

TG-Series

Water Cooled TG-300 Ozone Generator

TG Series: TG-75, TG-150, TG-300, TG-450, TG-600 Installation & Operations Manual



The element of success.

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v2d.

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IMPORTANT SAFETY INSTRUCTIONS READ AND FOLLOW ALL INSTRUCTIONS.

Read this manual completely before attempting installation.

SAVE THESE INSTRUCTIONS!



SECTION 1

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.**

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.

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 which is placed in a non-condensing environment.

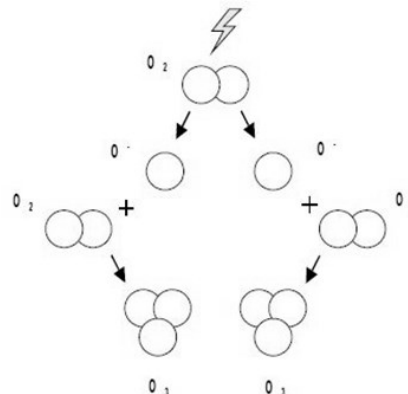
Carefully review and familiarize yourself with the following important safety information concerning the Ozone Generator:

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 Water Cooled Ozone Generator produces ozone from oxygen via corona discharge. The TG series is capable of generating 75- 600g/hr of ozone with a feed gas of 90% oxygen. Ozone has many uses including pathogen inactivation and destruction of odorous gases.

Ozone Generation from Corona Discharge



Theory of Operation

The Ozone Generator produces ozone via the corona discharge method. 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 O_2 molecules to form O_3 (ozone).

The spark inside the corona cell is a controlled corona or spark. This spark is produced by forcing a high voltage source through a dielectric and a small air gap where the feed-gas flows through. The spark occurs at a higher-than-line voltage and much higher-than-line frequencies, which are increased and regulated by the onboard electronics in the machine.

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 (CT value) allows a higher percentage of oxygen to be converted into ozone. The ozone production and concentration of the TG ozone machine can be determined using the performance charts in this manual.

While the flow-rate of the oxygen feed gas affects the ozone output the most, the pressure of the feed gas also effects the ozone output. Higher pressures create higher concentrations of the feed gas which result in a higher ozone output or concentration. If the feed gas flow-rate remains the same while under a higher pressure, it allows an increased contact time (CT value).

With increased feed-gas pressures, additional electrical power is needed to create a spark in the pressurized corona cell. The electronics of the TG series automatically compensate for the varying pressure to maximize the ozone output.

While increased feed gas pressure helps achieve a higher output, it also forces the created ozone molecules back into oxygen at a quicker rate.

SECTION 2

Component Diagram

LEGEND

1. Mounting tabs for wall mounting
2. HMI Screen
3. Enclosure latch
4. Emergency Stop
5. Cooling vents (filtered)
6. Power Cord
7. Ozone Outlet
8. Oxygen Inlet
9. Cooling Water Out
10. Cooling Water IN
11. Mounting Feet

Component Description



1. **Mounting tabs for wall mounting** – Can be mounted to a wall or rack using the stainless steel mounting tabs.
2. **HMI Screen** – Main screen to control the ozone generator.
3. **Enclosure Latch** – will latch and lock door of enclosure, a common flat blade screw-driver can be used to open the enclosure.
4. **Emergency Stop** – Immediate push stop
5. **Cooling Vents** – filtered cooling vents are used to cool the ozone generator and filter all air from major dust.
6. **Power Cord** – 220V power cord will supply power to the ozone generator.
7. **Ozone Outlet** – Refer to the Specifications table for more information
8. **Oxygen Inlet** – Refer to the Specifications table for more information
9. **Cooling Water Out** – Refer to the Specifications table for more information
10. **Cooling Water In** – Refer to the Specifications table for more information
11. **Mounting Feet** – For bench/ table placement

Specifications

TG Model	TG-75	TG-150	TG-300	TG-450	TG-600
Grams Per Hour	75	150	300	450	600
Feed-Gas Flow Rate (LPM)	0-15	0-30	0-60	0-90	0-120
Power (Volts A/C)	208-240*	208-240*	208-240*	208-240	208-240
Power (Watts)	600	1200	2400	3600	4800
Power (Amps)	3	5.5	15	10	20
Gas Connections (In & Out-Inches)	3/8 Comp.	3/8 Comp.	3/8 Comp.	1/2 NFPT	1/2 NFPT
Cooling Required (BTU/Hr.)	2,000	4,100	8,200	12,300	16,600
Cooling Water (GPM @ 70F or colder)(71 PSI Max)	0.75	1	1.5	2	2
Cooling Water Connections (In & Out-Inches)	3/8 NFPT	3/8 NFPT	1/2 NFPT	1/2 NFPT	1/2 NFPT
Size (D, W, H)	11, 24, 24	13, 24, 24	17, 24, 30	17, 30, 36	17, 36, 42
Weight (Lbs.)	75	90	180	200	250

* - Single Phase, others are Three Phase. Specifications are subject to change without notice.

Available Options

Optional Accessories	Description
Flowmeter	0-10 LPM, 0-20 LPM Acrylic Flowmeter or High Accuracy 0-10 LPM Aluminum Flowmeter (which is best for precise flow control).
Pressure Gauge	0-30 PSI or 0-60 PSI that displays corona cell pressure.
Ozone Control Input	4-20 mA Input or 0-10 Volt Input allows you to control the generator output remotely.

Installation Guidelines

The Ozone Generator is not weather proof; therefore, it must be operated indoors in a non-condensing, dust-free environment.

Ambient Temp.; The operating temperature should be 40°F to 95°F, and the storage temperature should be -20°F to 170°F.

Ventilation Needs; Approximately three air changes per hour are recommended. Proper ventilation will also help prevent the accumulation of ozone in the event of a leak.

Clear Space; Maintain 12-24 inches of clear space around the machine for proper ventilation and maintenance service work to be performed.

Adequate power source; Connect the machine to a grounded power source that is rated for the required electric current and voltage.

Wall Mounting

To mount the machine on a wall:

1. Use the wall mount tabs on the top of the unit to secure to a wall.
2. Ensure that the wall can support the weight of the system.

Ozone/Oxygen Connections

1. Using a stainless steel, Teflon, or other high-quality ozone-resistant tubing, connect to the oxygen inlet and ozone outlet fittings.
2. If the connections are compression fittings, then, with an open-ended wrench, tighten the compression-fitting nuts as needed.

*Note: For Stainless steel ferrules; After being tightened down properly, the ferrule will become part of the tubing, since it can no longer move freely on the tube.

