

VMUS-4 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 Ozone 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 Ozone Generator 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 Ozone 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.

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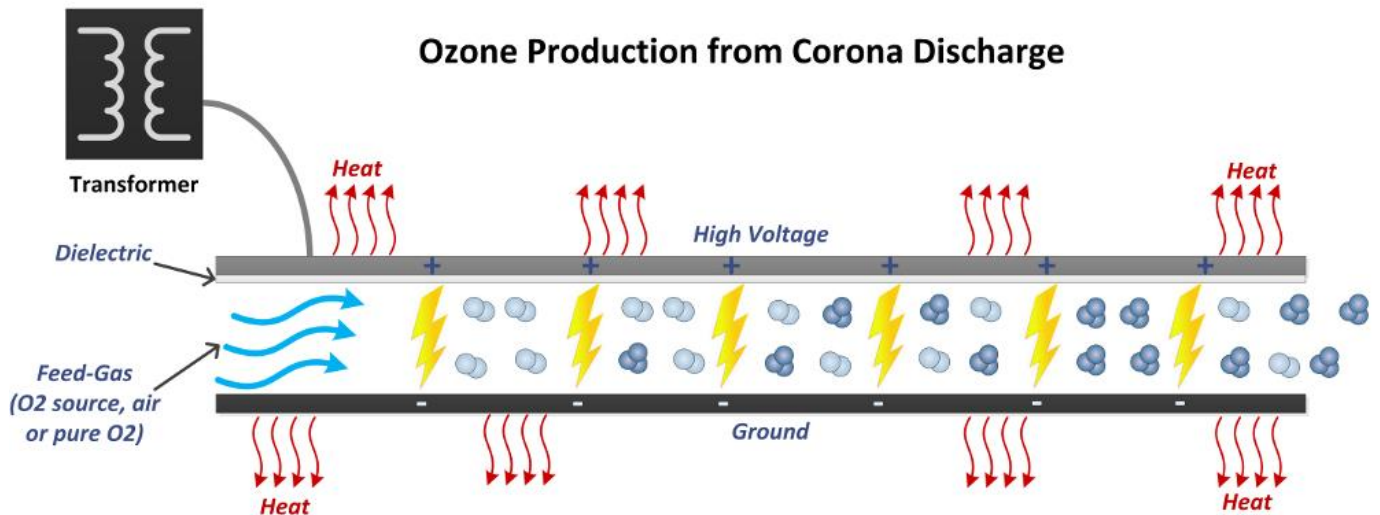
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Introduction

The VMUS-4 Ozone Generator produces ozone from air or oxygen using corona discharge technology. A stainless steel corona cell with quartz dielectric is used for ozone production and is the heart of the ozone generator. The corona (spark) inside the ozone generator passes through the quartz dielectric barrier to create a consistent corona throughout the ozone generator cell. This will efficiently split the oxygen molecule to produce ozone from oxygen.

The VMUS-4 is an air cooled ozone generator. Through the process of creating the corona inside the ozone generator corona cell heat is created. This heat is removed from the corona cell via cooling fins and a fan that blows air across the corona cell.

Oxygen or dry air can be used for ozone production. Expect about a 50 – 60% reduction in ozone output when using air for ozone production vs oxygen.



Ozone is formed via an electrical discharge that is diffused over an area using a dielectric to create a corona discharge. Oxygen passed through this corona discharge is converted to ozone.

Installation

Notes: Ensure the VMUS-4 is mounted in a clean, dry location. The VMUS-4 ozone generator is not rated for wash-down, or outdoor environments. Also, as the VMUS-4 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-4 ozone generator on a suitable wall using the slotted holes located on the back of the enclosure.

If wall mounting is not available, it is acceptable to operate the VMUS-4 in a horizontal location as a bench-mount unit. The visual flow meter will not be operational when using the VMUS-4 in a horizontal configuration.

Plumbing Connections

The VMUS-4 is equipped with 1/4" Female NPT connections on the bottom of the unit for both feed gas IN, and ozone OUT. Supplied with the VMUS-4 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 or dry air can be used as a feed-gas for this ozone generator)

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.

