODS-9000 Series
### 4.2 Mounting and Service Space Requirements

#### 4.2.1 Mounting
The Model ODS-9000 Series ozone generator is designed to be mounted in a standard 19” rack. Due to its weight (32 kg, 70 lbs), support brackets are required. The hole pattern on the front panel accepts ¼-20 or 6 mm hardware.

#### 4.2.2 Service Space Requirements
The components are designed for rack-mounting. A minimum clearances should be allowed for maintenance/service:
- Front clearance: minimum of 24” (60 cm)
- Rear clearance: minimum of 24” (60 cm)
- Side clearance: minimum of 24” (60 cm)

Clearance space can be shared space with other equipment. Refer to the component drawings for dimensions.

### 4.3 Site Preparation

#### 4.3.1 Before the system arrives

1. Use the component drawing as a reference for your space requirements.

2. Verify that all system gas hookups:
   - Nitrogen feeds and shutoff valves
   - Oxygen feeds and shutoff valves

3. Verify all cooling water hookups:
   - cooling water inlet/return connections
   - water flow meter needs to be installed on the cooling water lines
   - Sensor and means of stopping water flow

4. Verify all power hookups:
   - Power outlets (2, one for each component)

5. Verify EMO protection hookup:
   - Install an EMO switch in the facility since the ozone generator system does not contain an EMO shutdown

6. Verify ozone leak and exhaust protection hookups:
   - Ozone leak detectors in system exhaust and in desired protection areas
   - Ozone destructor installed for bypass/exhaust flow
4.4 Environmental Considerations

The components require an environment with the following conditions:

- Components are designed for indoor use only.
- Temperature range: 5 - 35°C
- Relative Humidity: 80%, non-condensing

**CAUTION**
Temperature-sensitive. Do not install within a meter of equipment which generates excessive heat, such as power supplies, transformers, blowers, exhaust ducts, heat ducts and other such equipment.

4.5 Exhaust system requirements

4.5.1 Exhaust contents

In the event of a fitting leak, exhaust contents may contain:

- Nitrogen
- Oxygen
- Ozone

**DANGER**
All components should be mounted/installed in cabinets or racks which provide proper exhaust/venting and airflow for the heat and gases used and generated by the components.

IN USA highly recommends the use our Model IN2000 Ozone Leak Detector system with FFOZ leak detectors as well as our Model CAT-03 Ozone Destruct Unit.

4.6 Receiving the system

4.6.1 Report any shipment damage

1. Make note of any shipment damage. Notify and then file a damage claim with the transportation carrier immediately.

2. Contact IN USA immediately.

4.6.2 Storing Your System

If the system must be stored be sure to store it:

- In the original shipping containers.
- In an area with a nominal ambient temperature of approximately 21°C (70°F).
- In an area with less than 50% non-condensing relative humidity.
4.6.3 Assemble the System

1. Connect the SCI-Turbo L to the generator using:
   - P/N: 300-0168-01 Screw 1/4-20 x 1/2" Long Round Head Philips SS
   - P/N: 110-2006-01 Bar, Adjoining SCI-Turbo L to Generator
   - Plastic Cup Washers on the screws
4.7 Making Water and Gas Connections

1. Connect the cooling water inlet and outlet.

2. Connect the gas inlet and outlet lines:
   Use standard gas connection techniques for the VCR fittings. Perform appropriate leak checking on each line prior to flowing gas.
   - Connect the oxygen supply gas to the appropriate input fittings.
   - Connect the nitrogen supply gas to the appropriate input fittings.

**WARNING**

Ozone Output ports are 1/4” male VCR. Use only Stainless Steel Gasket, Cajon Part Number SS-4-VCR-2-GR-VS. NEVER USE NICKEL PLATED gaskets as they will interact with the ozone and cause corrosion and leakage.

