

# **VMUS-10 Ozone Generator**



## **Installation and Operation Manual**

## **Cautions, Warnings and Hazards**

Refer to the manual of the ozone generating system first, to assure proper location of all ozone equipment.

Ozone is a powerful oxidizing agent. Observe strict operating procedures when using ozone equipment.

Ensure that the ozone generator is in a well-ventilated area. Do not allow rain or condensation to contact the ozone generator. The ozone generator must be operated indoors or in an enclosure non-condensing environment.

*Note: If the operator has asthma, he/she must not enter an ozonated airspace. Ozone can induce an asthma attack.*

Carefully review and familiarize yourself with the following important safety information statements concerning the use of ozone with the VMUS Generator.

**WARNING** Ozone is an extremely aggressive and powerful oxidizer. The Occupational Safety and Health Administration (OSHA) 8-hour exposure limit is 0.10-PPM. The OSHA 15-minute exposure limit for ozone is 0.3 PPM. Above 0.3 PPM, there is the risk of damage to respiratory tissues.

**WARNING** People who have no sense of smell should not operate this equipment.

**WARNING** **Never** attempt to verify ozone production by directly breathing or smelling the ozone outlet or an ozone-tubing outlet.

**WARNING** The VMUS uses ozone compatible tubing to plumb high concentration ozone gas under pressure in some places. These tubes under high pressures pose a possibility of leaks to occur. In the event water does leak from the VMUS Generator, shut all equipment off and repair immediately to prevent electric shock.

**WARNING** Make sure all tubing connections between the ozone generator and the injection point are secure and in good working condition. Failure to do so could result in the discharge of undesired ozone into an occupied space.

## **Introduction**

The VMUS-10 Ozone Generator produces ozone from oxygen using corona discharge technology. A stainless steel corona cell with a quartz dielectric is used for ozone production and is the heart of the ozone generator. The corona (spark) inside the ozone generator passes through a quartz glass dielectric barrier between the anode and cathode in the corona cell.

Oxygen or dry air can be used for operation of this ozone generator as a feed-gas.

## **Installation**

*Notes: Ensure the VMUS-10 is mounted in a clean, dry location. The VMUS-10 ozone generator is not rated for wash-down, or outdoor environments. Also, as the VMUS-10 is air cooled ensure ambient temperatures do not rise above 95-deg F.*

### **Mounting**

Choose a well ventilated area for ozone generation installation.

Mount the VMUS-10 ozone generator on a suitable wall using the slotted holes located on the back of the enclosure.

Install screws onto the wall, or onto a designer-frame and hook up the ozone generator. Allow for easy access to the bottom for connecting the tubing, and to the sides to flow cooling air from the right to the left through the ozone generator.

If wall mounting is not available, it is acceptable to operate the VMUS-10 in a horizontal location as a bench-mount unit.

### **Plumbing Connections**

The VMUS-10 is equipped with 1/8" Female NPT connections on the bottom of the unit for both feed gas IN, and ozone OUT. Supplied with the VMUS-10 are Kynar barbed fittings that will thread into this connections and adapt to 1/4" barbed connections.

**Oxygen Inlet:** connect oxygen inlet via oxygen compatible tubing. Flexible tubing such as polyethylene or Teflon tubing can be used with the 1/4" barbed fitting. Use 1/4" ID tubing to create this connection.

**Oxygen Outlet:** connect ozone outlet via Teflon tubing using the 1/4" barbed fitting. Use 1/4" ID x 3/8" OD Teflon tubing to create this connection. Stainless steel tubing can also be used with the 1/8" Female NPT connection.

**Back-flow Prevention:** A suitable back-flow prevention device will be required on the ozone outlet side when ozone is to be used in water. This will ensure water will not back-up into the ozone generator during an upset condition. Simple check-valves are not usually sufficient as these will fail over time. Either a back-flow preventer using a drain or a balance barometer should be used.