Electrical Connections

A 120 VAC power cord is supplied with the VMUS-4 ozone generator. Power the VMUS-4 with any standard 120 or 220 VAC electrical connection. The VMUS-4 is rated for 120 or 220 VAC power at 50 or 60 Hz, all power switching is performed internally and no external switch or input is required to switch between 120 or 220 VAC power, or 50 and 60 Hz.

VMUS-4 Component Diagram

VMUS-4 Components

Component Descriptions:

1. Feed-Gas Flow Meter
2. O3 Status Indicator
3. No Flow Light
4. Ozone Output power adjust UP button
5. Ozone Output LED indicators
6. Ozone Output power adjust DOWN button
7. ON/OFF push-button
8. Cooling fan inlets
9. Feed-gas Inlet
10. Ozone Outlet
11. 120/240 VAC power receptacle



VMUS-4 Ozone Generator Operation

ON/OFF Switch

The VMUS-4 is turned ON or OFF via the push-button ON/OFF switch. Simply press the ON/OFF switch to turn the ozone generator ON to produce ozone.

The VMUS-4 can be left permanently in the ON position and allow the flow switch start and stop ozone production based on oxygen or air flow through the unit.

Flow Switch (No Flow Light)

The VMUS-4 uses an internal flow switch to indicate flow of feed-gas (air or oxygen) through the unit. When flow rises above about 2 LPM the ozone generator will automatically start producing ozone and the No Flow light will turn OFF. When feed-gas flow drops below about 1.5 LPM the ozone generator will automatically turn OFF and the No Flow light will turn ON.

Cooling fans will operate for a short period of time after the No Flow light turns ON and the ozone generator ceases ozone production. This is to ensure the corona cell and electronics are properly cooled prior to complete shut-down. This delay is a normal part of the ozone generation operation.

O3 Status Light

When the VMUS-4 is producing ozone the O3 Status light will be illuminated to indicate ozone production

Power Setting Switch

The VMUS-4 can alternate power output to the corona cell, and therefore ozone output via 10-position power setting switch. This is the push-button switch with a vertical LED indicator bar on the control panel.

Press the UP arrow to increase ozone output, press the DOWN arrow to decrease ozone output.

Power setting is shown any time the ozone generator is powered up. Power setting can also be adjusted any time the ozone generator is powered up. The ozone generator can be in a No Flow condition when the power setting is adjusted.

The power setting will adjust ozone output in 10% increments from 0 – 100%.

Flow Meter

A visual flowmeter is included on the top of the VMUS-4 control panel. This indicates oxygen or air flow in LPM. Using the performance chart shown on page 10 and 12 actual ozone production can be determined.

Operation on Dry Air Feed-gas

The VMUS-4 can be operated in with a **vacuum driven air dryer** available from Oxidation Technologies. This will allow a venturi to pull ozone directly from the ozone generator and air dryer under a vacuum.

When Dry Air feed-gas is used for ozone production from the VMUS-4 follow the guidelines listed below.

- Maximum operational vacuum = -5 PSI
- Maximum dry air flow = 10 LPM
- Minimum dry air flow = 0 LPM

The air dryer must be under power 24 hrs./day. If power is interrupted, and restored only after 2-20 minutes, there is about 20% chance that steam may enter the air supply line.

Back-flow prevention devices must be in place between the ozone generator and ozone venturi. We suggest the use of a Balance Barometer and check valve to ensure reliable and safe operation.

The ozone generator can be left in the ON position at all times along with the air dryer. At any time air flows through the ozone generator the ozone generator is ready for operation at all times.

Dry air from a compressed air source can also be used when required. Follow the same requirements and operational criteria as the oxygen operation section below.

