



TG-40 Installation and Operation Manual

High Output Ozone Generator



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Safety Precautions

Ozone is a powerful oxidizing agent. Observe strict operating procedures while using ozone equipment. **It is imperative that only ozone compatible materials are used in conjunction with the ozone system.**

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 is not weather proof. The unit must be operator indoors or in an enclosure in a non-condensing environment.

Note: If the operator has asthma, he or she must not enter an airspace that has a significant ozone concentration. Ozone can induce an asthma attack.

Carefully review and familiarize yourself with the following important safety information concerning the Ozone Generator:

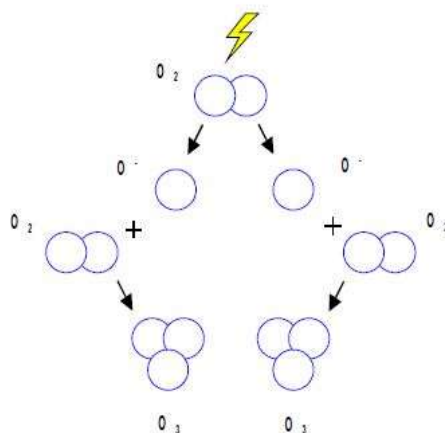
1. Ozone is an extremely aggressive and powerful oxidizer. The Occupational Safety and Health Administration (OSHA) 8-hour exposure limit is 0.10-PPM. The OSHA 15-minute exposure limit for ozone is 0.3 PPM. Above 0.3 PPM, there is the risk of damage to respiratory tissues.
2. People who have no sense of smell should not operate this equipment.
3. Never attempt to verify ozone production by directly breathing or smelling the ozone outlet or the ozone-tubing outlet.
4. The Ozone Generator contains high voltages. Unauthorized entry can result in serious injury or death. For service instructions, contact Ozone Solutions.
5. 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 ozone into an undesired space.



Introduction

The TG-40 Ozone Generator produces ozone from oxygen via corona discharge. The TG-40 is capable of generating 40 g/hr of ozone with a feed gas of 90% oxygen at 10 LPM, and 60 g/hr of ozone with a feed gas of 90% oxygen at 20 LPM. Ozone has many uses including pathogen inactivation and destruction of odorous gases.

Ozone Generation from Corona Discharge



Theory of Operation

The TG-40 Ozone Generator produces ozone via corona discharge. This process uses an electrical spark to split the molecular bond of natural diatomic oxygen to form the atomic O⁻ form of oxygen. These O⁻ atoms then bond to other O₂ molecules to form O₃ (ozone).

The spark inside the TG-40 is a controlled corona. This spark, an intense corona, is produced by forcing a high voltage source through a dielectric and a small air gap. These actions take place in a chamber called the corona cell. The spark occurs at a higher-than-line voltage and much higher-than-line frequencies. These changes in voltage and frequency are accomplished with the circuit board and transformer inside the TG-40. The oxygen feed is forced through the small air gap along the dielectric and intense corona. This process splits the oxygen molecule and generates ozone.

The basic fundamentals of flow and velocity of gas through the corona cell allow for more ozone production (g/hr) as oxygen flow increases. As the flow increases, the concentration of ozone (% by weight) decreases. Conversely, as the flow decreases, the concentration of ozone increases. At very low oxygen flow rates, the oxygen remains in the corona cell for a longer period of time. The contact time allows for higher percentage of oxygen to be converted into ozone. The proper ozone production and

concentration for the necessary application can be determined and achieved using the TG-40 performance charts included in this manual.

While flow and pressure of the oxygen feed gas affect the ozone output the most, the pressure of the feed gas into the corona cell also has an effect on the production of ozone. With higher pressures of oxygen, there is more oxygen in a given space. This increased concentration allows for more molecular O_2 to be present in the corona cell and to be converted into O_3 . The increased concentration also increases the contact time given the gas flow remains constant. The effect on the ozone generation process allows for the production of ozone to increase with higher pressures. Also, with higher pressures, the TG-40 will consume more electrical power as it takes more energy to create a spark in an environment with a high concentration of oxygen. The TG-40 automatically compensates for the varying pressures and maximizes the ozone output for every pressure level. There is a point where pressures will begin to have a negative effect on ozone production. Higher pressures will increase the reaction rate of ozone, causing the decomposition of ozone back into molecular oxygen in less time than at ambient pressures.

The TG-40 is an air-cooled Ozone Generator. The corona cell does create a substantial amount of heat that must be removed. This heat is created by the high voltage and high frequency corona that is contained inside the TG-40. The heat is removed by two 100 CFM fans on the front of the Ozone Generator.

