Product Manual

Pacific Water Technology

Ozone Disinfection Skid

Model PWT CUS4512

PACIFIC WATER TECHNOLOGY

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PACIFIC WATER TECHNOLOGY

Table of Contents

Contents

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1.0 Safety

Ozone is a strong oxidiser that is generally not harmful to mammals at low concentrations, however it can be harmful if not handled properly. Ozone may increase sensitivity in individuals with asthma. If you can smell it levels are above what you should be working with. Inhalation of Ozone will cause dry mouth, coughing, irritation of the nose, throat, and chest. It may cause laboured breathing, headaches, and fatigue. If affected, move to fresh air, loosen tight clothing and seek medical attention if required. Ozone in contact with eyes can cause irritation and minor inflammation. Ensure you wear safety glasses. If required flush eyes with large amounts of water for 15 minutes. Ensure you wash your hands before leaving the lab to avoid ingestion or skin contact. Make sure you are wearing a lab coat as any spills of ozonated water will damage clothing.

CAUTION: Do not power up the unit whilst any cover of the ozone generator has been removed/opened.

1. When installing and using the disinfection system, basic safety precautions should always be followed.
2. Be sure all the electrical power is shut OFF at the main circuit breaker before installing the unit.
3. Please read all the information provided in this owner's manual before operating the disinfection system.
4. For water cooled ozone generators, a dedicated water chilling unit or cooling circuit needs to be provided.

General Safety Rules

1. The equipment mentioned in this manual is specially designed for the disinfection of water
2. It is designed to work with water at a temperature not exceeding 30°C.
3. The installation should be carried out in accordance with the safety instructions relating to the safe usage of ozone in water treatment applications.
4. The rules enforced on accident prevention should be carefully followed.
5. Any modification of the system requires the prior consent of the manufacturer.
6. Original replacement parts and accessories authorised by the manufacturer ensure a high level of safety.
7. The manufacturer accepts no liability for the damage and injuries caused by unauthorised replacement parts and accessories.
8. During operation, some parts of the components are subject to dangerous electric voltage. Work may only be performed on the components or on the equipment connected to it after disconnecting them and the starting device from the mains power.

9. The user should make sure that assembly and maintenance tasks are carried out by qualified authorised persons and that these persons have first carefully read the Service and Installation Instructions.
10. The operating safety of the components of the system is only guaranteed if the Installation and Service instructions are correctly followed.
11. The limit values stated in the Technical Specifications should not be exceeded under any circumstance.
12. In the event of defective operation or fault, contact the manufacturer's Technical Support Department or its nearest Authorised Agent.
13. If any of the supply cord is damaged, it must be replaced by the manufacturer or its service agent or a similarly qualified person.
14. This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person.

Read and Follow All Instructions

- Read this manual completely before commencing installation.
- All permanent electrical connections should be made by a qualified electrician.
- Please ensure that voltage and frequency meet the range specified by the ozone generator. Ensure that the ozone unit has been earthed to the main power supply.
- Adequate water backflow prevention should be installed, comprising of an ozone compatible check valve and a backflow prevention device operated with a float.
- **Warning:** To reduce the risk of electrical shock, replace any damaged power leads immediately.
- Follow all applicable wiring standards.
- Electric shock hazard. Be sure to turn power OFF and disconnect from power source before any service work is performed. Failure to do so could result in serious injury or death.
- The ozone generator must be installed in an indoor location ideally in a dry, well ventilated and protected environment. Exposure to the weather/water can cause permanent damage to the ozone unit.
- **Warning:** Short-term inhalation of high concentrations of ozone and long-term inhalation of low concentrations of ozone can cause serious harmful physiological effects. DO NOT inhale ozone gas produced by this device. Please refer to the Safety Data Sheet for short and long-term exposure limits.
- For your safety, do not store or use gasoline, chemicals or other flammable liquids or vapours near the ozone generator.

