



451 Black Forest Road Hull, IA 51239 Ph: (712) 439-6880 Fax: (712) 439-6733

## **TG-40**

### **High Output Ozone Generator**

## **Installation and Operation Manual**



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**Cautions, Warnings and Hazards:**

Ozone is a powerful oxidizing agent. Observe strict operating procedures when using ozone equipment. ***It is imperative that only ozone compatible materials be 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 operated indoors or in an enclosure in a non-condensing environment.

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

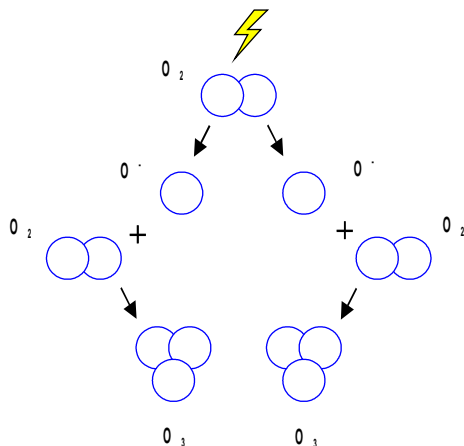
Carefully review and familiarize yourself with the following important safety information statements concerning the Ozone Generator.

- 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 the ozone-tubing outlet.
- WARNING** The ozone generator contains high voltages. Unauthorized entry can result in serious injury or death. For service instructions, contact Ozone Solutions.
- 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 ozone into an undesired space.

## Introduction

The TG-40 Ozone Generator produces ozone from oxygen via corona discharge. The Ozone Generator is capable of generating 40-gm/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 is used, among many other uses, for pathogen inactivation and destruction of odorous gases.

### **Ozone Generation from Corona Discharge**



## Theory of Operation

The TG-40 Ozone Generator generates ozone via corona discharge. In this process an electrical spark is used to split the molecular bond of oxygen, found in nature in the form of O<sub>2</sub>, into the atomic O- form of oxygen. These O- atoms attach themselves to other O<sub>2</sub> molecules to form O<sub>3</sub> (Ozone).

The spark inside the TG-40 is a controlled corona. This is produced by forcing a high voltage source through a dielectric and a small air gap. This occurs in call the corona cell. This spark occurs at a higher than line voltage and much higher than line frequencies. These changes in voltage and frequencies are accomplished with the circuit board and transformer inside the TG-40. The oxygen feed gas source is forced through the small air gap along the dielectric and intense corona (spark). This splits the O<sub>2</sub> 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. This contact time allows for a higher percentage of oxygen to be converted into ozone. The proper ozone production and concentration for the necessary application can be determined and achieved by using the TG-40 performance charts included with this manual.

While flow and pressure of the oxygen feed gas affect the ozone output the most the pressure of the feed gas in the corona cell also has an affect on the production of ozone. With higher pressures of oxygen there is more oxygen in a given space. This allows for more molecular O<sub>2</sub> to be present in the corona cell, and be converted into O<sub>3</sub>. This 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 where more oxygen is present in the same space. The TG-40 automatically compensates for varying pressures and will maximize 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, this will decompose the ozone back into O<sub>2</sub> 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 high voltage and 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 specific information

### **Feed Gas Requirements:**

oxygen dried to a minimum of minus 70-deg F dewpoint. No minimum airflow required.

Maximum airflow of 30 l/min (60 SCFH). Pressure on the corona cells must not exceed 100 PSI.

### **Maximum Cell Pressure**

100 PSI

### **Electrical Input**

120 VAC, single phase, 60 Hz, 5.0 Amps, 500 Watts

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

## **Installation:**

**IMPORTANT:** *Choose a location for the Ozone Generator that does not allow rain or condensation to contact the unit. The Ozone Generator is not weather proof. It must be operated indoors or in an enclosure in a non-condensing environment.*

Be certain there is sufficient access space around the TG-40 to perform normal maintenance and service. Also ensure there will be a free flow of cooling air around the unit. Connect the unit to a grounded power source rated for the voltage and current requirements.

If wall mounting the TG-40, the RS-2 rack is required. Install the mounting bracket (optional) on a secure wall. Attach the brackets with the screws provided 17-inches apart. (It may be advisable to secure a large piece of plywood to the wall for extra support.) Slide the ozone generator into the bracket and secure with 10-32 bolts and nuts, or equivalent.