Specifications

Ozone output

20 g/hr ozone – 4 LPM oxygen

30 g/hr ozone – 6 LPM oxygen

40 g/hr ozone – 10 LPM oxygen

These are estimates; see your specific performance chart for more information.

Feed gas requirements

Oxygen must be dried to a minimum of $-70\text{ }^\circ\text{F}$ dewpoint. No minimum airflow required. Airflow must not exceed maximum of 20 L/min (40 SCFH).

Maximum cell pressure

Pressure on the corona cells must not exceed a maximum of 100 PSI.

Electrical Input

120 VAC, single phase, 60 Hz, 5 Amps, 500 Watts

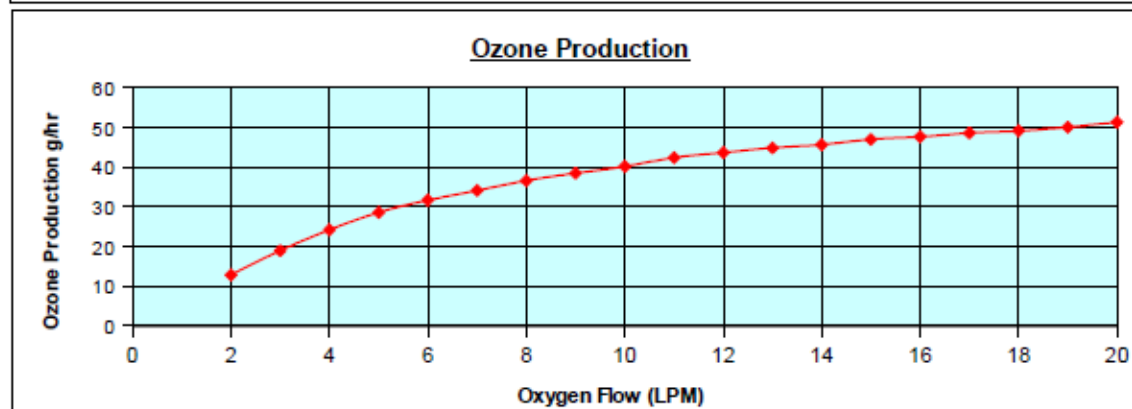
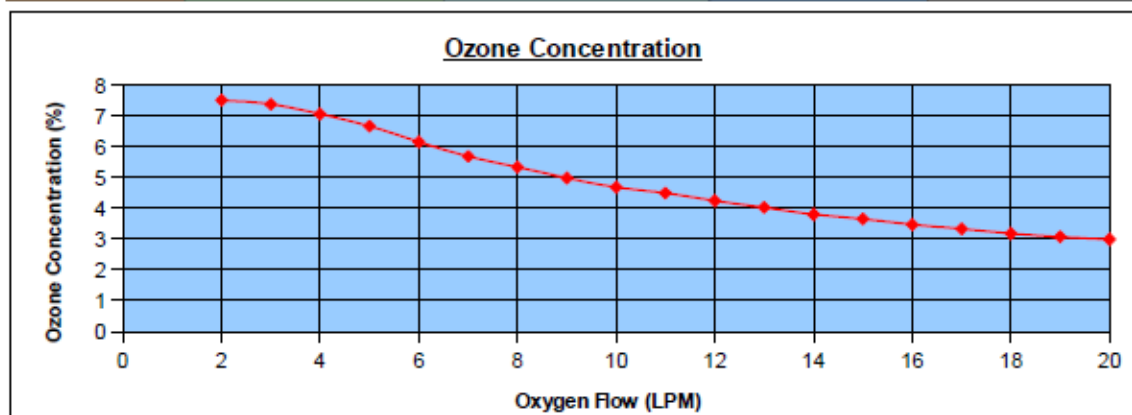
220 VAC, single phase, 50 Hz, 2.5 Amps, 500 Watts (optional)



Performance Chart

TG-40 Ozone Generator

Oxygen Flow in LPM	Ozone Concentration g/Nm ³	Ozone Concentration, % by weight	Ozone Production in g/hr	Oxygen Pressure PSI
2.00	119.5	7.50	12.87	10
3.00	114.3	7.37	18.97	10
4.00	110.1	7.05	24.20	10
5.00	104.4	6.66	28.57	10
6.00	97.3	6.15	31.66	10
7.00	90.7	5.68	34.11	10
8.00	86.2	5.33	36.59	10
9.00	79.0	4.98	38.46	10
10.00	74.3	4.68	40.15	10
11.00	68.6	4.49	42.38	10
12.00	64.6	4.24	43.66	10
13.00	61.0	4.02	44.84	10
14.00	57.0	3.80	45.65	10
15.00	53.5	3.65	46.98	10
16.00	53.1	3.47	47.64	10
17.00	51.1	3.33	48.57	10
18.00	48.7	3.18	49.11	10
19.00	46.9	3.07	50.05	10
20.00	45.6	2.99	51.31	10



Test was performed at 72°F, Generator was ON for more than 1 hour.

