

**INSTALLATION
OPERATION & MAINTENACE
MANUAL
OF
OZONE GENERATOR SYSTEM**

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1. INSTRUCTIONS BEFORE INSTALLING OZONATOR

Ozone Generator must be installed, operated, and maintained by qualified and properly trained operators. It is the responsibility of the owner to ensure that operators have been properly trained to operate and maintain Ozone Generator.

Use Proper Power Connections

Use proper wiring and connection methods as stated in this manual and local regulation.

Device Labeling

Do not, under any circumstances, remove any Caution, Warning, or other descriptive labels from the devices. Chemtronics Ozone Generator is a durable piece of equipment, which with proper care will last for many years. Whenever possible precautionary measures have been made to reduce the possibility of a dangerous condition. However, as a result of misuse or improper maintenance, dangerous conditions may present themselves. The areas of potential danger include:

- Ozone
- High Voltage Electricity

Ozone Safety Precautions:-

- Follow national and local regulations and guidelines for handling ozone. Ozone must not be exposed to the following:
 - Open flames
 - Oil and grease
 - Non-compatible grease

Open flames in the presence of ozone can cause a potentially explosive situation.

Under no circumstances should smoking, welding, or any source of ignition (sparking) be allowed in the vicinity of the ozone producing equipment.

Oil and grease in the presence of ozone can rapidly combust. Therefore, the ozone equipment must be kept free of oil and grease. This includes operator and maintenance personnel's clothing in order to reduce the potential for danger.

Ozone Generator Safety:-


Ozone Generators are designed to operate safely. The potentially lethal nature of ozone requires the equipment owner to follow additional safety precautions.


To ensure safety the following precautions should be taken:

- Access to ozone generator should be limited to authorized and trained personnel only.
- Evacuation routes must be clearly marked in the event of an ozone leak.
- Install an electrical disconnect switch on the power feed to the ozone generator. This electrical disconnect switch disconnects the electrical supply to the equipment. This switch should be in an accessible location and installed per local regulations.
- Install ozone detectors to monitor for the presence of ozone. Wire the detectors into the discreet ozone generator shut down input whenever possible.
- Have suitable breathing apparatus available on site. A breathing apparatus must be worn before entering areas with suspected concentrations of ozone.


WARNING: Once the ozone generator has been turned off, the machine still contains ozone gas. Before opening the machine or piping, flush the equipment thoroughly with dry air or oxygen gas until no ozone can be detected.

Electricity

 **WARNING:** Never open the electrical equipment when power is supplied. Always remove power (unplug) before opening electrical equipment.

 **WARNING:** The internal capacitors can hold a dangerous electrical charge for up to five (5) minutes after turning the machine off. Wait at least five (5) minutes after machine is turned off before opening the door. Always disconnect power from the machine before opening the door.

 **WARNING:** **NEVER WORK ON LIVE EQUIPMENT!**
HIGH VOLTAGE CAN CAUSE INJURY AND DEATH.

 **Do not increase the rated current for the particular model as it could damage the ELECTRODE.**

2. INTRODUCTION OF EQUIPMENT

1. Oxygen Concentrator



1. ON /Off Power Switch
2. Circuit Breaker
3. Oxygen Outlet
4. Flow Adjustment Knob

Front panel (Fig. 1.0)



5. Cabinet Air Filter
6. Manufacturers Technical Label
7. Power Cord

Rear panel (Fig. 2.0)

2. Ozone Generator



Front Control Panel with Indicators (Fig.3.0)

Indicators:

- 1 : Stand By
- 2 : Mains ON
- 3 : Inverter On
- 4 : Ozone ON
- 5 : OFF/ON Regulator
- 6 : Fuse Button
- 7 : Current Meter

3. Ozone Recirculation Submersible Pump



Ozone Recirculation Submersible Pump (Fig. 04)

4. Cooling Water Recirculation Pump



Cooling water Recirculation Pump (Fig. 05)