### **Electrical Connections**

A 120 VAC power cord is supplied with the VMUS-10 ozone generator. Power the VMUS-10 with any standard 120 VAC electrical connection.

## **VMUS-10 Ozone Generator Operation**

### **Operation on Oxygen feed-gas**

Ensure oxygen flow is present and pure prior to turning ON the ozone generator.

Under normal operation turn ozone generator OFF and purge oxygen through the ozone generator for at least 5 seconds prior to ceasing oxygen flow to properly purge the ozone generator.

When oxygen feed-gas is used for ozone production from the VMUS-10 follow the guidelines listed below.

- Maximum oxygen pressure = 10 PSI
- Maximum operating pressure = -5 PSI
- Maximum oxygen flow = 10 LPM
- Minimum oxygen flow = 0 LPM

Ensure oxygen flow is present and pure prior to turning ON the ozone generator.

Under normal operation turn ozone generator OFF and purge oxygen through the ozone generator for at least 5 seconds prior to ceasing oxygen flow to properly purge the ozone generator.

Ozone production on oxygen is shown on the chart on the following page.

# VMUS-10 Performance on Oxygen feed-gas

## OZONE GENERATOR PERFORMANCE TEST

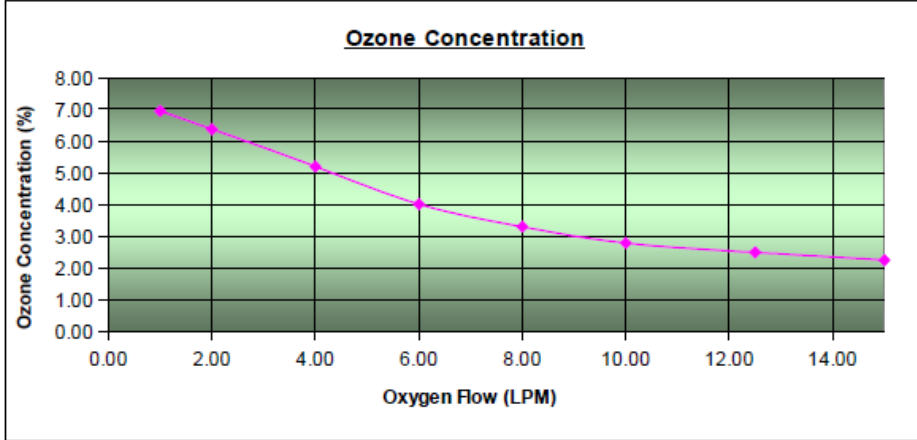
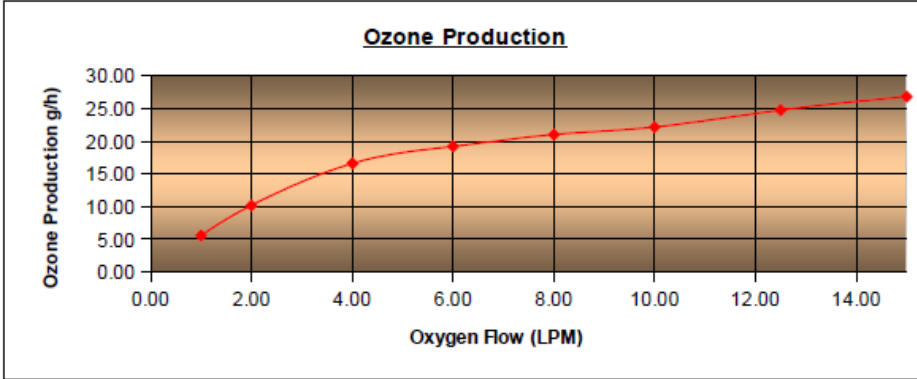
Model: VMUS-10