OZONE GENERATOR PERFORMANCE TEST

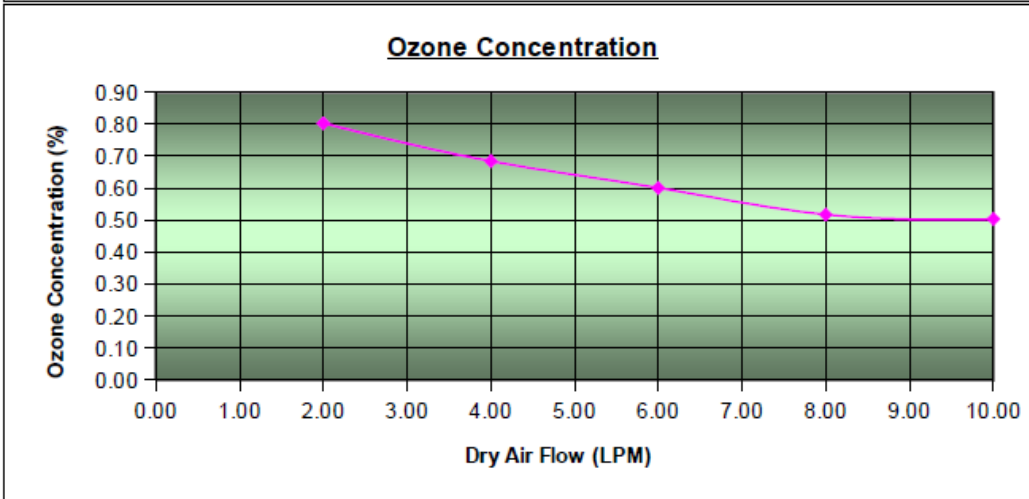
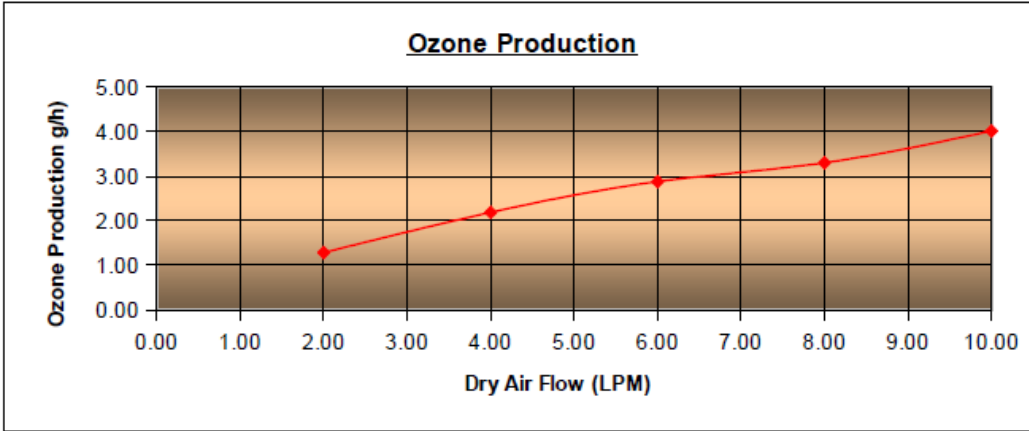
Model: VMUS-4

Feed Gas: Dry Air

Rated Ozone Production = 4 g/hr from 10 LPM dry air

Max Ozone Production = 4 g/hr

Max Ozone Concentration = 0.8% @ 0.8 LPM



Dry Air Flow (SLPM) 90-92%	GAS PRESS. (psig)	OZONE CONC. (g/Nm ³)	OZONE PRODUCTION (g/h)	OZONE CONC. (%W-W)	COMMENT
2.00	5.00	11.50	1.28	0.80	
4.00	5.00	9.80	2.19	0.68	
6.00	5.00	8.60	2.88	0.60	
8.00	5.00	7.40	3.30	0.52	
10.00	5.00	7.20	4.02	0.50	

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

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.

Operation on Oxygen Feed-gas

When oxygen feed-gas is used for ozone production from the VMUS-4 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 next page.