Cooling Water Connections

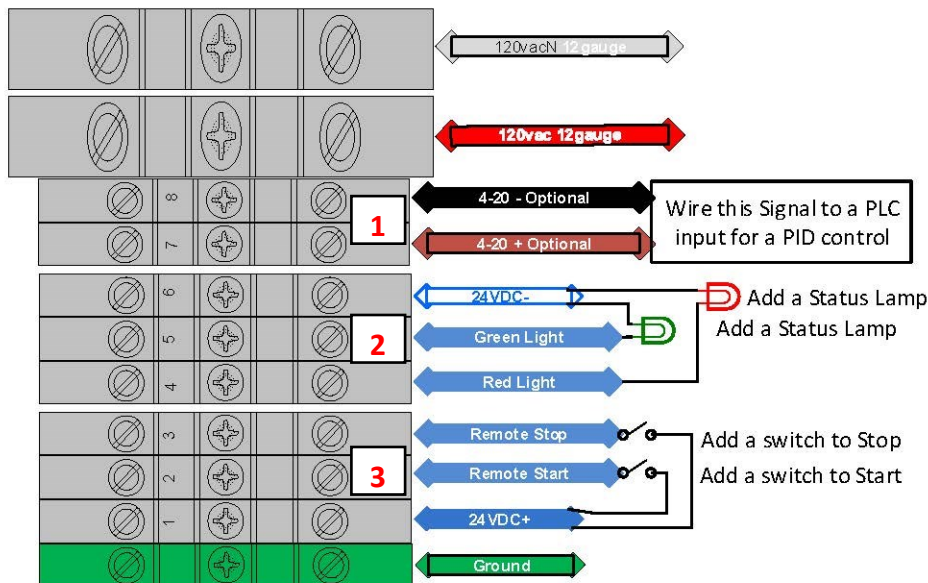
Refer to the specific model in the Specifications table which will inform you of the water connection size. If you need additional fittings to make the proper connections, please contact us for that need.

Electrical Connections

Wire in the correct power source as listed in the Specifications table.

SECTION 3

Remote Operation or Control



- 1** Use the 4-20mA option to remotely control the ozone output from 0-100%.
- 2** When the Inverter is ON and producing ozone there is a 24 VDC reference signal that can be wired to a remote location. This can be wired using terminals “24 VDC(-)” and “Green Light ” and “Red Light”.
- 3** By using either a momentary or latching relay, the ozone generator can be turned ON or OFF remotely by bridging the terminals “24 VDC (+)” and “Remote Stop” or “Remote Start”.

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

Flow-Meter Corrected Flow Chart

When setting the flow and pressure of the Ozone Generator, it is important to understand how the pressure will affect the flow rate as displayed on the flow meter (s). 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 refer to the Corrected Flow Chart in this manual, or contact Ozone Solutions if additional assistance is required.

This corrected flow can then be used in the appropriate Performance Chart to determine how much ozone you are making. There can be up to a 10% error in this equation. Using an ozone analyzer in line with your ozone system will provide the greatest level of accuracy and understanding of your ozone production.

Corrected Flow Chart

PSI

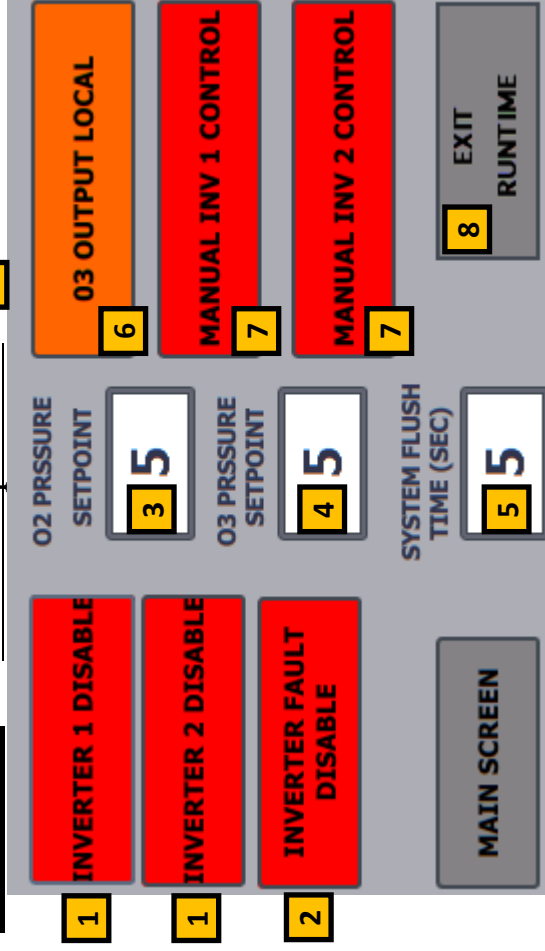
0	5	10	15	20	25	30	35	40	45	50	55	60
5	5.79	6.48	7.11	7.68	8.22	8.72	9.19	9.65	10.08	10.49	10.89	11.27
10	11.58	12.96	14.21	15.36	16.43	17.44	18.39	19.29	20.15	20.98	21.77	22.54
15	17.36	19.44	21.32	23.05	24.65	26.16	27.58	28.94	30.23	31.47	32.66	33.81
20	23.15	25.93	28.43	30.73	32.87	34.88	36.77	38.58	40.30	41.96	43.55	45.08
25	28.94	32.41	35.54	38.41	41.08	43.59	45.97	48.23	50.38	52.45	54.44	56.36
30	34.73	38.89	42.64	46.09	49.30	52.31	55.16	57.87	60.46	62.94	65.32	67.63
35	40.52	45.37	49.75	53.77	57.52	61.03	64.36	67.52	70.53	73.43	76.21	78.90
40	46.31	51.85	56.86	61.46	65.73	69.75	73.55	77.16	80.61	83.92	87.10	90.17
45	52.09	58.33	63.96	69.14	73.95	78.47	82.74	86.81	90.69	94.41	97.99	101.44
50	57.88	64.81	71.07	76.82	82.17	87.19	91.94	96.45	100.76	104.90	108.87	112.71
55	63.67	71.29	78.18	84.50	90.39	95.91	101.13	106.10	110.84	115.39	119.76	123.98
60	69.46	77.78	85.28	92.18	98.60	104.63	110.32	115.74	120.91	125.88	130.65	135.25
65	75.25	84.26	92.39	99.87	106.82	113.35	119.52	125.39	130.99	136.37	141.54	146.53
70	81.03	90.74	99.50	107.55	115.04	122.07	128.71	135.03	141.07	146.86	152.42	157.80
75	86.82	97.22	106.61	115.23	123.25	130.78	137.91	144.68	151.14	157.35	163.31	169.07
80	92.61	103.70	113.71	122.91	131.47	139.50	147.10	154.32	161.22	167.84	174.20	180.34
85	98.40	110.18	120.82	130.59	139.69	148.22	156.29	163.97	171.30	178.33	185.09	191.61
90	104.19	116.66	127.93	138.28	147.90	156.94	165.49	173.61	181.37	188.81	195.97	202.88
95	109.98	123.14	135.03	145.96	156.12	165.66	174.68	183.26	191.45	199.30	206.86	214.15
100	115.76	129.63	142.14	153.64	164.34	174.38	183.87	192.90	201.52	209.79	217.75	225.42
105	121.55	136.11	149.25	161.32	172.55	183.10	193.07	202.55	211.60	220.28	228.64	236.70
110	127.34	142.59	156.36	169.00	180.77	191.82	202.26	212.19	221.68	230.77	239.52	247.97
115	133.13	149.07	163.46	176.69	188.99	200.54	211.45	221.84	231.75	241.26	250.41	259.24
120	138.92	155.55	170.57	184.37	197.20	209.26	220.65	231.48	241.83	251.75	261.30	270.51