3. TECHNICAL SPECIFICATION

1. Ozone Generator

Ozone Output (Range)	:	100 Gm/hr
Electrode	:	02 SS (Water Cooled)
Ozone Concentration	:	10%
Transformer	:	Ferrite Based Air Cooled
Inverter	:	IGBT Based Resonant Converter
Power Consumption	:	250 Watts
Voltage Input	:	230 Volt
Type Of Feed Gas	:	Dry Oxygen
Feed Gas Requirement	:	10 LPM
Max.Ozone Current	:	2.0 Amp
Operation Ozone Current	:	1.5 Amp
Dimension	:	385mm (L) x 355mm (W) x 965mm (H)

2. Oxygen Concentrator

Oxygen Output	:	0 – 5 LPM
Oxygen Purity	:	5 LPM – 90%
Oxygen Outlet Pressure	:	7 psi
Component	:	Inbuilt air compressor, filter.
Ozone Output (Range)	:	60 Gm/hr
Power Consumption	:	400 Watts
Safety Alarms ON	:	For Power Failure/Process Failure
Sound Level	:	Less than 47 dBA
Dimension	:	340mm (L) x 485mm (W) x 690mm (H)

3. Cooling Water Recirculation Pump

Make	:	Crompton Greaves
Type	:	MINIMARVEL – II
Head	:	6/24 m
DIS	:	2000/400 LPH
Speed	:	2780 RPM
Kw/H P	:	0.37 / 0.50
Power	:	50 Hz, 220 Volts

4. Ozone Recirculation Submersible Pump

Pump Model No.	:	JDS-05A
Pump Sr.No.	:	C/NO.: C 1240-009
Flow Rate	:	110 LPM, flow :(6.6 M3/HR)
Pump Capacity	:	0.5 HP
Discharge	:	2 inch
Motor	:	Single Phase

4.INSTALLATION OF UNIT

1. **STEP 1:** Arrange all the equipments in proper order as shown in the Figure 06



Fig. 06

2. **STEP 2 :** Connect Blue Colour PU Tube to the Oxygen Concentrator as shown in Fig. 07



Fig. 07

3. **STEP 3 :** Connect PU Tube Similarly to another Oxygen Concentrator as shown in fig 08



Fig. 08

4. **STEP 4:** Connect both the PU Tubes (blue colored) with “T” as shown in Fig. 09, 10 & 11