The Model ODS-9000 Series system produces ozone gas that is available at the OZONE OUTLET ports. These are 1/4” female VCR pneumatic connectors, labeled “DIVERT” and “PROCESS”. Depending on the status of the internally mounted EV (electro-pneumatic) valve, the ozone will be directed to either the “DIVERT” or the “PROCESS” port.

- Flow is directed to the “DIVERT” port when there is no pneumatic control signal applied (via the CDA inlet port).
- Flow is directed to the “PROCESS” port when there is a pneumatic control signal (60 PSI typically) at the CDA port.

**IMPORTANT!!:** Gas flow should be piped as indicated by the labels associated to the Ozone Outlet port, located in the rear panel of the generator.

**DANGER**

**IMPORTANT!!:** Ozone gas is toxic. Make sure that appropriate abatement equipment is connected to the DIVERT port, located in the rear panel of the generator.
4.8 Electrical Connections

**DANGER**
Only a qualified electrician should complete these steps.

1. Connect the supplied DB-25 cable from the controller to the generator:
   The DB-25 connects from the Generator A connector on the SCI-Turbo-L to the Remote Interface connector on the generator.

2. Connect the supplied DB-15 cable from the controller to the generator:
   The DB-15 connects from the FFOZ A sensor connector on the Sci-turbo to the FFOZ sensor connector on the generator.

3. Connect both the controller and generator to appropriate input power. Connectors are at the rear of the components. Each component has a separate power inlet.

Operation from 200-240VAC, 1 φ, 50/60 Hz (Single Phase)

The system operates from 200-240 VAC, 1 φ, 50/60 Hz, at 10 Amp, RMS. Use 12 AWG three-conductor cable terminated in a 3-pin circular style jack connector to bring the main VAC in to the unit. The following table illustrates the pin-out of the circular jack connector.

200-240 VAC, 1 φ, 50/60 Hz OPERATION, VAC SUPPLY CONNECTOR PIN-OUT

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>HOT</td>
</tr>
<tr>
<td>B</td>
<td>NEUTRAL</td>
</tr>
<tr>
<td>C</td>
<td>GROUND</td>
</tr>
</tbody>
</table>

Make sure that pin C is connected to Ground. Use IN USA P/N 245-0204-01 (Amphenol p/n 97-3106A-16-10S) More information can be found at: [http://www.ittcannon.com/media/pdf/catalogs/ms_e.pdf](http://www.ittcannon.com/media/pdf/catalogs/ms_e.pdf)

4. Ground Connection:
The Model ODS-9000 Series features a threaded stud, labeled “GROUND” located in the rear panel, intended to allow for the connection, via a cable, between earth ground and the chassis. Use 12 AWG or heavier wire (green and yellow) to connect to earth ground to chassis.

**DANGER**
High voltages that can cause injury or death to operators are present in the Model ODS-9000-Series systems.

**The Model ODS-9000 series systems must be grounded before operation.**

4.9 Install/Verify Operation of Leak Detection Equipment

IN USA highly recommends the use our Model IN2000 Ozone Leak Detector system with FFOZ leak detectors as well as our Model CAT-03 Ozone Destruct Unit.

Install/Verify the operation of all leak detection equipment per the manufacturer’s instructions.
4.10 System Interlock Testing

Prior to normal operation, all system interlocks should be tested to insure safe operation.

IN USA highly recommends the use our Model IN2000 Ozone Leak Detector system with FFOZ leak detectors as well as our Model CAT-03 Ozone Destruct Unit.