**IMPORTANT:** *The location of the Ozone Generator must be well ventilated. Approximately 6 air changes per hour are recommended. Contact Ozone Solutions if further assistance is needed.*

### **Ozone/Oxygen Hookup:**

Connect to the oxygen inlet and ozone outlet fittings on the rear of the TG-40. The ozone and oxygen connections are 3/8-inch stainless steel compression connections. (see image below). Ensure that stainless steel, Teflon, or another high quality ozone resistant tubing is used. Hand-tighten with the proper open ended wrench the compression fitting nuts that hold the tubing in place and seal the tubing to the TG-40. Remember the ferrule in this compression fitting is not reusable and will be secured to the tubing you have tightened into this fitting. Spray the fitting with soapy water when oxygen is flowing through the unit to ensure no leakage.



Do not lay items on the ozone generator as the top is not designed to support any weight. This could potentially cause internal damage in the event the top is pushed against delicate internal parts in the TG-40 ozone generator.

If installing more than one generator, set all ozone generator flowrates to an identical setting so each generator has the same flowrate going through the unit.

**IMPORTANT:** Ensure that the oxygen flow is measured and controlled to rates that do not exceed rated capacity of the ozone generator.

Remote operation or control:

The TG-40 can be turned ON or OFF remotely, also the output of the unit can be adjusted from 0-100% via a 0-10 volt input. Please contact Ozone Solutions for more information on either of these options, as the use and type of control MUST be qualified prior to implementation.

## **Start-Up**

Before initial startup of the ozone generator begin oxygen flow through the unit. Set the flow and pressure to the flow and pressure the unit will be operated at for your application. Ensure there are no leaks at the rear input and output connections. This can be done by spraying a light mist of soapy water on the fittings and checking for air bubbles.

Ensure the downstream systems where ozone is to be used have no leaks or other open lines that may cause excess ozone to escape into the ambient atmosphere. It is important that the ozone will not escape in any areas where personnel is located.

To start the ozone generator, connect the unit to a grounded power source rated for the voltage and current requirements. Push the toggle switch on the front panel to the up position. The "ON" light will illuminate indicating ozone production.

## **Operation**

While the ozone generator is operating there is a green light on the front of the unit to indicate that the inverter is ON. This light is driven directly from the inverter board only when the inverter is sending power to the transformer successfully. If this green light is lit ozone should be being generated. The fans will also be turning to cool the unit at all times while the unit is ON.

Adjust the oxygen feed gas flow and pressure to the necessary values for the ozone production and concentrations necessary for your application. Use the attached ozone generator performance charts to evaluate the oxygen flow necessary.

Maximum ozone production is realized at 10-20 PSI of pressure. Pressures up to 100 PSI are acceptable but will not produce the maximum ozone production. If pressures higher than 30 PSI are to be used please contact Ozone Solutions for tuning information to maximize the efficiency of the ozone generator.

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.

There is a potentiometer installed on the unit that can adjust the ozone output. This dial will adjust the ozone output from 0-100%. This is not perfectly linear and the actual output should be measured with an ozone analyzer. This switch adjusts the voltage to the cell from 0-100%.

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. Approximately 3 air changes per hour are necessary.

**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 or pressure gauge installed these may be used to evaluate the flow and pressure on the corona cell. The pressure gauge on the unit can be used to calculate actual adjusted flow of the TG-40. The Pressure gauge and flow meter are 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. A check valve after the ozone generator is strongly recommended to prevent back flow.

## **Environment**

The Ozone Generator is not weather proof; it must be operated indoors or in an enclosure 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 3 air changes per hour are recommended.

Temperature (Operating): 40°F to 95°F

Temperature (Storage): -20°F to 170°F

No dust or debris may be in the area, must be clean dry environment.

## **Maintenance**

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.

## **Service Parts**

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.

## **Mechanical Specifications**

Dimensions: 7-in H x 17-in W x 17-in D (2.7-cm H x 43-cm W x 43-cm D)  
Weight: 35-lbs (15.8 kg)

## **How to Contact Ozone Solutions**

By mail:

*Ozone Solutions, Inc.*  
451 Black Forest Road  
Hull, IA 51239 USA

By telephone: (712) 439-6880  
By fax: (712) 439-6733  
By mobile phone: (712) 441-0210  
By e-mail: [sales@ozonesolutions.com](mailto:sales@ozonesolutions.com)  
Website: [www.ozonesolutions.com](http://www.ozonesolutions.com)