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2.0 Ozone Summary

Injection of Ozone into Water

As Ozone is a gas, correct contact measures are critical to system design. Bubble diffusers are a popular and inexpensive method for injecting ozone into small volumes of water. The gas transfer occurs immediately at the interface between the bubble surface and surrounding water. A diffuser creates bubbles in the water similar to a fish tank air-stone. The smaller the bubble the better the ozone transfer. For larger volumes of water, a venturi outlet is the best way to inject oxygen. Venturi injectors work by forcing water through a conical body, this creates a pressure differential between the inlet and outlet ports, creating a vacuum inside the injector body. This creates a suction port where the ozone gas is sucked into the water. This method is an extremely efficient way of injecting ozone and required little maintenance, however it is not appropriate for small volumes of water. *Source:* "The definitive guide to understanding Ozone" (Ozone solutions).

Ozone Formulas

Ozone dosage in water = Water flow rate (L/min) x ozone dosage(mg/L) = required ozone production (mg/min)

Ozone dosage is the quantity of ozone applied to the water. This will exceed the amount of ozone absorbed into solution. Ozone not absorbed into the water must be off gassed through an ozone destruct unit, converting it back to harmless oxygen.

Calculate the output of an ozone generator = Flow rate (L/min) x ozone concentration (g/m3) x (1m3 /1000L) = ozone production (g/min)

- Ozone is the most powerful oxidant for disinfecting water and sanitising surfaces.
- Ozone can kill pathogens in seconds versus minutes for other agents.
- Ozone decomposes in oxygen, leaving no harmful by-products.
- Ozone by itself does not alter pH.
- Ozone enhances the flocculation and coagulation of organic material there by improving filtration
- Ozone can be effective in partially oxidising organics in the water to biodegradable compounds that can be removed by biological filtration.

⚠ Environmental Requirements ⚠

- There should be no flammable gas or liquids and no conductive powder dusts in the same location.
- Indoor installation only, with electrical power supply of 220V/50Hz AC.
- Ambient temperature: 10°C to 37°C
- Ambient humidity: ≤75%
- The surface where the ozone generator is to be located should be level and it is recommended for the longevity of the equipment, that the room air is air conditioned or humidity controlled to recommended thresholds.

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Ozone Applications

Ozone is used in a wide variety of applications. Most applications are associated with air treatment or water treatment. There are numerous advantages for ozone applications for water treatment systems. Ozone can improve the quality of aquaculture production water by helping improve solids settling and by reducing nitrite-nitrogen (NO_2-N), colour, fine particulate matter, and microbial activity. Ozone shows excellent potential for many aquacultural systems because of its rapid reaction rate, few harmful reactions by-products, and oxygen produced as a reaction end product.

Examples of Ozone Applications in Aquaculture

Removal of fine and colloidal solids

Fine and colloidal solids consist of particles 1-30 microns (mm) and 0.001-1 mm respectively. The small size of the particles enables the solids to remain in suspension and avoid most mechanical methods of separation. The accumulation of fine and colloidal solids can impair biofilter nitrification efficiencies and stress fish stocks.

Ozone removes fine and colloidal solids by causing clumping of the solids (micro flocculation), which facilitates removal by foam-fractionation, filtration and sedimentation.

Removal of dissolved organic compounds

Dissolved organic compounds (DOC's) or refractory organics, give the water a characteristic tea-coloured stain. DOCs are non-biodegradable and accumulate according to feed input, water exchange rate and the rate of solids removal. High levels of DOC's can stress fish and reduce nitrification efficiencies of the biofilter.

Ozone removes dissolved organics by oxidation into products that are more readily nitrified in the biofilter; including precipitation, which enables removal of waste particles by conventional filtration or sedimentation.

Removal of Nitrite

Nitrite can accumulate as production intensifies and organic loadings on the biofilter increase. Bacteria that process ammonia into nitrite (Nitrosomonas spp) operates more efficiently under high organic loadings than bacteria that process nitrite to nitrate (Nitrobacter) and levels of nitrite rise accordingly.

High levels of nitrite can be toxic to fish. Data available for silver perch, indicates levels of nitrite as low as 2.8 parts per million (ppm) can reduce growth of fingerlings by 5%.

Ozone removes nitrite by:

- direct oxidation to nitrate;
- reducing organic loading, which improves biofiltration efficiency and nitrification.