4.11 Leak Test the System

To leak test the system, all gas connections must be made. For gas to fully access all regions of the system, the system must be powered up and all interlocks must be satisfied so internal isolation valves are opened. Use standard leak testing procedures, first checking for gross leaks, then finding the source of the leak using He leak test techniques.
## System Startup/Shutdown/Operation

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<td>5.3 Normal Operation (Local Mode)</td>
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<td>5.4 Normal Operation (Remote Mode)</td>
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<td>5.5 Sci-Turbo-L Operation Details</td>
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<tr>
<td>5.6 Emergency System Shutdown</td>
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<tr>
<td>5.7 Normal System Shutdown and Purge</td>
<td>50</td>
</tr>
</tbody>
</table>
5.1 Operation Warnings

**WARNING**
Read this manual carefully before applying power, oxygen, nitrogen or water to the Ozone Delivery System.

**WARNING**
The Ozone Delivery System is shipped with the ozone output ports capped off. Remove these caps before running the system.

**WARNING**
Ozone Output ports are 1/4” male VCR. Use only Stainless Steel Gasket, Cajon Part Number SS-4-VCR-2-GR-VS. NEVER USE NICKEL PLATED gaskets as they will interact with the ozone and cause corrosion and leakage.

**WARNING**
During setup and verification do not apply power to the generator.

**WARNING**
Be sure to connect an ozone destruct to the ozone exhaust port and provide the appropriate connections to the process ports before powering up the tool.
5.2 Initial System Startup

**WARNING**
During this procedure, never over-extend your reach. If necessary, use a sturdy step stool to reach any controls or devices that you cannot comfortably reach.

1. Verify that the system has been properly installed and signed off by your facility safety team.

**DANGER**
Any interlocks must be verified prior to starting the system. All personnel must be properly trained on the function of all system components, system settings, operation, and emergency response procedures.

2. Confirm the following:
   - Power switches for Sci-Turbo L and Generator are in the OFF position.
   - Cooling water is connected to the system.
   - Oxygen supply gas is connected and set the pressure to 50 PSIG.
   - Nitrogen supply gas is connected and set the pressure to 50 PSIG.
   - Process exhaust port is connected to the process input.
   - Diverter exhaust port is connected to a suitable ozone catalyst.
   - Pneumatic control signal connected to the CDS inlet port.
   - Sci-Turbo L connected to the Generator.

3. Turn ON the power switch in the back of the Sci-Turbo L.

4. Using the keypad and controls, set the nitrogen and oxygen MFCs to zero volts.
   
   **NOTE:** The SCI-TURBO L displays the values for each MFCs as follows:

<table>
<thead>
<tr>
<th>MFC</th>
<th>GAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Oxygen for Generator A</td>
</tr>
<tr>
<td>C</td>
<td>Nitrogen for Generator A</td>
</tr>
<tr>
<td>B</td>
<td>Oxygen for Generator B</td>
</tr>
<tr>
<td>D</td>
<td>Nitrogen for Generator B</td>
</tr>
</tbody>
</table>

   Note that the Nitrogen MFC is slaved to its respective Oxygen MFC; when the setpoint of the Oxygen MFC is changed, the setpoint of its corresponding Nitrogen MFC is mirrored. However, if only the Nitrogen MFC setpoint is changed, the Oxygen MFC setpoint value is not mirrored.

5. Turn ON the cooling water supply.

6. Set the oxygen and nitrogen MFC setpoints to zero.
   
   Use the key to move to the MFC Parameter Screen. Use the up key (↑), or a left arrow (←) key to program the desired value.

7. Turn ON the oxygen supply.
   Note: Make sure the oxygen MFC is set to zero prior to opening the oxygen supply valve.

8. Turn ON the nitrogen supply.
   Note: Make sure the nitrogen MFC is set to zero prior to opening the nitrogen supply valve.
9. Set the Oxygen and Nitrogen MFCs to the desired flow rate via Sci Turbo process controller. Recommended Nitrogen flow rate is 0.5% of Oxygen flow rate.

*MFC Setpoint* is a numerical variable. Use the up key (↑), or a left arrow (⇐) key to *program* the desired value. Note that the values of *MFC Setpoint* are in the range of 0 to 5 VDC. 0 VDC maps to no flow and 5VDC maps to the maximum flow associated to the MFC. Please refer to the Table below for flow rates associated for each system.