Ozone Analyzer API 454

Setting up the TG-40

Installation Guidelines

- Sufficient access space. There must be at least a foot or two of space around the TG-40 in order to provide room for maintenance service and to allow a free flow of cool air around the unit.
- Adequate power source. Make sure to connect the unit to a grounded power source that is rated for the required electric current and voltage.
- Proper ventilation. The location of the Ozone Generator must be well ventilated with a recommended 6 air changes per hour.

Wall mounting

If mounting the TG-40, the RS-2 rack is required.

1. Install the mounting bracket on a secure wall.
2. Attach the brackets, leaving the screws 17 inches apart. For extra support, secure a large piece of plywood to the wall.
3. Slide the Ozone Generator into the brackets and secure with 10-32 bolts and nuts.

Ozone/oxygen hookup

1. Using a stainless steel, Teflon, or other high-quality ozone-resistant tubing, connect to the oxygen inlet and ozone outlet fittings on the backside of the TG-40. These connections are ¼ inch stainless steel compression connections.
2. With an open-ended wrench, tighten the compression-fitting nuts that hold the tubing in place and seal it to the TG-40. See the image below for guidance.
Note: Keep in mind that the ferrule is not reusable and will be permanently secured to the tubing you have tightened into this fitting.
3. When the oxygen is flowing, spray the fitting with soapy water and watch for air bubbles. If none appear, the seal is secure.



Starting up the TG-40

Here are tips for ensuring performance for the TG-40:

1. Make sure oxygen is flowing through the unit before beginning the initial start-up process.
2. Set the flow and pressure to that which is expected for future operation.
3. Ensure that there are no leaks at the backside input and output connections by spraying soapy water and watching for air bubbles.
4. Check the downstream systems where the ozone is to be used. Make sure that there are no leaks or other open lines that may cause excess ozone to escape. It is very hazardous to have exposed ozone in areas where personnel are located.

To start the Ozone Generator, simply toggle the switch on front panel of the generator to “on,” and a small light above the switch will turn green to signify that it is active.

Operation guidelines

The indicator light

While the Ozone Generator is in operation, the green light will remain lit to indicate that the inverter is on, power is being sent to the transformer, and ozone is being generated. Additionally, fans will run in order to cool the unit throughout the time that it is on.

This light is also responsible for indicating proper operation of the inverter:

- When the green light is on, the inverter is active and operating normally.
- When the green light is off, the inverter is malfunctioning and must be repaired.
- When the green light is flashing, the inverter is off due to a normal condition that could be caused by the potentiometer being adjusted to the lower limits.

Adjust the oxygen feed, gas flow, and pressure to the necessary values for continued ozone production and concentrations to remain without issue and do not exceed capacity of the Ozone Generator. Use the attached Ozone Generator performance charts in order to evaluate the necessary oxygen flow required for proper function.

If installing more than one generator, set all of the flow rates to an identical setting so that each generator has the same flow rate passing through the unit.



Remote operation

The TG-40 can be turned on or off remotely, and the output of the unit can be adjusted from 0–100% via a 0–10 volt input.

Note: The use and type of the remote control must be qualified prior to implementation, so please contact Ozone Solutions for more information before installing a remote for your unit.

WARNING: Never place items on top of the Ozone Generator, as it is not designed to support any weight.

Maximum ozone production is realized at 10-20 PSI of pressure. Pressures up to 100 PSI are sufficient but will not produce the maximum ozone production. If pressures will reach higher than 30 PSI, the generator must be tuned properly to maximize the efficiency of the machine. Please contact Ozone Solutions for information regarding this process.

The Ozone Generator will not operate under a vacuum and must have at least 1 PSI of pressure for ozone production. Below 1 PSI the cell will shut down and produce no ozone.

The ozone output can be adjusted using a potentiometer installed on the unit. The dial on the potentiometer can adjust the ozone from 0-100%. This reading is not perfectly linear; the actual output should be measured with an ozone analyzer. The dial adjusts the voltage to the cell from 1-100%. At the lower limits when ozone is not being produced, the inverter will turn off. When the inverter is off without a current, the green light will flash.