FLOW

Section 4

HMI Setup Screen

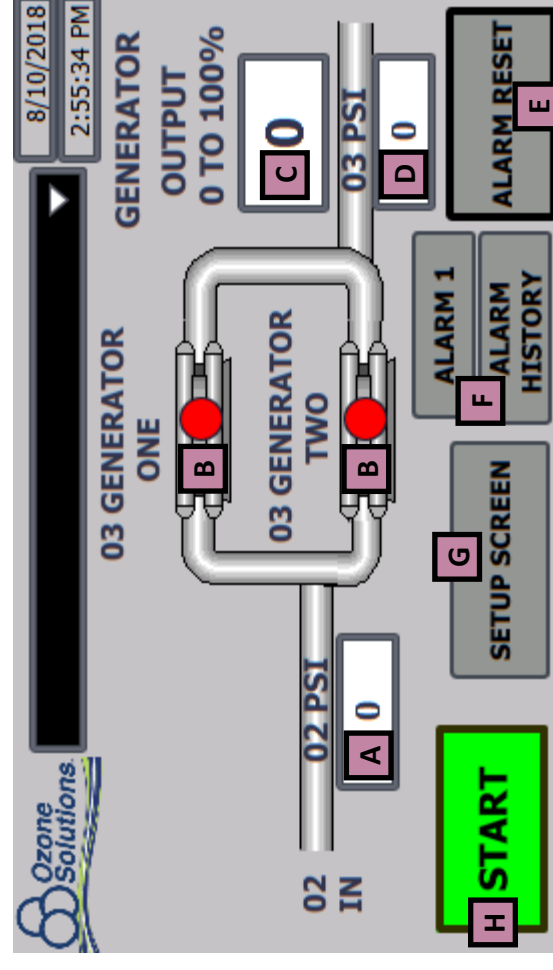
1 Green means Disabled



- A** The measured O2 PSI or Oxygen Pressure is only a readout value.
NOTE– Adjust the external PSI regulator which can be on an Oxygen Concentrator or other Oxygen feed-source.
- B** Green means ON, Red means Off
- C** Touching this field will bring up the Setpoint Entry Screen allowing you to enter or edit the displayed value.
NOTE- To operate the system on oxygen only, enter a zero (“0”) in this field.
- D** The measured O3 PSI or Ozone gas Pressure is displayed.
NOTE– The difference between the Oxygen and Ozone Pressure can be 1-3 PSI.
- E** Resets the non-active alarms.
- F** Pressing either the Alarm 1 or Alarm History will bring up the ALARM SCREEN.
- G** Will bring you to the SETUP SCREEN.
- H** This button Starts or Stops the machine; The button will be **Green** w/ the word “START” when the machine is not yet operated. After pressing the green button, it will then turn **RED** showing the word “STOP”.
NOTE– When “STOP” is activated, Oxygen will continue to flow.

- 2** Allows system to operate despite a fault/alarm. Main use is to tune the board.
- 3** The O2 PSI LOW SETPOINT: Touching this field will bring up the Setpoint Entry Screen allowing you to enter or edit the displayed value.
NOTE- If the oxygen pressure drops below this level, the ozone generator will shut down. **This MUST be set at a minimum of 5 PSI.**
- 4** The O3 PSI LOW SETPOINT: Touching this field will bring up the Setpoint Entry Screen allowing you to enter or edit the displayed value.
NOTE- If the ozone pressure drops below this level, the ozone generator will shut down. **This MUST be set at a minimum of 5 PSI.**
- 5** Lapsed Ozone flush time after touching **H** to stop the machine.
- 6** LOCAL or REMOTE control via a 0-10VDC signal. Terminals are inside the cabinet.
- 7** Green when touched. The appropriate inverter board ON led will light up proving
- 8** This button when touched will exit the run-time program and bring you to the operating system.

HMI Main Screen



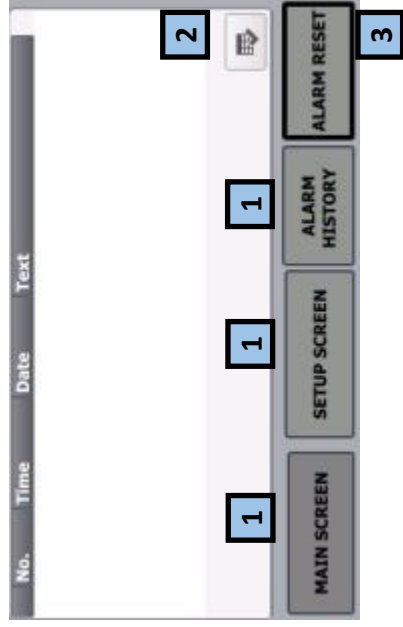
NOTE– If the value in “D” is below the value shown in “4”, the machine will stop making Ozone. To keep adequate pressure against the Ozone Cell (s), adjust the manual needle valve inside of the cabinet as needed.

HMI Alarm Screen

NOTE- You can highlight other alarm entries by selecting it with your finger.

- 1** Brings up the titled HMI Screen.
- 2** Un-Active posted alarms can be removed from the screen.
- 3** Resets posted alarms which are latched.

The Alarm screen displays ozone system alarms.



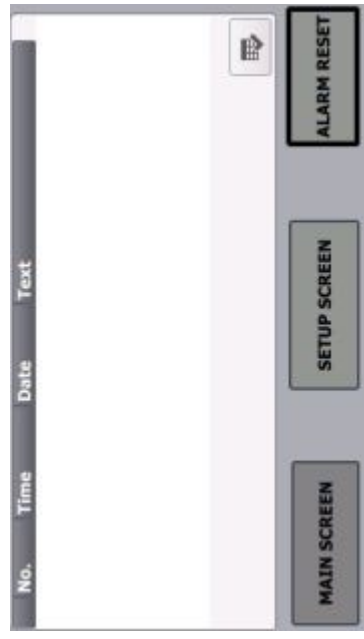
Starting up

Here are tips for ensuring performance for the ozone generator:

1. Using an oxygen purity meter, measure the purity of the oxygen. When the meter measures 90% or higher. Since the purity value is not displayed on an HMI screen, and if you do not have an oxygen purity meter, flowing the oxygen through the system for a minute should be fine.
2. Set the flow and pressure to that which is expected for its operation while not exceeding the capacity of the ozone machine as shown in the performance charts in this manual.
3. Spraying soapy water on all of the gas connection points will ensure there are no leaks. Tighten or repair as needed.
4. Refer to the HMI screens to inform you when the machine is making ozone or not.
5. If the machine is or has been making ozone gas for awhile, do number 6 below. If it is not making ozone, go to #7.
6. To make sure the flow rate of the cooling water is adequate, disconnect all power sources and open the cabinet door to access the ozone generating cell (s). The cells must be cool to the touch.
7. If you encounter any problems with the operation of the machine, please check the HMI alarm screen.