<table>
<thead>
<tr>
<th>Model</th>
<th>Range (sccm O2)</th>
<th>Model</th>
<th>Range (sccm O2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ODS-9001-A</td>
<td>0 - 200</td>
<td>ODS-9010-A</td>
<td>0 - 2000</td>
</tr>
<tr>
<td>ODS-9003-A</td>
<td>0 - 600</td>
<td>ODS-9025-A</td>
<td>0 - 5000</td>
</tr>
<tr>
<td>ODS-9005-A</td>
<td>0 - 1000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. Let the units purge with the gas and warm up for a few hours. In order to achieve maximum performance and stability, it is strongly recommended to allow an overnight warm up period on initial startup or on a "cold" start. This warm up period should preferably be done while the unit is purging with ozone-free gas (typically oxygen). After this warm up period, the unit can be zeroed as explained below.

   **NOTE:** It is recommended that the sensor be powered on at all times (24 hours/day, 7 days/week). This will ensure peak performance, minimal zero drift, and maximum system life.

11. Zero the gFFOZ sensor via the Sci-Turbo L.

12. Make sure the Local/Remote switch on the ozone generator front panel is set to Local, the ON/OFF-RST to the OFF-RST position, and the potentiometer is turned all the way counter-clockwise.

   - Flip the generator circuit breaker to the ON position.
   - Turn the generator on by flipping the ON/OFF-RST to the ON position.
   - Use the potentiometer to adjust the percent power.
   - At this point, the user should see the ozone concentration reported on the Sci-Turbo L.
5.3 Normal Operation (Local Mode)

1. Verify that water is flowing through the generator.
2. Verify that output gas can flow through to the process port.
3. Turn ON the Nitrogen feed gas and adjust flow using the SCI Turbo controller.
4. Turn ON the Oxygen feed gas and adjust flow using the SCI Turbo controller.
5. With the generator LOCAL/REMOTE switch to the LOCAL position set the ON/OFF/RST switch to ON and adjust the power level potentiometer to the desired power level (turn clockwise (CW)). The Sci Turbo will display the ozone gas concentration flowing into the process.

5.4 Normal Operation (Remote Mode)

1. Make sure Analog Link Mode on Sci Turbo controller is set to ENABLED.
2. Make sure water is flowing through the generator.
3. Make sure output gas can flow through to the process port.
4. Turn ON the Nitrogen feed gas and adjust flow using the SCI Turbo controller.
5. Turn ON the Oxygen feed gas and adjust flow using the SCI Turbo controller.
6. With the generator LOCAL/REMOTE switch to the REMOTE position, turn the generator ON and adjust power level via Sci Turbo controller. The Sci Turbo will display the ozone gas concentration flowing into the process. The Sci Turbo will display the ozone gas concentration flowing into the process.

5.5 Sci-Turbo-L Operation Details

5.5.1 Initial Power-On

To turn the SCI-TURBO Controller on, press the POWER switch on the rear panel. The switch illuminates (red) when the power is ON. The SCI-TURBO powers up and goes through a four-step start-up procedure.

1. The SCI-TURBO displays the Software Revision for approximately 5 seconds. For example:

   SCI_TURBO    SW    V4.84
   PLEASE WAIT

2. The SCI-TURBO displays the ozone sensor type for each of the four channels approximately 5 seconds. TYPE 1 refers to a gFFOZ ozone gas sensor. TYPE 2 refers to a dFFOZ dissolved ozone sensor. If a sensor is not installed for a channel, "NO SEN" is displayed. For example:

   A: TYPE 1  B: TYPE 1
   C: TYPE 2  D: NO SEN
3. The SCI-TURBO displays the warm-up screen. The display shows “w” on the top right, indicating that a warm-up period (approx. 3 minutes) is in progress. During this time the ozone reading will show a series of asterisks if a FFOZ sensor is connected, or a series of dashes if no sensor is connected. For example:

A: *****  B: *****  %WT
C: *****  D: ------  mg/L

4. The “w” indicator disappears, and the SCI-TURBO Controller displays the Ozone Concentration screen. Channels with no sensor connected will show a series of dashes.