Feed Gas: Oxygen

Rated Ozone Production = 20 g/hr @ 7 LPM oxygen flow

Max Ozone Production = 26.8 g/hr

Max Ozone Concentration = 6.95% @ 1.0 LPM



OXYGEN FLOW (SLPM) 90-92%	GAS PRESS. (psig)	OZONE CONC. (g/Nm³)	OZONE PRODUCTION (g/h)	OZONE CONC. (%W-W)	COMMENT
1.00	5.00	101.60	5.55	6.95	
2.00	5.00	93.00	10.18	6.37	
4.00	5.00	75.50	16.59	5.19	
6.00	5.00	58.00	19.19	4.00	
8.00	5.00	47.50	21.01	3.29	
10.00	5.00	40.00	22.15	2.77	
12.50	5.00	35.70	24.74	2.48	
15.00	5.00	32.20	26.80	2.24	

Ozone Analyzer BMT 963 O2 Flow Meter Aalborg 171, Accuracy +/-5%

## **Operation on Dry Air feed-gas**

Ensure oxygen flow is present and pure prior to turning ON the ozone generator.

A suitable air dryer must be used to provide dry air dried to -40 deg F or better.

Under normal operation turn ozone generator OFF and purge air through the ozone generator for at least 5 seconds prior to ceasing airn flow to properly purge the ozone generator.

When Dry Air feed-gas is used for ozone production from the VMUS-10 follow the guidelines listed below.

- Maximum oxygen pressure = 10 PSI
- Maximum operating pressure = -5 PSI
- Maximum Dry Air flow = 20 LPM
- Minimum Dry Air flow = 0 LPM

Ensure oxygen flow is present and pure prior to turning ON the ozone generator.

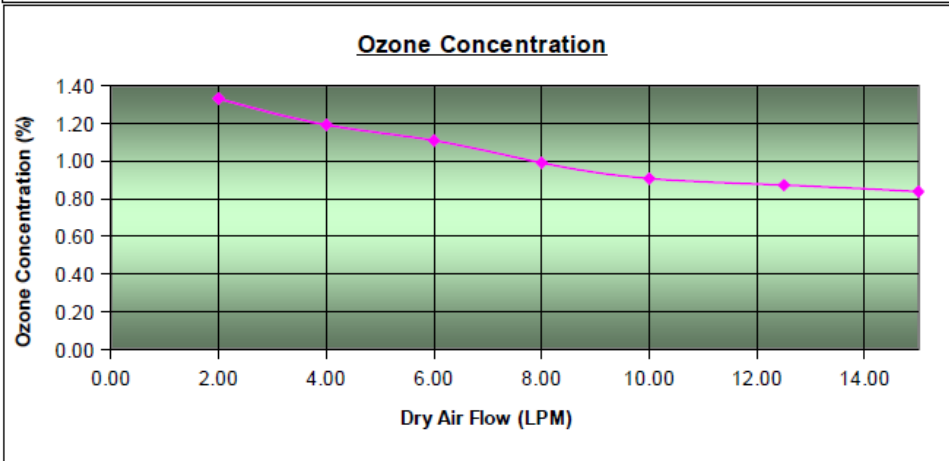
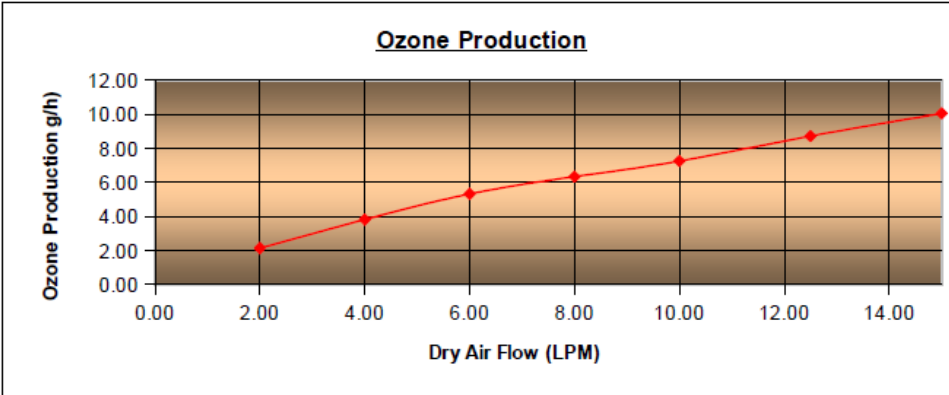
Under normal operation turn ozone generator OFF and purge oxygen through the ozone generator for at least 5 seconds prior to ceasing Dry Air flow to properly purge the ozone generator.