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Disinfection

The high stocking densities, associated fish stress and increased nutrient loads found in Recirculating Aquaculture Systems (RAS) create an ideal environment for fish pathogens. An important step in reducing the risk of disease outbreaks in RAS is the use of standard quarantine procedures for any fish introduced. Facilities using surface waters, including RAS and flow-through hatchery systems, are also interested in reducing the pathogen load introduced via the source water. The disinfection of effluent waters before introduction to the environment is also crucial to prevent the translocation of exotic diseases.

Ozone can effectively inactivate a range of bacterial, viral, fungal and protozoan fish pathogens. The effectiveness of ozone treatment depends on ozone concentration, length of ozone exposure (contact time), pathogen loads and levels of organic matter. If high levels of organic matter are present, the demand created by oxidising the organic matter can make it difficult to maintain enough residual ozone for effective disinfection.

Production of Ozone

Most commercially available ozone generators use corona discharge to produce ozone. In corona discharge generation, a high-energy electric field is established between two metallic plates and dried air or oxygen gas is fed through the plates. The electrical energy excites a proportion of the oxygen molecules creating atoms of oxygen (O). The oxygen atoms then bond to oxygen molecules in the feed gas to create ozone.

UV light of a certain wavelength (140-190nm) can be used to excite and break the oxygen molecules to generate ozone in a similar way. UV generators are at present a much less energy efficient way of producing ozone.

Use of oxygen as the feed gas increases the yield of ozone corona discharge generation substantially when compared with dried air but has an associated cost.

Ozone Application - System specifications

The design of the ozone reactor or contact vessel is very important for safe, successful ozonation. There is a range of reactors available using various designs to transfer ozone to the water. Designs include fine bubble diffusers, turbine contactors, injectors, deep U-tube reactors, packed columns, static mixers and spray contact chambers. Some designs are also used for oxygen transfer or aeration.

Important considerations when choosing a reactor include:

- ozone transfer efficiency;
- leak-free design and construction;
- construction with ozone resistant materials.

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Materials used in an ozone treatment system must be highly resistant or inert to ozone. Use of improper materials can lead to erosion of the unit and cause dangerous and costly leakages. Such systems are not suitable for the long-term application of ozone and require on-going, high replacement costs. The generation of ozone in systems with substandard materials is also less efficient as ozone is lost as the materials of the reactor are oxidised. The use of some plastics, such as polyvinyl chloride (PVC) and polycarbonate is not recommended for long-term applications for this reason. Galvanised steel is also not recommended.

Stainless steel 316 contact chambers and piping are recommended for use with ozone. Valves should be made of stainless steel 316, with gaskets and membranes of Teflon® or similar

Treatment Regimes

The optimum rate of ozone for disinfection is highly variable and represents the sum of ozone demands from dissolved organics, colloidal solids, nitrate and disinfection. In many situations in ozone disinfection, the cost of production of sufficient residual ozone for complete disinfection after all other ozone demands are met is prohibitive. However, some reduction in pathogen loads can be achieved using moderate levels of ozone, and water quality improvements are considerable.

Disinfection of exchange and effluent water is more cost effective than treating the entire system due to the relatively small volumes treated. Disinfection of source water with ozone, in combination with quarantine procedures for incoming stock, reduces the risk of bacterial contamination within the system.

Exposure standards for residual ozone of various international occupational health and safety administrations range between 0.05 and 0.1 ppm for an 8-hour work period and a maximum single dosage of 0.3 ppm for less than 10 minutes. It is therefore important to repeat the requirements of a leak-free ozone reactor made of suitable ozone resistant materials. Venting of sheds or areas of a RAS where ozone is used is also highly recommended. Humans can detect low levels of residual ozone as a sharp, pungent odour, but continued exposure can quickly dull the senses. For this reason, perceived odour should not be used as an indicator of ozone presence.

Test-kits for the detection of air-borne ozone are commercially available and are a useful tool in helping to ensure the safety of operator personnel.

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3.0 System Specification

The ozone generator is supplied as a packaged system providing disinfection of water for bottling lines. The ozone demand should be relatively low as there are insignificant number of impurities that can potentially react with the ozone.