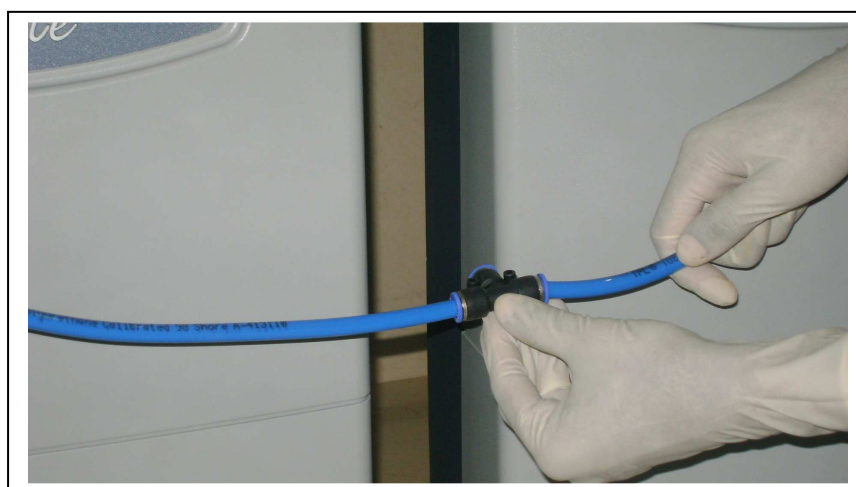


Fig. 09



Fig. 10



Fig. 11

5. STEP 5: Now connect Oxygen Concentration connections with Ozonator as shown in Fig. 12, 13 & 14

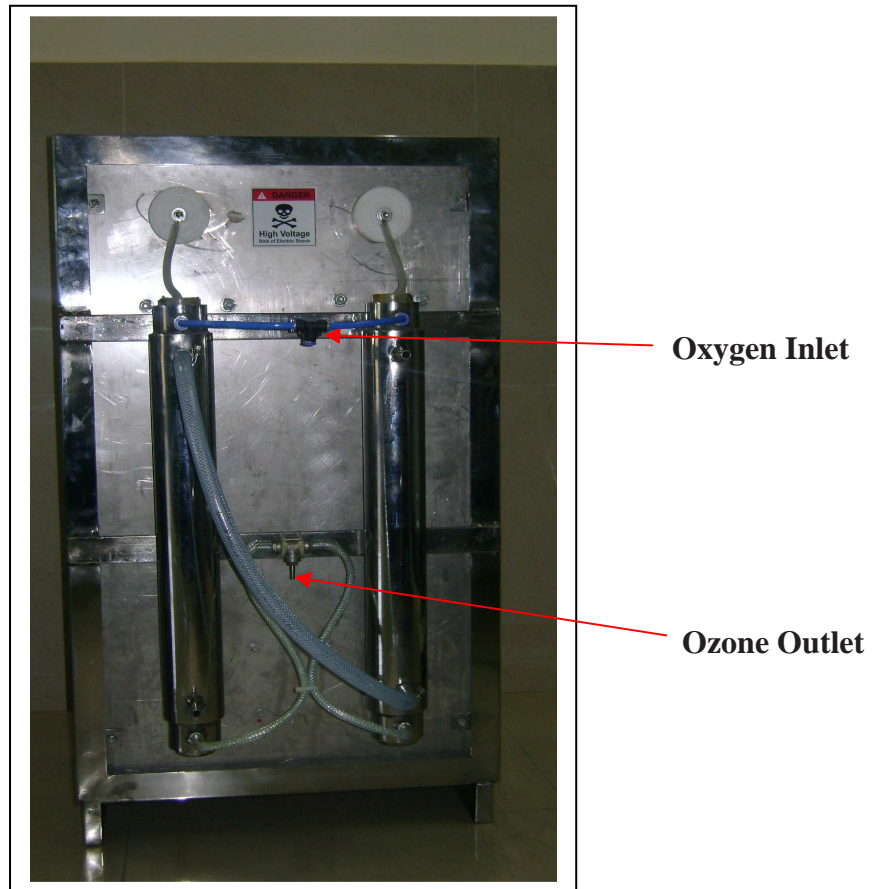


Fig. 12

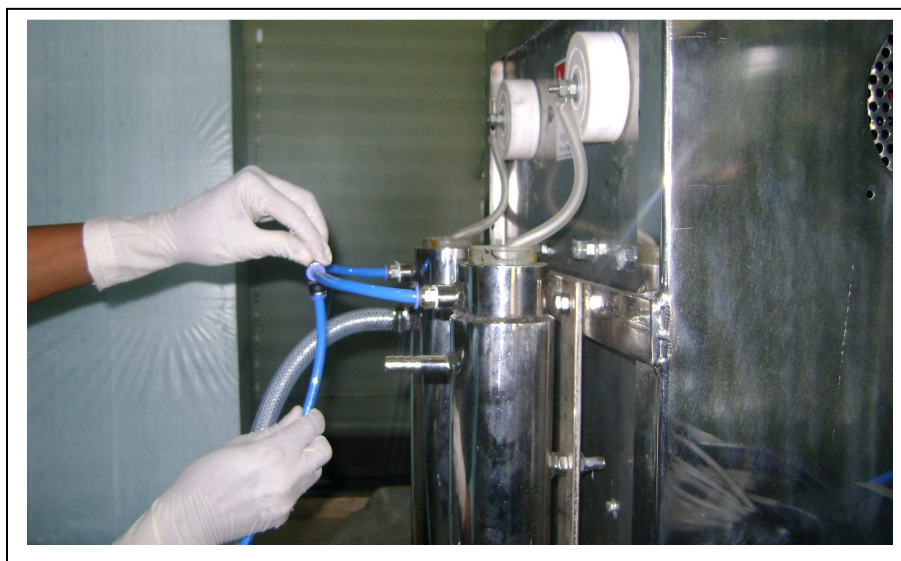


Fig. 13



Fig. 14

6. **STEP 6:** The complete Assembly is ready to Operate as shown in Fig. 15



Fig. 15

OZONE RECIRCULATION SUBMERSIBLE PUMP FITTINGS TO BE DONE AS FOLLOWS:

1) OZONE RECIRCULATION PUMP



FIG.16

2) FIT 2" X 1 1/2" DOUBLE NIPPLE AS SHOWN IN FIG.17



2" X 1 1/2" DOUBLE NIPPLE

FIG.17

3) FIT TEE AS SHOWN IN FIG.18



1 1/2" EQUAL TEE

FIG.18