5.5.2 Front Panel Buttons

The SCI-TURBO front panel has five keys, a Scroll (iotic) key, an Enter (E) key, a Display (D) key, an up key (⇑), and a left arrow (⇐) key.

The "D" key is used to cycle through the top-level menu. When the last screen is reached, press the "D" key again to return to the first screen.

The "E" key is used to enter a menu, or to return from a menu depending on the menu state. The Enter key is used to proceed with certain options on the Main Menu and to view error messages. Instructions for its use are provided on the screen for the option.

The Enter key is also used to initiate a zeroing operation for the FFOZ ozone sensors connected to the SCI-TURBO. Use the Scroll key to show the Zero Ozone Channel n screen in the display (where n is the number of the ozone channel that you wish to zero). Use the Enter key to initiate the zeroing operation.

The "⇑" key is used to scroll through the lower level menu items.

The "⇐" is used to make changes to an editable menu item.

The "⇐" is used to move character by character through an editable menu item.

5.5.3 Calibration

The controller incorporates a calibration routine for the ozone generator servo control.

This routine will automatically tune Sci Turbo servo control on a given environment. It will gradually increment ozone generator power setpoint and record the ozone concentration, producing a performance vs. power map to optimize the stability and response time of the servo control algorithm.

The response obtained is dependent on the conditions under which the routine is performed. Hence it is strongly recommended this calibration be performed under process-like conditions. Several conditions might impact the ozone generator performance, the most important ones being:

- Oxygen flow rate
- Nitrogen flow rate
- Generator back pressure
- Cooling water flow rate
- Cooling water temperature

Under some conditions the ozone generator output may not be monotonic with power, thus providing maximum ozone generation at power settings different than 100 percent. The servo calibration routine will identify this optimum power setting, or maximum effective setpoint, and limit the closed-loop power delivered to the generator to the maximum effective setpoint.
5.5.4 Performing servo calibration

**WARNING**

OZONE GAS IS PRODUCED DURING THE SERVO CALIBRATION. MAKE SURE OZONE DESTRUCT IS PROPERLY CONNECTED BEFORE PERFORMING THIS CALIBRATION

1. Start the ozone calibration by pressing the ‘E’ key on the servo calibration screen.

   **SERVO CALIBRATION**
   **PRESS E TO START**

2. Verify ozone generator conditions when the reminder screen appears:

   **VERIFY FEED GAS FLOW**
   **PRESS ENTER KEY**

3. Conditions during the servo calibration should match process conditions as closely as possible to optimize the servo algorithm performance. Important conditions to verify include:
   - Oxygen flow rate
   - Nitrogen flow rate
   - Generator back pressure
   - Cooling water flow rate
   - Cooling water temperature

Once these conditions have been verified, press the ‘E’ key to start the calibration routine. This calibration routine will run automatically to determine the generator performance at different power settings and the maximum effective power level. This process may take several minutes to complete.
5.6 Emergency System Shutdown

1. The ozone generator should be installed in a system with an Emergency Machine Off (EMO) button. Press the EMO button to immediately de-energize the system and to stop producing ozone.

2. Follow your facility’s procedures for emergency shutdown notification.

5.7 Normal System Shutdown and Purge

This procedure should be followed to perform a normal system shutdown, for either extended idle periods or to perform system maintenance.

1. Follow your facility’s procedures to notify appropriate personnel that you will perform a system shutdown, and to ensure that you are authorized to re-start the system at this time.

2. Turn the LOCAL/REMOTE switch on the ozone generator to LOCAL.

3. Turn the power level to Zero on the ozone generator (turn the power level potentiometer counterclockwise (CCW) until it stops and the readout is zero. After a few moments, the SCI-TURBO Controller show a decrease in the Ozone concentration.