HMI Alarm History Screen

The Alarm History screen lists all the ozone system alarms.



The Alarm History screen keeps a history of all ozone system alarms.

This running log can be of good use or history when needing to service or trouble-shoot the machine.

NOTE- This logged history cannot be deleted or cleared.

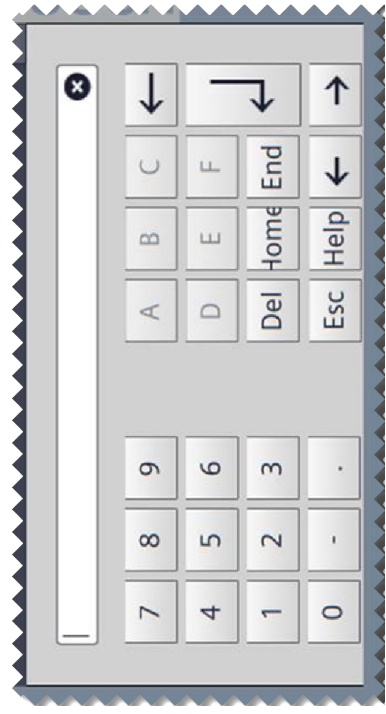
HMI Set-Point Entry Screen

This Set-Point Entry Screen comes up when you touch fields;

3 **4** **5** in the Setup Screen, and

C In the Main Screen.

Enter the desired value into the top field and touch the button with the bent arrow.



Section 5

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 Series. If any part fails to operate or other problems arise call Ozone Solutions for service and repair.

Warranty

Ozone Solutions warrants all new 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 manufacturer.

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.

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Contact Information

Ozone Solutions, Inc.

451 Black Forest Road

Hull, IA 51239 USA

Phone: (712) 439-6880

Fax: (712) 439-6733

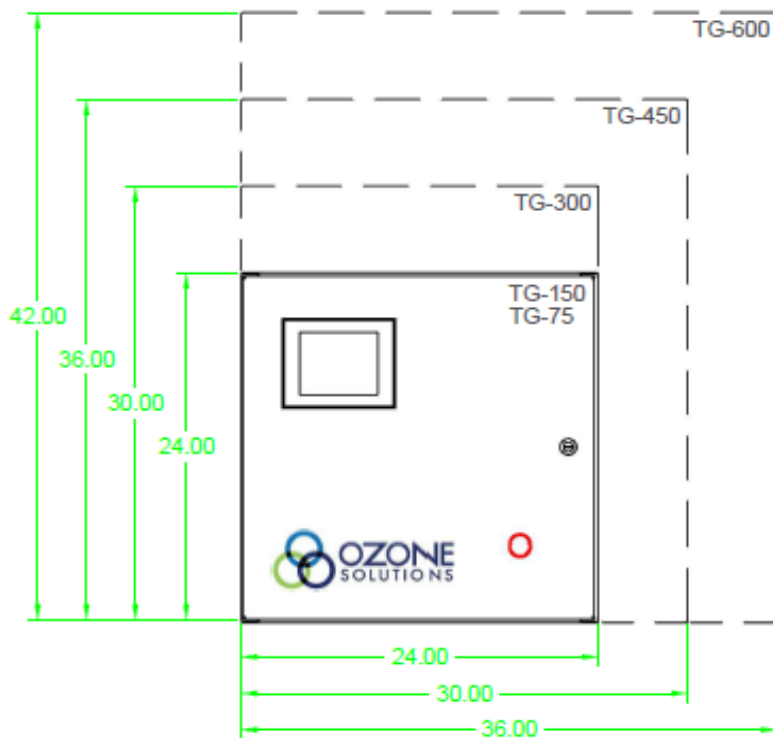
Email: sales@ozonesolutions.com

Website: www.ozonesolutions.com

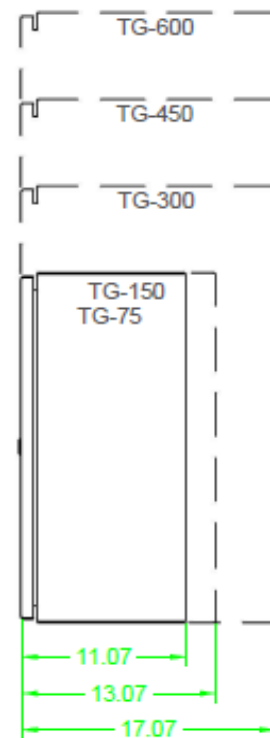
Appendix A - CAD Drawings

SIZE CHART

TG-75	24" x 24" x 11.07"
TG-150	24" x 24" x 13.07"
TG-300	24" x 30" x 17.07"
TG-450	30" x 36" x 17.07"
TG-600	36" x 42" x 17.07"



FRONT VIEW



RIGHT-SIDE VIEW

SCALE: 1" = 1'-0"