4)FIT VENTURI AS SHOWN

CHECK FOR RING IDENTIFICATION AT INLET



VENTURI

FIG.19

5)FIT NON RETURN VALVE AS SHOWN IN FIG.20



NON RETURN VALVE

FIG.20

6)COMPLETE ASSEMBLY FOR USE IS AS SHOWN IN FIG.21



ATTACH OZONE OUTLET FROM OZONATOR HERE FROM BREADED PIPE

FIG.21

COOLING WATER PUMP FITTING IS SHOWN BELOW:

1) FIT OUTLET FITTING AS SHOWN BELOW:

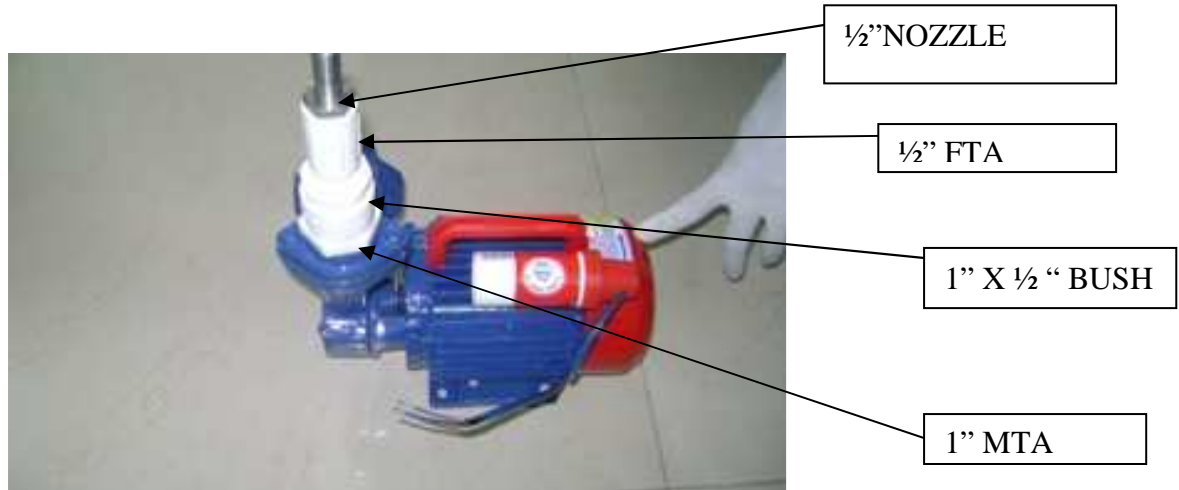


FIG.22

2) CONNECT BREADED PIPE AS SHOWN IN FIG.NO.23



FIG.23

3)CONNECT COOLING WATER INLET TO FIRST OZONATOR



COOLING WATER INLET (1/2" BRADED PIPE)

FIG.24

4)INTERCONNECTING COOLING CONNECTION(1/2" BRADED PIPE) TO BE DONE AS SHOWN BELOW.