4. Set the oxygen MFC to zero.

5. Allow gas to continue to flow through the generator for 1 hour to purge/flush any residual ozone from the system. This eliminates ozone from the system. No further decontamination is required.

6. Turn OFF and LOCKOUT/TAGOUT the oxygen supply.

7. Turn OFF and LOCKOUT/TAGOUT the nitrogen supply.

8. Turn OFF the Ozone Generator.

9. Turn OFF and LOCKOUT/TAGOUT the cooling water supply.
## Preventative Maintenance Schedules

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<td>6.2 Monthly Preventative Maintenance</td>
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</tr>
<tr>
<td>6.3 Yearly Preventative Maintenance</td>
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</tr>
</tbody>
</table>
Performance of periodic maintenance requires advanced knowledge, understanding, and training with the Ozone Generator System. NEVER perform a maintenance task unless you are trained and certified to perform the task.

6.1 Solid Waste Disposal

The system requires very little maintenance and produces little waste. In addition to cleanroom wipes which can be used to clean the external surfaces of the control cabinet, you will need to properly dispose of the system’s UV lamps. See “Yearly Preventative Maintenance” on page 53.

No other system components need to be discarded at any time unless they fail. Failure of an Ozone Generator would require repair or replacement. If a destruct unit is provided with the system, disposal should be done according to local laws and regulations, or returned to the factory for proper disposal.

6.2 Monthly Preventative Maintenance

Replacement parts: None.

1. Verify the proper operation of all system interlocks. Refer to the supplied interlock testing procedure.

2. The sensor on each ozone sensor should be checked according to the provided instructions.
6.3 Yearly Preventative Maintenance

Refer to parts list and replacement instructions in each device’s manual.

**WARNING**

**UV RADIATION HAZARD**

Carefully follow bulb replacement and adjustment procedures, as directed by the bulb maintenance instructions. DO NOT look directly at a UV lamp as irreversible, disabling eye damage can occur. Always wear proper eye protection equipment when calibrating UV lamps to prevent accidental exposure.

**DANGER**

**TOXIC HAZARD**

UV lamps contain trace amounts of Mercury. Handle bulbs with extreme care to prevent shattering. Wear appropriate gloves, glasses, and any required safety equipment to prevent exposure to this dangerous element.

6.3.1 MFCs

1. Verify the calibration of the installed Mass Flow Controllers, according to their manufacturer’s recommendations.

6.3.2 gFFOZ Maintenance

The gFFOZ sensor is designed to operate continuously with minimal maintenance requirements. Only the UV lamp will need to be replaced on a periodic basis (every 24-36 months). Lamp replacement does not change calibration and can be done while the sensor is on line and while gas is flowing through it. After lamp replacement, re-zero unit following the after start-up zeroing procedure.

The use of particulate filters on the gas inlet of the monitor is recommended in order to minimize the risk of optical component soiling.

1. Remove covers as required to access the gFFOZ in the ODS-9000 Series Ozone Generator.
2. The UV lamp can be replaced without disconnecting pneumatic lines and without interrupting the flow of gas through the sensor. The lamp is accessed by removing the cover with the two thumb screws as shown on the next page:

**REMINDER: SAFETY FIRST!!** Disconnect power to the sensor (power off) before removing the cover.

3. Once the cover is removed as described above, unplug the lamp and slide it up and out of its housing by loosening the lamp set-screw. To re-install the lamp, follow the aforementioned steps in reverse order.