Ensure that the Oxygen Generator is in a well-ventilated area. If the space is occupied, sufficient ventilation must be provided to prevent the accumulation of low oxygen concentration waste gas in the space.

IMPORTANT: When setting the flow and pressure of the Ozone Generator it is important to know that pressure will have a factor on the flow displayed on most flow meters. If the actual discharge pressure is substantially above atmospheric pressure, the reading can be adjusted to determine the precise flow rate, according to the following formula (using PSIG):

$$(adjusted\ flow) = (measured\ flow) \times \sqrt{\frac{oxygen\ _\ pressure + 14.7}{14.7}}$$

Please contact Ozone Solutions if additional assistance is required.

Do **not** allow the oxygen or ozone to vent freely.

Do **not** exceed rated capacity.

If the TG-40 Ozone Generator has a flow meter and a pressure gauge installed, they may be used to evaluate the flow and pressure on the corona cell. The pressure gauge on the unit can be used to calculate the actual adjusted flow of the TG-40. The pressure gauge and flow meter have been installed before the corona cell and may not be 100% ozone resistant. It is important not to allow ozone to flow in the reverse direction when the oxygen flow is turned off. After running the Ozone Generator, a check of the valves is strongly recommended to prevent back flow.

Optimal environment

The Ozone Generator is not weather proof; therefore, it must be operated indoors in a non-condensing, dust-free environment. Sufficient ventilation must be provided to prevent the accumulation of ozone in the event of a leak. Approximately three air changes per hour are recommended.

The operating temperature should be 40°F to 95°F, and the storage temperature should be -20°F to 170°F. No dust or debris may be in the area; it must be clean and dry environment.

Maintenance and service parts

As long as the feed gas is kept dry, dust free, and pure, the Ozone Generator will not need maintenance. Ensure strict maintenance procedures of the oxygen generator as specified in the oxygen generator manual.

There are no serviceable parts inside the TG-40. If any part fails to operate or other problems arise call Ozone Solutions for service and repair.

The mechanical specifications are as follows:

Dimensions: 7-in height x 17-in width x 17-in depth
(2.7-cm height x 43-cm width x 43-cm depth)
Weight: 35 lbs
(15.8 kg)

Contact information

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Warranty

Ozone Solutions warrants all equipment assembled, manufactured, and sold to be free from defects in material and workmanship under normal use and service for a period of one (1) year after date of sale to the original purchaser.

Some products may have a specific warranty period other than what is outlined in this document. For such products, the manufacturer warranty will supersede this warranty. Ozone Solutions will honor the manufacturer's warranty, but if and when advised by the manufacturer, may have the customer deal directly with the manufacture.

This warranty covers all parts that are not outlined in a product maintenance schedule. This warranty will be void if any piece of the equipment is used in a manner other than what is explicitly outlined in the product manuals.

If any part of the equipment manufactured by Ozone Solutions proves to be defective during the warranty period, please contact Ozone Solutions at 1-888-892-0303, or tech@ozonesolutions.com. Prior authorization is required before working on or shipping a product back to us. Failure to get prior authorization may result in denial of your claim. Once authorized, you may return the defective equipment to Ozone Solutions with the transportation charges prepaid. If Ozone Solutions finds the equipment to be defective, it will be repaired or replaced at our discretion, free of charge, to the original purchaser (F.O.B. factory). This warranty shall not place any liability on Ozone Solutions for any transportation charges, labor, or cost for, or during the replacement of any parts. The replaced part(s) or product will then continue the original warranty duration. The replaced parts will not start a new one (1) year coverage period.

The purchaser by acceptance of the equipment will assume all liability for the consequences of its use or misuse by the purchaser, employees, or others. This warranty shall not apply to any piece of equipment, or part thereof sold by this company which has been subject to any accident caused in transit, alterations by unauthorized service, negligence, abuse, or damage by flood, fire, or act of God.

This warranty shall constitute the entire warranty and/or agreement between Ozone Solutions and the original purchaser, and in lieu of all other warranties, expressed or implied, either oral or written, including the warranty of merchantability and fitness for a particular use and of all other obligations or liabilities on our part. Ozone Solutions neither assumes nor authorizes any other person or entity to assume for us any liability associated with the sale of its products or equipment.

The term "original purchaser," as used in this warranty, means whom the product was originally sold to by Ozone Solutions or by an authorized dealer.

Ozone Solutions reserves the right to make changes in its products without notice. Because of this, Ozone Solutions is not obligated to replace warranty defective part(s) and/or product with the same original part or product.