COOLING WATER OUTLET FROM FIRST OZONATOR

COOLING WATER OUTLET FROM SECOND OZONATOR TO TREATED WATER TANK

COOLING WATER INLET TO SECOND OZONATOR

FLOW SENSOR

FIG.25

5)FLOW SENSOR

CHECK FOR FLOW ARROW DIRECTION



FIG.26
OZONE OUTLET INTER-CONNECTION(1/4" BRADED PIPE)

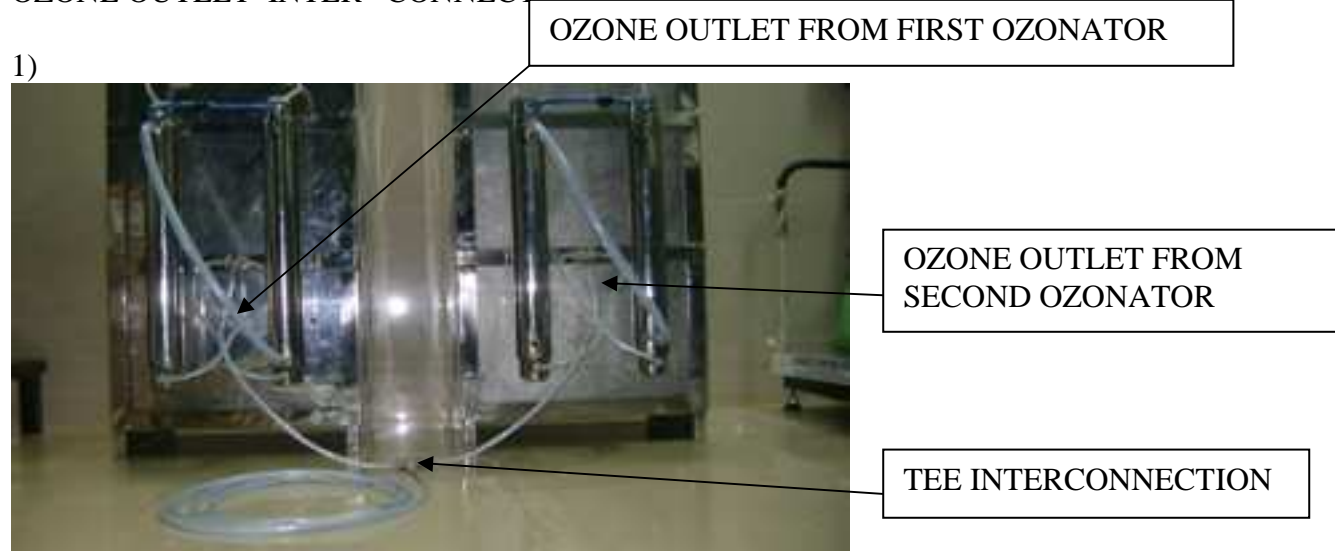


FIG.27
2) TEE CONNECTION

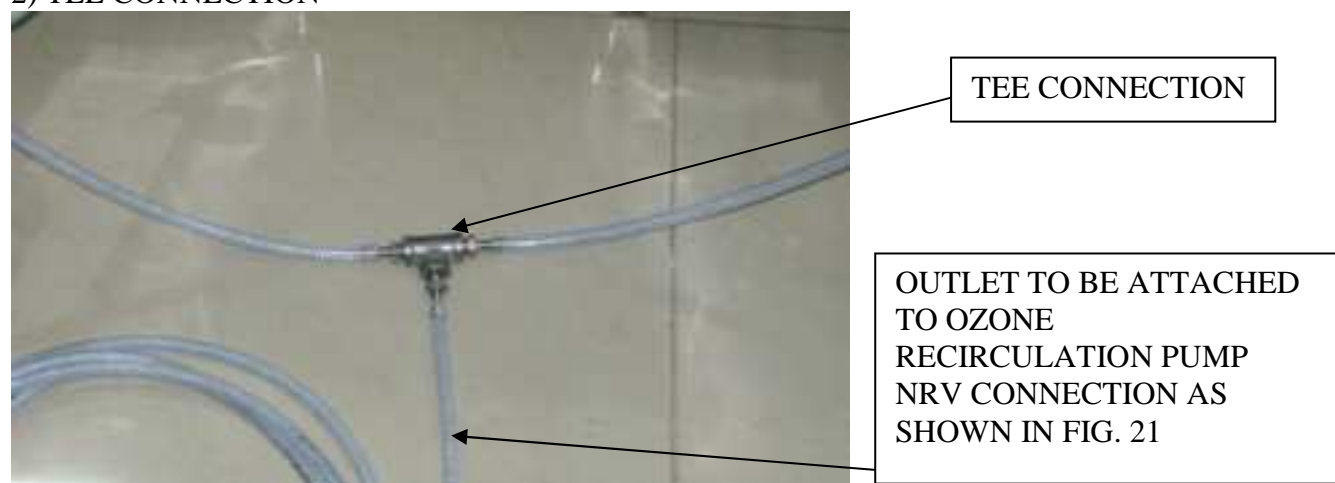


FIG.28

FLOW SENSOR ELECTRIC CONNECTION FOR EACH OZONATOR :

- 1) OPEN OZONATOR FRONT PANEL.



LOOK FOR WIRE JUMPER
CONNECTION(MIDDLE)

FIG.29



REMOVE THIS WIRE JUMPER CONNECTION AND CONNECT
FLOW SENSOR CONNECTION



FIG.30

5. OPERATING PROCEDURE

Oxygen Concentrator – Starting UP

1. Ensure that the switch is in the (OFF) position.
2. Plug the power cable into a power outlet of the correct voltage and frequency as defined on the Manufacturer's technical label
3. Press the power switches **to** the ON positions. The green indicator will light.
4. Oxygen Concentrator ON
5. Adjust the flow of the Oxygen Concentrator to 5 lpm.

Remark: The required oxygen concentration is normally obtained within five minutes after the unit is started. At the end of the treatment, press the **I/O** Switch to place it in the **O** (OFF) position to stop the device. The oxygen enriched air flow continues for approximately one minute after the device is stopped.