Water is fed via customer supplied water circuit either via pump or tank outlet. A flow switch and pressure switch will provide a permissive for the start-up of the booster pump and a 50 g/hr. ozone generator. The settings of the pressure switch will have to be set to meet site conditions and the dynamic pressure conditions when water is fed into the ozone system. A booster pump will provide the right conditions to allow for the venturi to

create a vacuum and draw the ozone gas into the liquid line. The by-pass flow will also determine the level of vacuum generated by the venturi. The concentration of ozone can be controlled at the ozone control panel by adjusting the power level. The nominal water flow is 50 lpm and is also restricted by amount of ozone introduced into the water line. For higher flow rates it may necessary to have a secondary by-pass loop that joins after the ozone contact tank. The maximum amount of gas that can be introduced into the venturi is 10 lpm of ozone gas. The gas bubbles should be visible in the static mixer, whereafter the water flows into a baffled stainless steel contact tank. The ozone contact tank will also allow any undissolved ozone gas to collect in the headspace of the tank. A gas phase separator installed at the top of the tank will allow the gaseous phase to vent and that can be reticulated to an ozone destruct unit.

The water exits at the bottom of the tank and an in-line valve generates some backpressure, sufficient enough to allow a side stream to flow to the dissolved ozone cell and sensor. It is important to control the flow and not create back pressure more than

300kPa. The dissolved ozone sensor is rated for a maximum of 2ppm, and once this level is reached the ozone monitor will show overlimit. The GPO outlet for the ozone monitor is located above the ozone sensor flow cell. This GPO remains energised even under no- flow conditions. The by-pass water is fed to the drain. To save water, the bypass flow to the ozone probe can be turned off. It is important to keep the probe moist if it is not used for extended periods.

Two levels of backflow protection have been included in the ozone line:

- Check valve – ozone compatible materials
- Float type water trap

There is also a water-cooling circuit that provides cooling water to the ozone generator.

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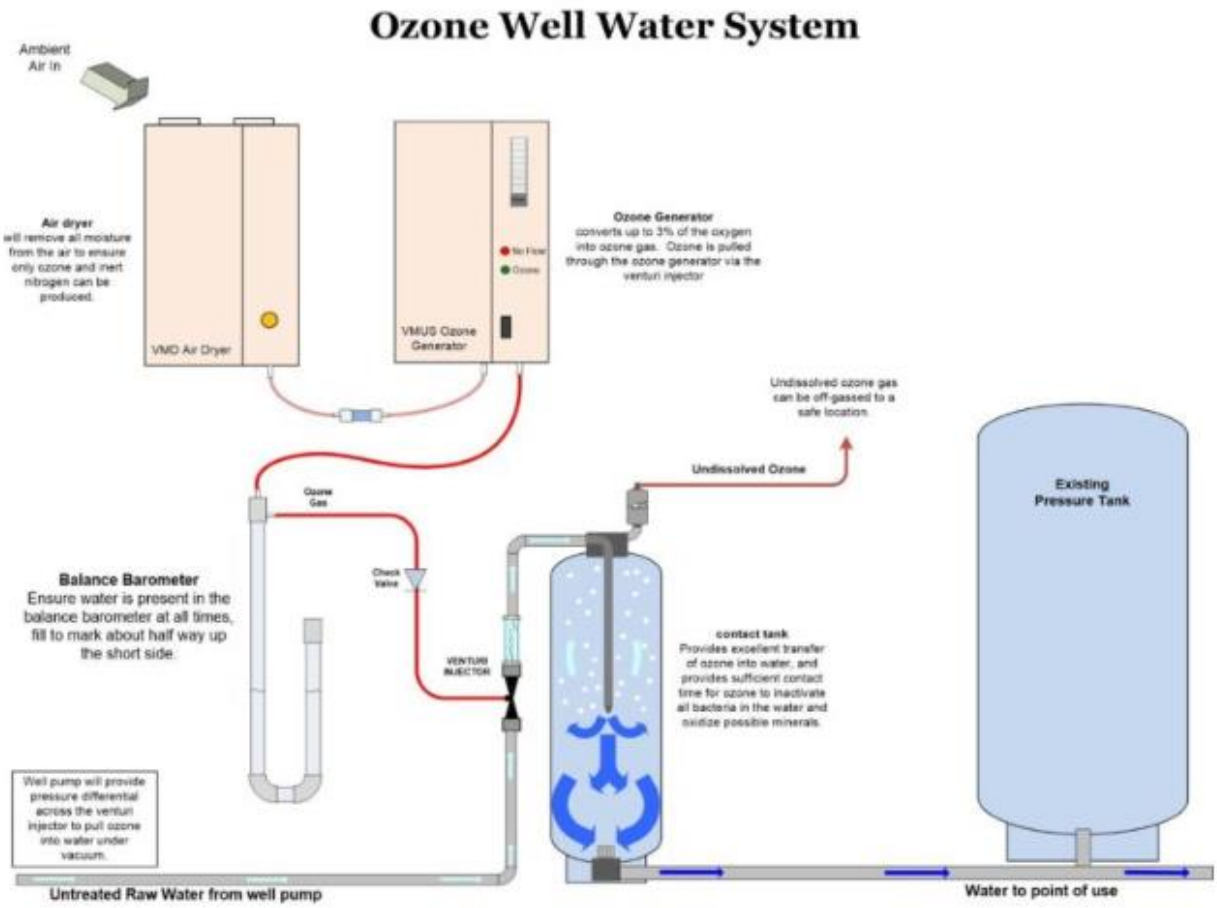
Generic Schematic