ORIG DRAWN: 04/14/16

CHECKED: DAK

APPROVED: DAK



DRAWING NO: TG-75,150,300,450,600

TITLE: TG-75,150,300,450,600

SIZE: A

SHEET: 1 OF 1

REV: A

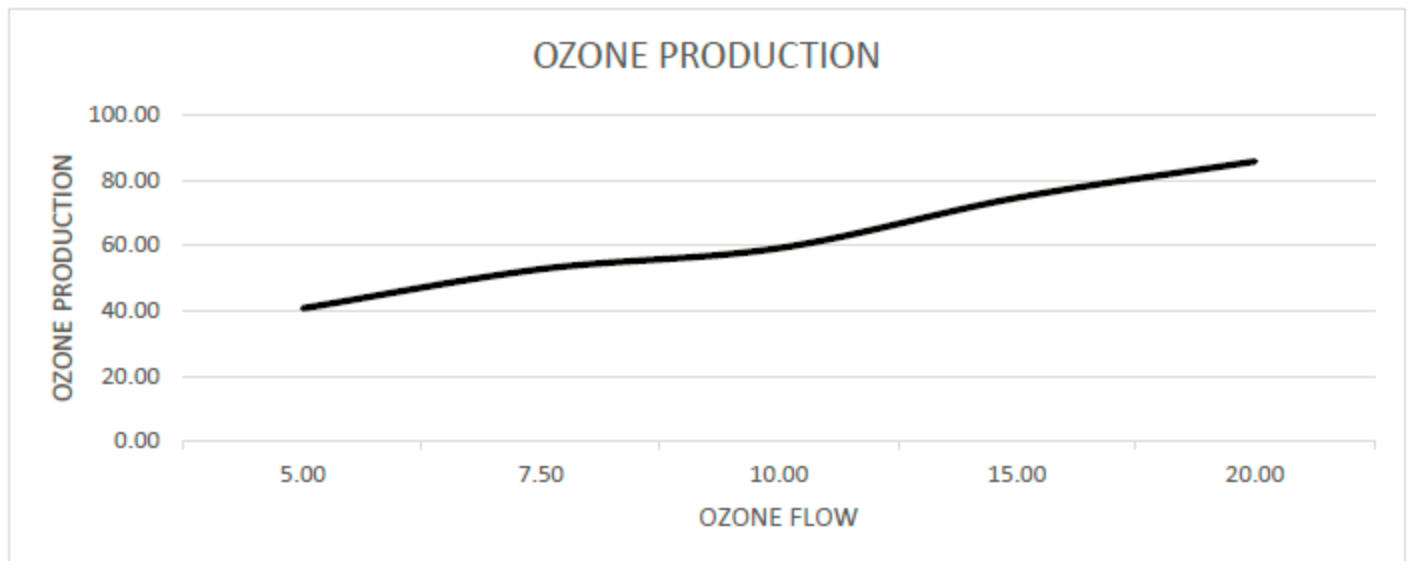
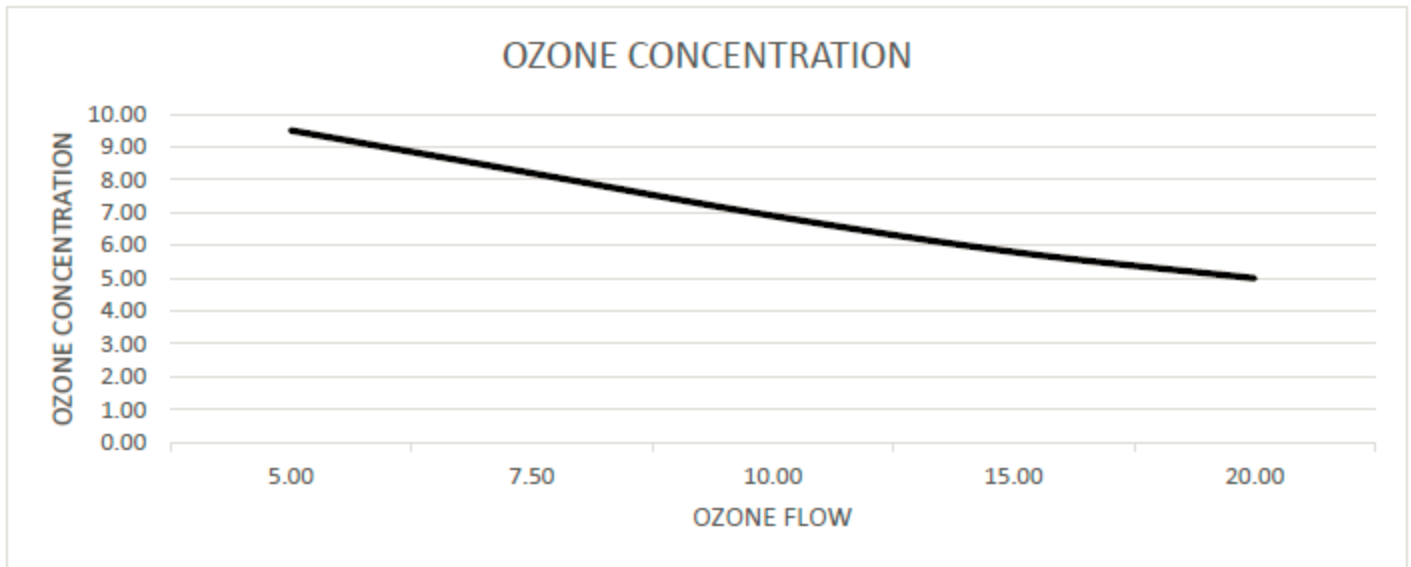
Appendix B - Performance Charts

OZONE GENERATOR PERFORMANCE TEST



TG SERIES OZONE GENERATORS

		Ozone Concentration (% by weight)	Ozone Production (g/hr)
Ozone Flow (lpm)	PSI	TG-75	TG-75
5.00	10	9.50	40.76
7.50	10	8.20	52.77
10.00	10	6.90	59.20
15.00	10	5.80	74.65
20.00	10	5.00	85.80



Test was performed at 72°F, running for over an hour. Cooling water @ 10 gph flow rate and 70°F.
Additional Equipment: Ozone Analyzer API 454 and API 460H