Important: Before starting ozone generator start the cooling water, by starting side stream pump

Ozone Generator – Switching ON

1. Connect the main plug in socket.
2. Switch On the plug.
3. Stand By Indicator on the front panel starts glowing up.
4. Keep ON/OFF regulator in ON position.
5. After this Mains ON, Inverter ON and Ozone ON start glowing up.
6. Switch ON Ozone Generator system.

Ozone Generator – Switching OFF

1. Switch OFF the ON/OFF regulator.
2. Keep oxygen flow ON for 1 min and Switch OFF the Oxygen Flow.
3. Let the ozone be flushed out of the system for at least 2 minutes.
4. Turn off the water cooling line.
5. Switch OFF the main cord plug.

The Ozone Generator starts producing Ozone almost instantaneously.

☠ Caution: DO NOT inhale Ozone directly.

- To check if the ozone is being produced, monitor the following three things:
- The Ozone Out indicator lamp. It should be glowing.
- The Ammeter on the front panel should show the specified current.
- The oxygen feed is as per the specification. Read the Rota Meter.



6. TROUBLE SHOOTING

Troubleshooting Of Ozonator System:

If the machine does not start:

1. Check the Mains switch. If it is in OFF position and the Stand By indicator is not glowing, then Mains power is not supplied.
 - a) Check the Mains power line.
 - b) Check the fuse.
 - c) Check main MCB.