**NOTE:** Some lamps may have marks indicating preferred rotational position. If so, install the lamp accordingly.
## 7.1 Ozone Generator

### 7.1.1 Status Fault Troubleshooting

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<th>Symptom</th>
<th>Possible Causes</th>
<th>Corrective Action</th>
</tr>
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<tbody>
<tr>
<td>READY LED not lit</td>
<td>Overvoltage LED lit&lt;br&gt;Internal interlock LED lit&lt;br&gt;System fault LED lit</td>
<td>Confirm outlet pressure within specifications&lt;br&gt;Check cooling water flow&lt;br&gt;Check cooling water temperature</td>
</tr>
<tr>
<td>OVERVOLTAGE LED Lit</td>
<td>Cell pressure too low&lt;br&gt;Line voltage high</td>
<td>Confirm outlet pressure within specifications&lt;br&gt;Confirm input line voltage</td>
</tr>
<tr>
<td>INTERNAL INTERLOCK LED Lit</td>
<td>Low cooling water flow&lt;br&gt;No cooling water flow&lt;br&gt;Interlock switch failure</td>
<td>Check cooling water flow&lt;br&gt;Call customer service</td>
</tr>
<tr>
<td>SYSTEM FAULT LED Lit</td>
<td>Inlet water &gt;&gt;20°C&lt;br&gt;Low water flow&lt;br&gt;No water flow&lt;br&gt;Cooling fan failure</td>
<td>Decrease temperature of water to ≤ 20°C&lt;br&gt;Increase water flow&lt;br&gt;Verify water flow input and output&lt;br&gt;Call customer service</td>
</tr>
<tr>
<td>EXTERNAL INTERLOCK LED Lit</td>
<td>Interface cable disconnected&lt;br&gt;Sci-Turbo L is powered off&lt;br&gt;Error messages on Sci-Turbo L&lt;br&gt;Sci-Turbo L failure</td>
<td>Reconnect interface cable to Sci-Turbo L&lt;br&gt;Check power connections, power on Sci-Turbo L&lt;br&gt;Check for errors on Sci-Turbo screen, refer to the Sci-Turbo L troubleshooting guide&lt;br&gt;Call customer service</td>
</tr>
</tbody>
</table>

### 7.1.2 Performance Fault Troubleshooting

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Causes</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low ozone concentration relative to operating specifications</td>
<td>Low Nitrogen flow&lt;br&gt;Gas flow too high&lt;br&gt;Cell pressure too high or too low&lt;br&gt;Cooling Water Temperature too high&lt;br&gt;Gas feed purity problem&lt;br&gt;Status fault&lt;br&gt;Ozone analyzer error&lt;br&gt;Low cooling water flow&lt;br&gt;Ozone generator open to air</td>
<td>Confirm Nitrogen flow rate conforms to specifications.&lt;br&gt;Verify flow-metering device setpoint and calibration&lt;br&gt;Confirm outlet pressure conforms to specifications&lt;br&gt;Decrease temperature of water&lt;br&gt;Purge for nine hours with grade 6 O₂&lt;br&gt;Refer to generator manual&lt;br&gt;Refer to ozone analyzer manual&lt;br&gt;Increase flow of water&lt;br&gt;Check integrity of seals, fittings, lines, and cabinet.&lt;br&gt;Generate ozone for seven hours</td>
</tr>
<tr>
<td>Unstable Concentration</td>
<td>Unstable gas flow&lt;br&gt;Unstable pressure&lt;br&gt;Ozone analyzer error&lt;br&gt;Unstable temperature of cooling water&lt;br&gt;Unstable cooling water flow&lt;br&gt;Unstable power</td>
<td>Verify flow-metering setpoint and calibration&lt;br&gt;Confirm outlet pressure conforms to specifications&lt;br&gt;Refer to ozone analyzer manual&lt;br&gt;Verify water temperature&lt;br&gt;Verify integrity of water system and water flow&lt;br&gt;Verify line voltage within specifications</td>
</tr>
</tbody>
</table>
7.2 SCI-TURBO Controller

7.2.1 Error Messages Summary
Following is a summary of the valid system messages that may appear on the SCI-TURBO Controller display.