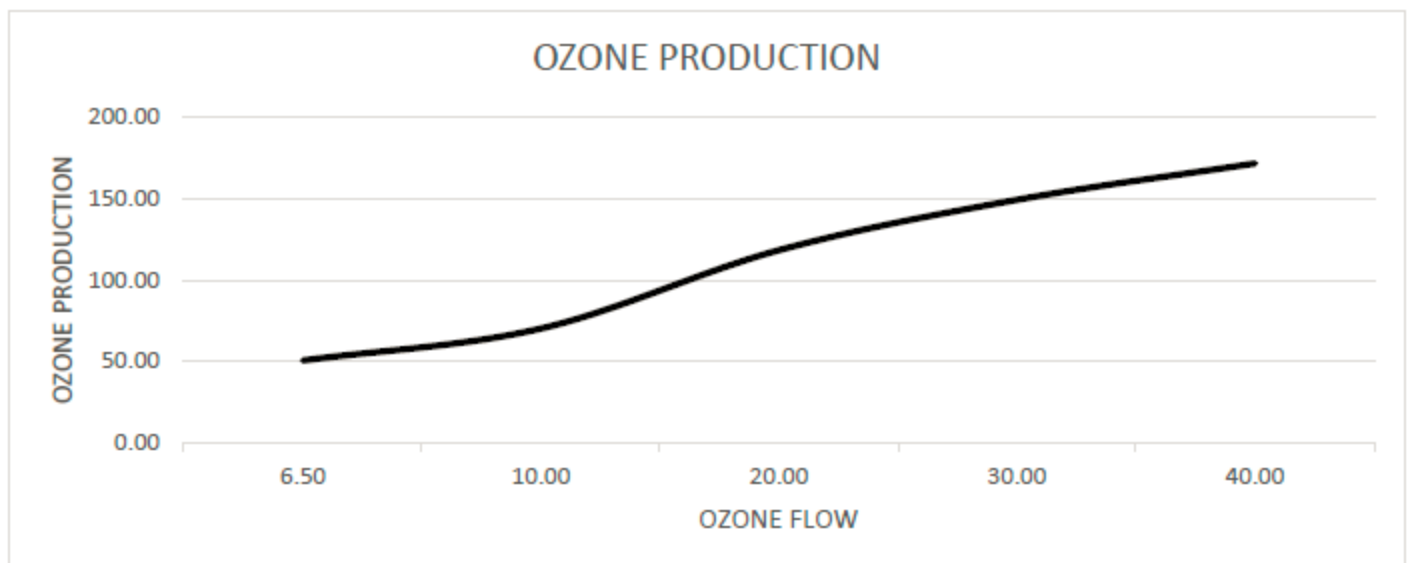
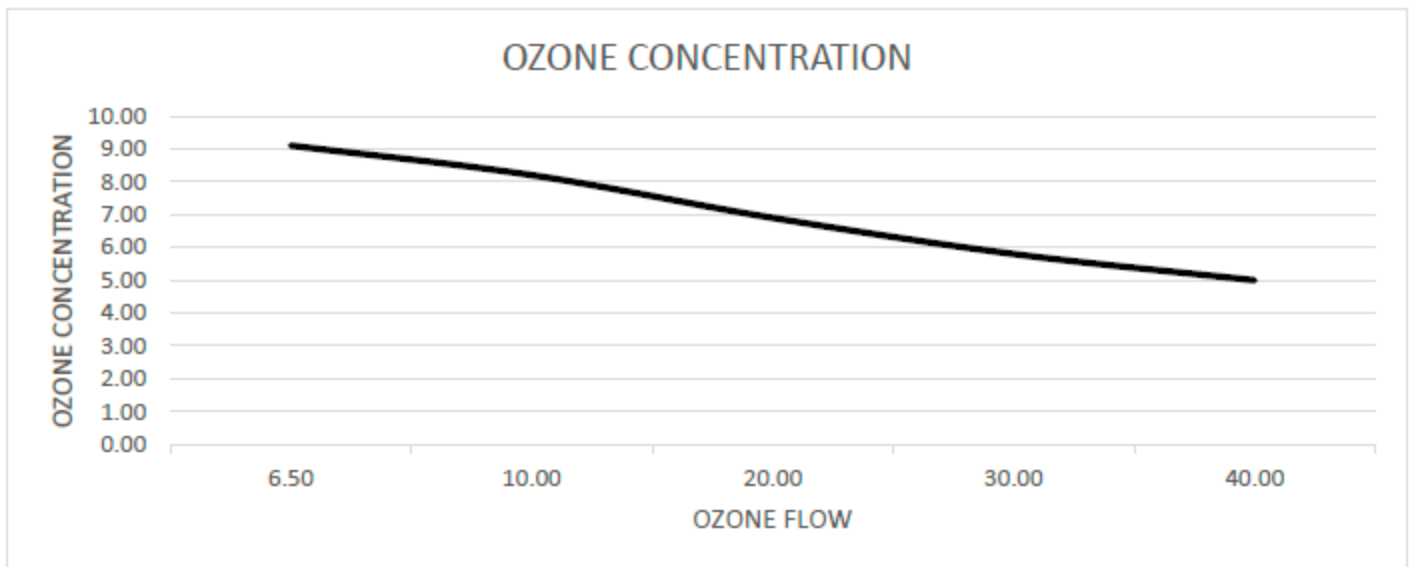
Appendix B - Performance Charts

OZONE GENERATOR PERFORMANCE TEST



TG SERIES OZONE GENERATORS

		Ozone Concentration (% by weight)	Ozone Production (g/hr)
Ozone Flow (lpm)	PSI	TG-150	TG-150
6.50	20	9.10	50.75
10.00	20	8.20	70.36
20.00	20	6.90	118.40
30.00	20	5.80	149.29
40.00	20	5.00	171.60



Test was performed at 72°F, running for over an hour. Cooling water @ 20 gph flow rate and 70°F.

Additional Equipment: Ozone Analyzer API 454 and API 460H

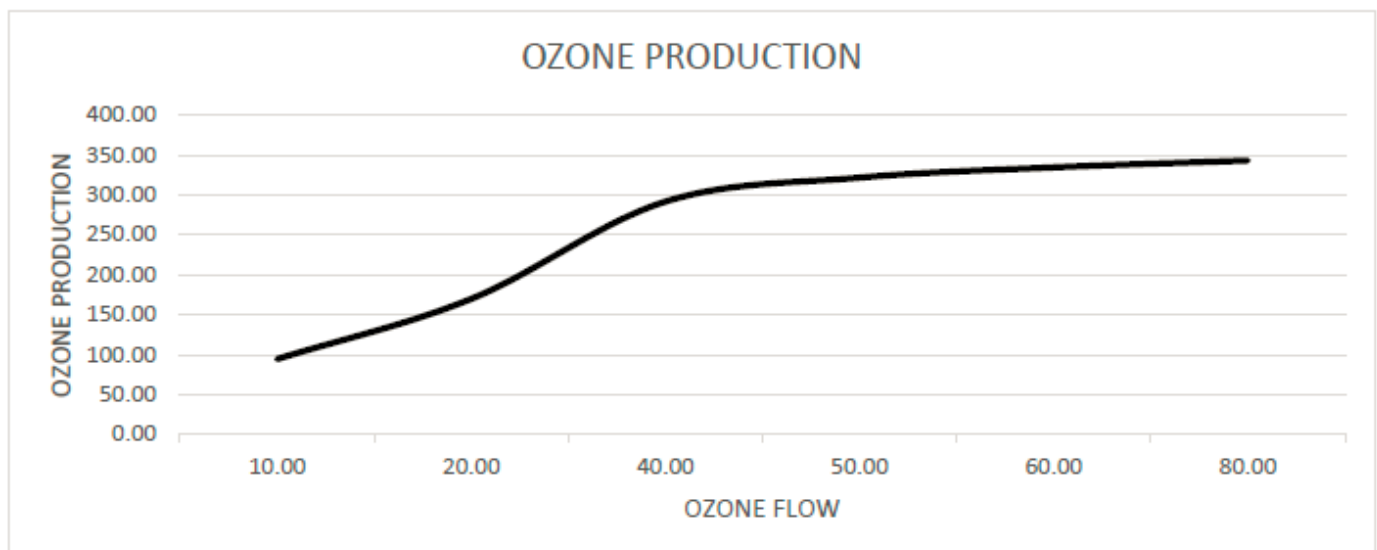
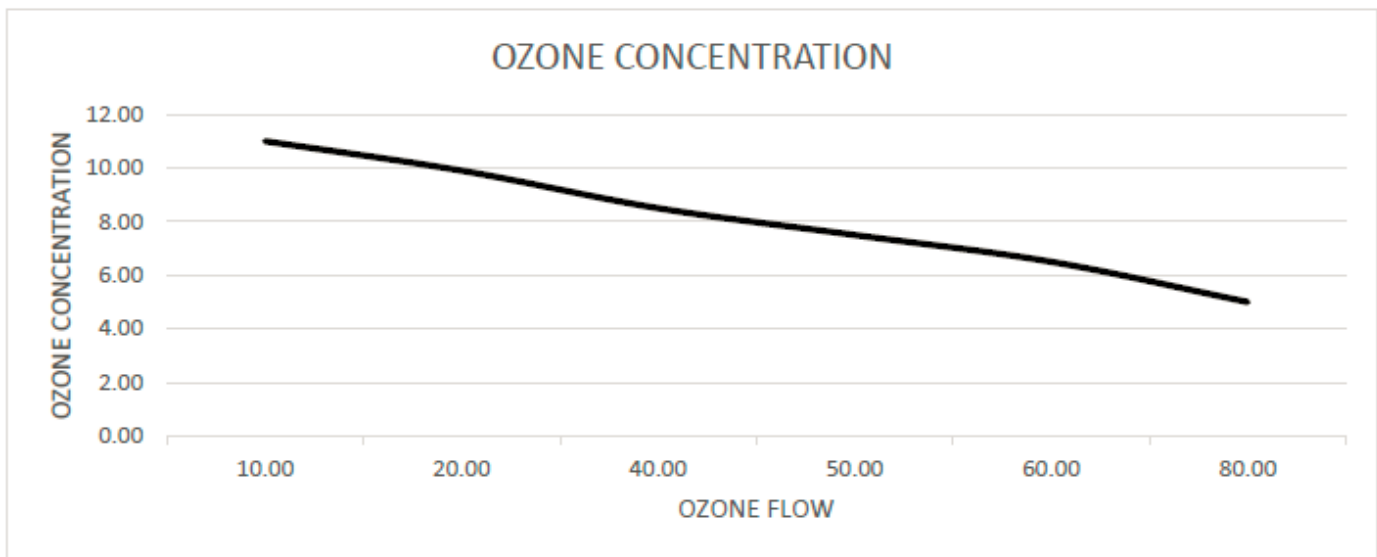
Appendix B - Performance Charts