2. If the Mains switch is ON and the Inverter ON is not glowing, then the water flow is insufficient.
 - a) Check for any blockages in output pipe.
 - b) Check supply voltage.
 - c) Check water level of treated water tank.
 - d) Check working condition of ozone recirculation pump

3. If the Mains switch is ON and the Inverter ON is glowing but Ozone Out light doesn't glow, then
 - a) Ozone Current is set to zero
 - b) Electrode has failed (due to failure of NRV)
 - c) Check cooling water flow.

4. Machine ON but no ozone odour in water, electrode over heated. & Venturi suction not OK.
 - a) Check cooling water flow.
 - b) Remove ozone pipe and check suction.

7. MAINTAINANCE

It is the joint responsibility of the designer, supplier & installer of ozone generating and handling equipment to conduct the commissioning to determine whether or not the system is working properly. The operation & maintenance manual provided with the equipment outlines the operating procedures and maintenance requirements. All service should be performed and logged to ensure warranty compliance.

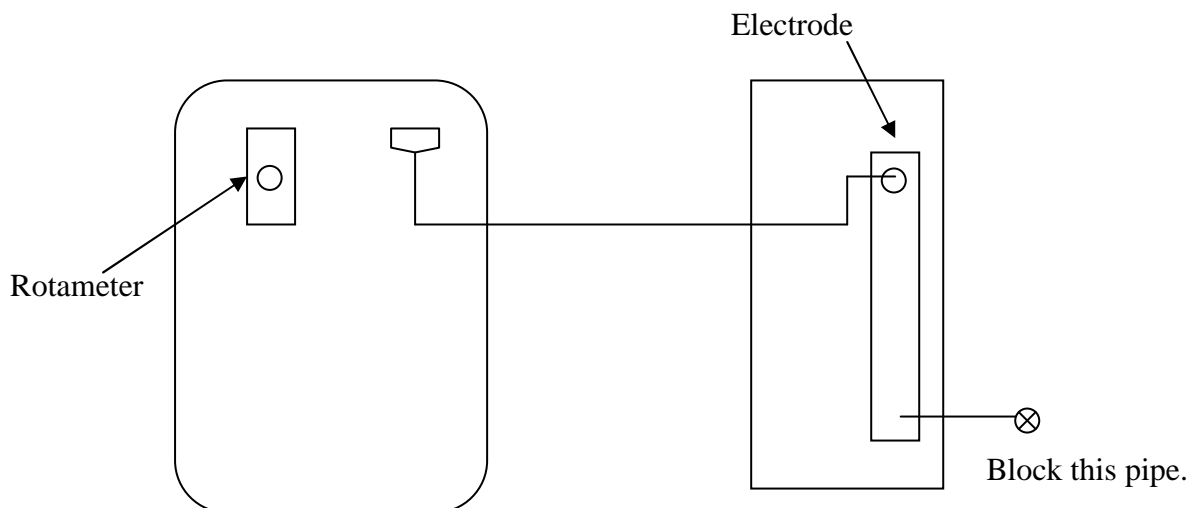
WARNING: Shut power off to the generator at the feed disconnect before performing any service or maintenance inside the cabinet.

Generator

1. Be sure that gas parameter (flow) is within the specified operating limits.
2. Check overall system for gas leaks and repair as necessary.

Checking for System Leakage in oxygen line.

- Disconnect ozone line from electrode.
- Switch off Ozone Generator.
- Keep Oxygen Concentrator ON.
- Block Ozone Output.
- Rotameter on Oxygen concentrator should come down to zero.



8. SAFETY PRECAUTION

Ozone Properties:-

- Molecular Formula – O₃
- Molecular Weight – 48.0
- Production – Corona Discharge.
- Concentration – up to 18% by weight in oxygen/oxygen enriched air
- Boiling Point - -111.9°C
- Melting Point - -192.7°C
- Solubility in water by weight @20°C.
- Vapor Density – 1.6(air-1.0)

- Appearance & Odor-

Ozone is colorless at all concentrations experienced in industry. It has a pungent characteristic odor usually associated with electrical sparks. The odor is generally detectable by the human nose at concentrations of 0.02 and 0.05 ppm.