**Ozone production on Dry Air is shown on the chart on the following page.**

# VMUS-10 Performance on Dry Air feed-gas

## OZONE GENERATOR PERFORMANCE TEST

**Model: VMUS-10**  
**Feed Gas: Dry Air**  
**Rated Ozone Production = 10 g/hr @ 10 LPM dry air flow**  
**Max Ozone Production = 10 g/hr**  
**Max Ozone Concentration = 1.33% @ 2.0 LPM**



Dry Air FLOW (SLPM) 90-92%	GAS PRESS. (psig)	OZONE CONC. (g/Nm³)	OZONE PRODUCTION (g/h)	OZONE CONC. (%W-W)	COMMENT
2.00	5.00	19.10	2.13	1.33	
4.00	5.00	17.10	3.81	1.19	
6.00	5.00	15.90	5.31	1.11	
8.00	5.00	14.20	6.33	0.99	
10.00	5.00	13.00	7.25	0.91	
12.50	5.00	12.50	8.71	0.87	
15.00	5.00	12.00	10.03	0.84	

Ozone Analyzer BMT 963 O2 Flow Meter Aalborg 171, Accuracy +/-5%



## **Operation with internal air pump**

The VMUS-10 can be equipped with an internal air pump to supply air flow through the ozone generator.

Ensure a vacuum driven air dryer is used on the inlet of the ozone generator to prevent damage to the corona cell due to moisture build-up.

The ozone generator corona cell and air pump will start simultaneously. Ensure the ozone outlet is plumbed to a safe location prior to turning ON the ozone generator.

If the ozone generator will be bubbling ozone into water, ensure adequate back-flow prevention devices are used to prevent the back-flow of water into the corona cell of the ozone generator.

## VMUS-10 Maintenance

The VMUS-10 has no consumables or replaceable parts inside. Provided no moisture, dust or other contamination enters the ozone generation cell there will be no maintenance required to the ozone generator.

In the event the ozone generator corona cell is contaminated the ozone generator will cease to produce ozone. It will be necessary to call for service by a qualified technician at this time.

### **Monthly:**

Check tubing for leaks, cracks or other degradation. Replace all suspect tubing

Check oxygen purity, or air dew-point to ensure quality feed-gas is used at all times

Check water level in balance barometer (if applicable)

### **Every 6-months:**

Replace check valves on ozone outlet.

### **Annually:**

Disconnect the ozone generator from power and check for excessive dust inside. With long hair brush and vacuum cleaner gently sweep all dust away.

## VMUS-10 Troubleshooting

**Fuse 1:** The lamp indicates a need for service (Main Fuse is blown).

**Fuse 2:** The lamp is lit with short interruptions after ~ 20 seconds, indicating a problem in the HV circuits. Ozone is not being produced.

The most likely reasons are:

- Water is inside the ozone electrodes
- Dirt or moisture is accumulated over a long period of operation around the HV circuits causing HV discharges.
- The pressure or vacuum inside the ozone-generating cell are extremely high. This may only be possible if the Balance Barometer BBL is not installed
- The HV coil may have failed.

Except for the last item the digital fuse will recover once proper conditions for operation are established.

- Fuse 2: The lamp flashes – Voltage in the power line is greater than 132V

The digital controls will restore the operation once proper operating line-voltage is restored.

## **How to Contact Oxidation technologies**

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