OZONE GENERATOR PERFORMANCE TEST

TG SERIES OZONE GENERATORS

		Ozone Concentration (% by weight)	Ozone Production (g/hr)
Ozone Flow (lpm)	PSI	TG-300	TG-300
10.00	20	11.00	94.38
20.00	20	9.90	169.88
40.00	20	8.50	291.72
50.00	20	7.50	321.75
60.00	20	6.50	334.62
80.00	20	5.00	343.20



Test was performed at 72°F, running for over an hour. Cooling water @ 30 gph flow rate and 70°
Additional Equipment: Ozone Analyzer API 454 and API 460H

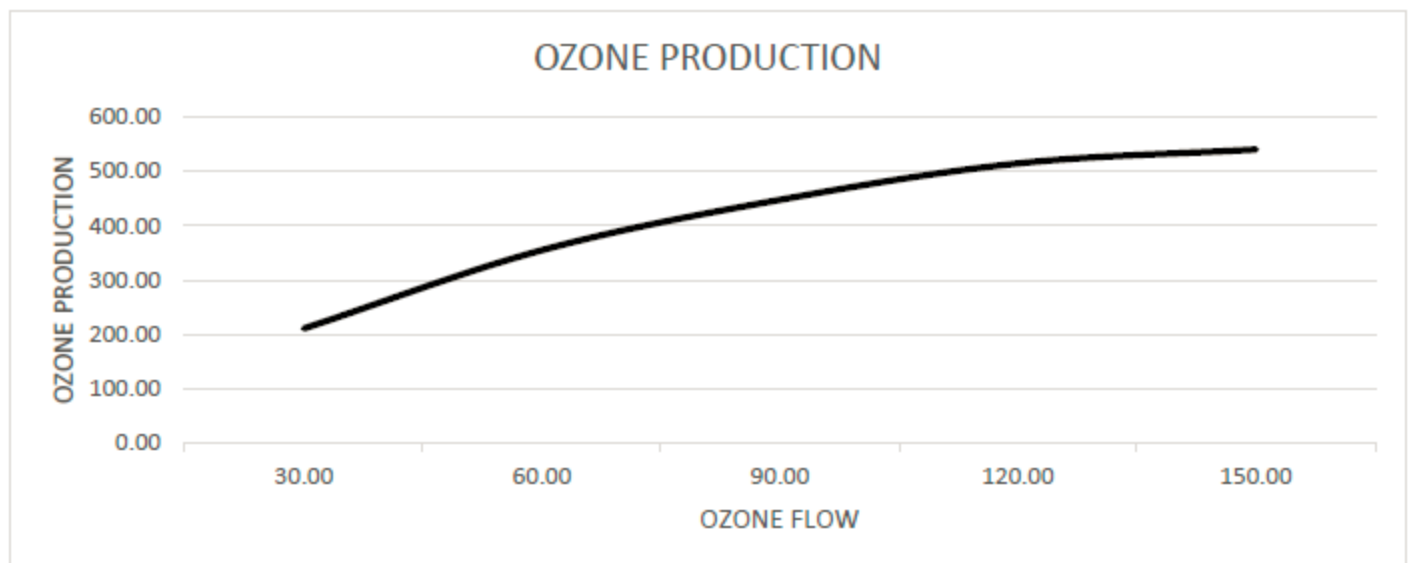
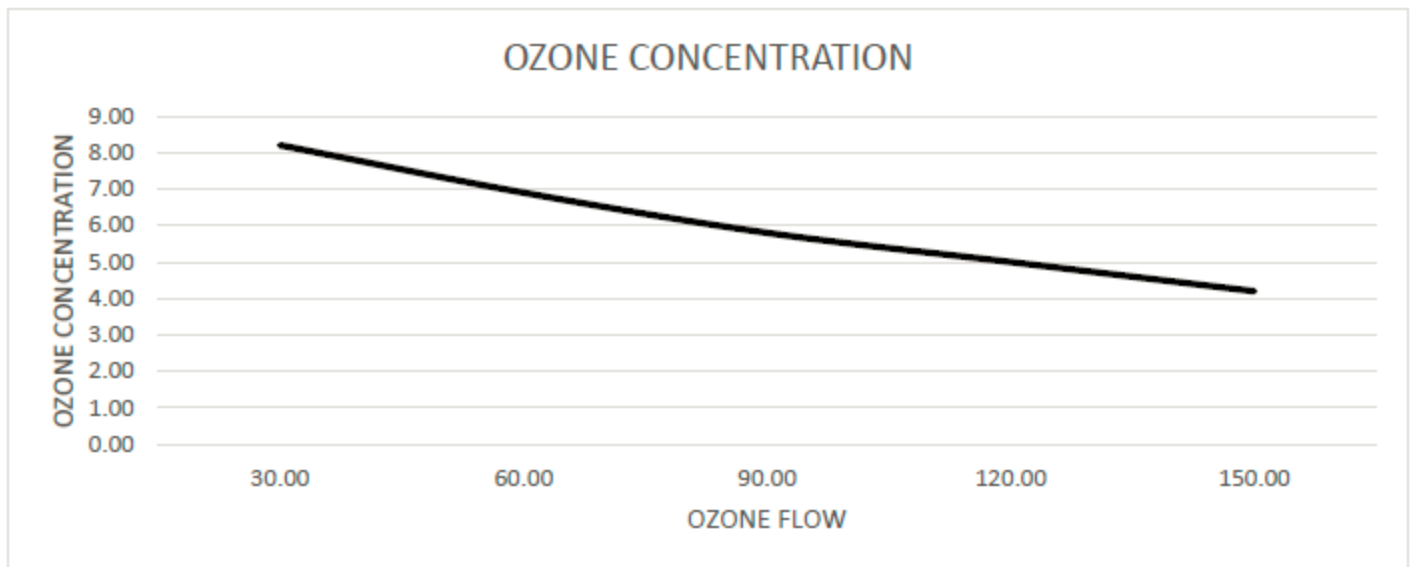
Appendix B - Performance Charts