- Fire/Explosion and Hazard data

Ozone is a powerful oxidizing agent. Oxidation with ozone evolves more heat and usually initiates at a lower temperature than oxidation with oxygen. Ozone reacts with non-saturated organic compounds to produce ozonides, which are unstable and may decompose with explosive violence. Ozone is an unstable gas that, at normal temperatures, decomposes to biatomic oxygen. At elevated temperatures and in the presence of certain catalysts such as hydrogen, iron, copper and chromium, this decomposition may be explosive.

HEALTH HAZARD DATA

Permissible Exposure Limits

- EPA Discharge Limits – 1.0 ppm to Atmosphere.
- OSHA Exposure Limit – 0.1 ppm for 8 hrs & 0.3 ppm for 10 minutes

Toxicology of Ozone

The acute and chronic effects of excessive exposure to ozone have been well investigated. Exposures to concentrations of ozone in excess of several tenths of a ppm sometime cause reports of discomfort in a small susceptible portion of the population. This can be in the form of headaches or dryness of the throat and mucous membranes of the eyes and nose following exposures of short duration. Repeated exposure to ozone at such concentrations at 24-hour intervals, however, caused no further increase in airway irritability. In fact, after the first exposures, additional exposures to ozone had progressively lesser effects suggesting that Tolerance may develop over time. Ozone has been shown to be more injurious at concentrations exceeding 2.0 ppm over several hours, such as experienced by gas shielded arc welders. The primary site of acute effects is the lung which is characterized by pulmonary congestion. This acute impact Subsided in welders when exposures were reduced to less than 0.2 ppm. Based on animal studies, exposures over 10 to 20 ppm or an hour or less are believed to be lethal in humans although there has never been a single recorded fatality attributed to ozone exposure in more than 100 years of commercial use. (Compare this experience with Chlorine gas which has claimed many victims in peacetime as well as during war). With respect to long term or chronic toxicity, ozone is a radiomimetic agent. i.e. the effects of long term exposure to excessive ozone exhibits the same effects as excessive exposure to sunlight. These effects are drying of the dermal surfaces and general ageing of exposed tissues. Ozone is not generally regarded or suspected of being a human carcinogen, neither does it exhibit tertogenic or mutagenic properties.

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

Precautionary measures:-

- In the event of ozone leak a Ventilate the area.
- Immediately switch the ozone generator off.
- Where high levels of ozone are experienced (in excess of 0.1 ppm), all personnel should vacate the affected area until it has been thoroughly ventilated.
- Where ozone levels in excess of 0.3 ppm are present, or when personnel are required to work in restricted spaces or tanks, where ozone may be present, only persons wearing suitable breathing apparatus should be allowed in the area and the appropriate safe working practices for confined areas should be applied.

First Aid Measures:-

- **Eye Exposure** - If ozone gets into the eyes, wash eyes immediately with large amounts of water, lifting the upper and lower eye lids occasionally. Seek medical attention as soon as possible.
- **Breathing** - If a person breathes in large amounts of ozone, move the person into warm-contaminated air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist by administering breathing oxygen. Keep the affected person warm and at rest. Seek medical attention as soon as possible.
- **Rescue** - Move the affected person to safety. If the person has been overcome notify somebody else and put into effect the established emergency procedures. Do not enter the affected area without assistance or against the advice of the recommended safety procedures as they may apply at each facility.

9 RECORD KEEPING

A log sheet/logbook should be used to record the result of ozonator.

Ozone Generator Maintenance Log Book

Specifications	Date						
Oxygen Gas Flow (LPM)							
Electrical Current							
Cooling Water Flow							
Flow Sensor							

First connect the Water Inlet & Outlet tubing (Braded Pipe) on the Ozone Generator.
Properly fix the stainless steel hose clip only over the cooling water line inlet & outlet.
Connect the Oxygen inlet using PU Tube.
Connect the ozone outlet tubing (Braded Pipe).

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