<table>
<thead>
<tr>
<th>Message</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>An error condition was detected by the SCI-TURBO.</td>
</tr>
<tr>
<td>*****</td>
<td>FFOZ sensor is warming up.</td>
</tr>
<tr>
<td>-----</td>
<td>FFOZ sensor is not installed.</td>
</tr>
<tr>
<td>WARNING ZERO REQ</td>
<td>FFOZ sensor needs to be re-zeroed.</td>
</tr>
<tr>
<td>WARNING LAMP ERR</td>
<td>FFOZ sensor UV lamp output too low or unstable.</td>
</tr>
<tr>
<td>SENSOR ERROR</td>
<td>FFOZ sensor UV lamp output excessive.</td>
</tr>
<tr>
<td>OZONE OVERRANGE</td>
<td>Ozone concentration exceeds the range of the FFOZ sensor.</td>
</tr>
<tr>
<td>GENERATOR INTERLOCK</td>
<td>ODS interlock tripped</td>
</tr>
<tr>
<td>LOW PRESSURE</td>
<td>Ozone generator pressure too low</td>
</tr>
<tr>
<td>LOW FEED GAS FLOW</td>
<td>Ozone generator feed gas flow too low</td>
</tr>
</tbody>
</table>

7.2.2 System Messages
Following is a detailed explanation of the error messages/codes that are generated by the SCI-TURBO.

7.2.2.1 Warning Zero Required
This error is generated if one of the FFOZ ozone sensors needs to be “zeroed”.

WARNING ZERO REQ
The error may be triggered by, for example, excess light intensity or low light intensity of the FFOZ sensor UV lamp during normal operation.
Refer to Start Up Section for details on zeroing the FFOZ ozone sensor. After the sensor is zeroed, the error message should clear.

7.2.2.2 Warning Lamp Error
This error is generated if the UV lamp of one of the FFOZ ozone sensors needs to be replaced. The error is generated only after a Lamp Check during a zeroing of the sensor

WARNING LAMP ERR
The error may be triggered by, for example:
1. A low UV lamp light intensity during zeroing.
2. An unstable UV lamp reading during zeroing.
If this error is generated, the UV lamp requires service. Refer to the Preventative Maintenance Section for instructions on servicing the UV lamp. After the UV lamp is serviced, the error message should clear.

**7.2.2.3 Sensor Error**
This error is generated if the UV lamp of one of the FFOZ ozone sensors needs to be serviced. The error is generated only after a *Lamp Check* during a zeroing of the sensor.

SENSOR ERROR

The error is triggered by, for example, an excessive UV lamp light intensity during zeroing.

If this error is generated, the UV lamp requires service. This is a more severe condition than the *Warning Lamp Error* message described previously. Refer to the Preventative Maintenance Section for instructions on servicing the UV lamp. After the UV lamp is serviced, the error message should clear.

**7.2.2.4 Ozone Overrange**
This message is generated if the ozone concentration measured by one of the FFOZ sensors exceeds the range of the sensor.

OZONE OVERRANGE

The condition is triggered by, for example, an ozone concentration in excess of the sensor’s capability. The message automatically clears after the ozone concentration returns to normal.

**7.2.2.5 Low Feed Gas Flow**
This error is generated if the Oxygen MFC-B flow value read by Sci Turbo controller is smaller than 1% of full scale value (of the MFC).

**7.2.2.6 Ozone Delivery System**

No Flow through the oxygen flow meter (or MFC).
- Verify the oxygen supply is turned on.
- Verify the oxygen supply pressure is within the range specified in the facility requirements section.
- Verify the nitrogen supply valve for is turned on. Remember this supplies the solenoid assembly that controls the system gas flow into the generator(s). Refer to the pneumatic diagram for more information.
- Verify the nitrogen supply pressure is within the range specified in the facility requirements section.
- Make sure the correct Ozone Process Valve is turned on.
- Make sure Mass Flow Controller setpoint is greater than zero.