OZONE GENERATOR PERFORMANCE TEST



TG SERIES OZONE GENERATORS

		Ozone Concentration (% by weight)	Ozone Production (g/hr)
Ozone Flow (lpm)	PSI	TG-450	TG-450
30.00	20	8.20	211.07
60.00	20	6.90	355.21
90.00	20	5.80	447.88
120.00	20	5.00	514.80
150.00	20	4.20	540.54



Test was performed at 72° F, running for over an hour. Cooling water @ 10 GPH and 70° F.

Additional Equipment: Ozone Analyzer API 454 and API 460H

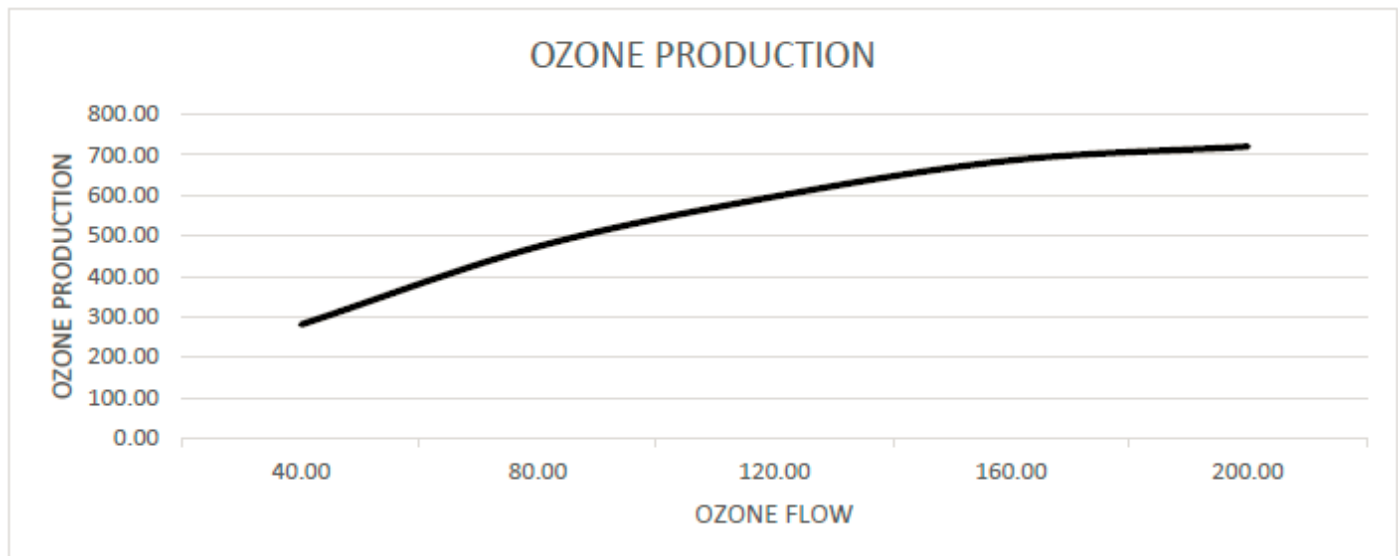
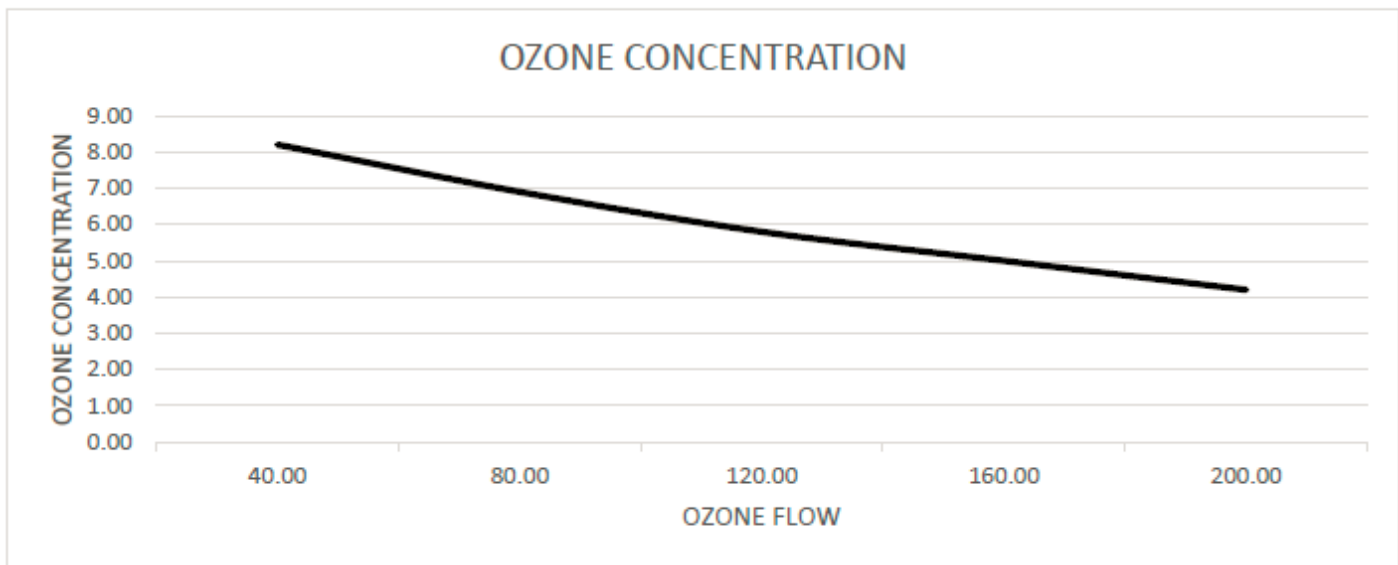
Appendix B - Performance Charts

OZONE GENERATOR PERFORMANCE TEST



TG SERIES OZONE GENERATORS

		Ozone Concentration (% by weight)	Ozone Production (g/hr)
Ozone Flow (lpm)	PSI	TG-600	TG-600
40.00	20	8.20	281.42
80.00	20	6.90	473.62
120.00	20	5.80	597.17
160.00	20	5.00	686.40
200.00	20	4.20	720.72



Test was performed at 72°F, running for over an hour. Cooling water @ 10 GPH and 70°F.
Additional Equipment: Ozone Analyzer API 460H



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