OZONE GENERATOR PERFORMANCE TEST

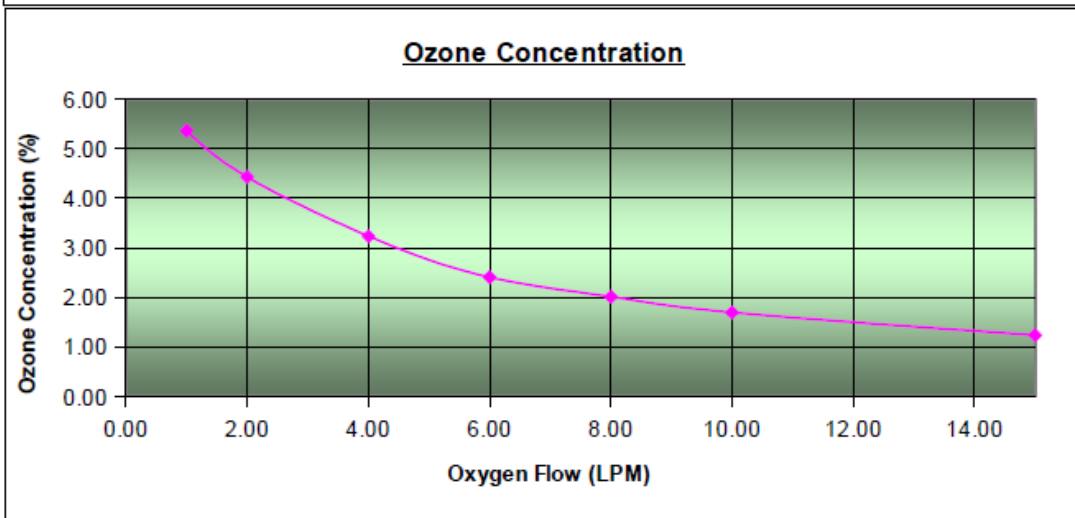
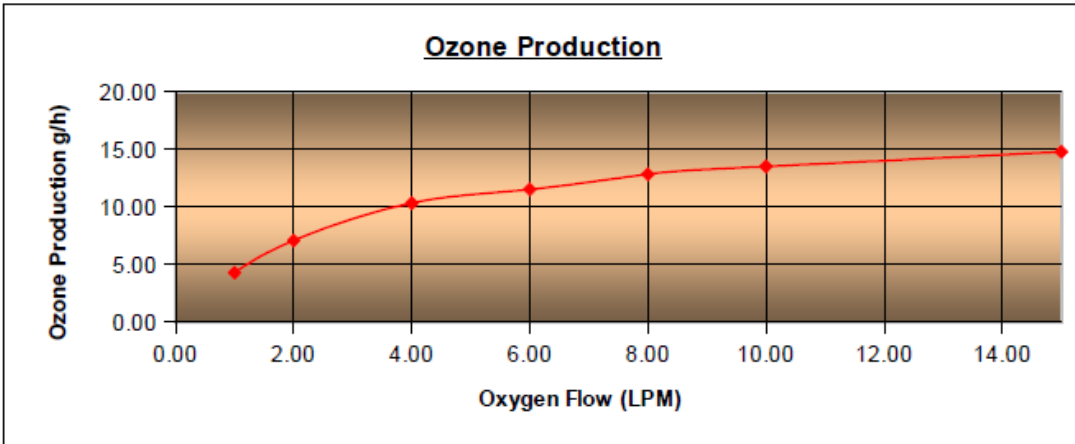
Model: VMUS-4

Feed Gas: Oxygen

Rated Ozone Production = 10 g/hr @ 4 LPM dry oxygen

Max Ozone Production = 14.7 g/hr

Max Ozone Concentration = 5.3 % @ 1.0 LPM



Oxygen Flow (SLPM) 90-92%	GAS PRESS. (psig)	OZONE CONC. (g/Nm ³)	OZONE PRODUCTION (g/h)	OZONE CONC. (%W-W)	COMMENT
1.00	5.00	78.00	4.28	5.36	
2.00	5.00	64.20	7.07	4.43	
4.00	5.00	46.70	10.33	3.23	
6.00	5.00	34.60	11.51	2.40	
8.00	5.00	28.90	12.84	2.01	
10.00	5.00	24.30	13.51	1.69	
15.00	5.00	17.70	14.78	1.23	

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

Operation with internal air pump

The VMUS-4 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-4 Maintenance

Warning! Do not attempt to enter the unit. THERE IS DANGEROUS HIGH VOLTAGE INSIDE. Only trained and qualified personnel are allowed to repair the equipment.

The VMUS-4 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.

How to Contact Oxidation Technologies

By mail: Oxidation Technologies, LLC
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Inwood, IA 51240

By telephone: (515) 635-5854

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