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Ozone Generator Parts and Controls

01 - Control System
02 - Oxygen Inlet
03 - Water Cooling Pump 220V
04 - Cooling Water Outlet
05 - Cooling Water Inlet
06 - Ozone Outlet

Structure

Power Lamp: Plug-in, power lamp lighting.
Ozone Lamp: Power switch on, ozone lamp lighting. Alarm: Over temperature or water return generator protection.
Ozone Concentration: variable ozone output 0-100%. Power Button: Press power switch, ozone generator working.
Stop Button: Turn off the ozone generator.
Reset: During alarm statue, normal working conditions after fixing.
Timer: Setting working time, details in Page.10.
Amp Meter: Display generator working current status.

Control System

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4.0 Technical Specification

Ozone Generator FG-OF-50

Item	FG-OF-50	Unit
Ozone Output	50	g/hr
Wattage	1150	W
Power Supply	220-250/50-60	VAC/Hz
Oxygen Concentration	90±5	%
Oxygen Flow Rate	10	L/min
Ozone Concentration	50-80 (Oxygen Supplied)	mg/L
Booster Pump Power	1	HP
Booster Pump Max Flow	3500-5000	L/hr
Output Pressure	2.0±0.5	bar
Contact Tank Capacity	180	L
Size (L*W*H)	800x400x1230	mm
Weight	77	kg

Note: Due to bespoke applications, the CNP pump is customised to suit application.

Dissolved Ozone Analyser:

FG-DOZ5000

FG-DOZ5500

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Dissolved Ozone	Measuring range	0.000 -2.000 mg/L or 0.00-20.00 mg/L	
	Resolution	0.001 mg/L or 0.01mg/L	
	Measuring Accuracy	1%±1 LSD	
Temperature	Measuring range	-10.0～110.0 °C	
	Resolution	0.1°C	
	Measuring Accuracy	±0.3°C	
	Temperature input	22KΩ / PT1000	
	Temperature compensation	automatic	
Signal output	Output range	4～20 mA (adjustable)	
	Current accuracy	1%F.S.	
	Output loading	<500 Ω	
Data interface	RS485	RS485 Modbus protocol	
On off control	Control method	2 SPST relay	
Other parameters	Load capacity	2.5A 230 VAC	
	Cleaning/alarm relay	Optional	
	Working power supply	85~260VAC or 12~36VDC	
	Working temperature	0～60°C	
	Working humidity	< 90%	
	Levels of protection	IP65	
	Method of installation	Panel mounting	Wall-mounting
	Outline dimension	(H×W×D) 108×108×156 mm	158×188×108 mm
	Cut size	94.5×94.5 mm	/
	Weight	0.6kg	0.7kg

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Ozone Destruct Unit

Product Specification

Model:	FG-HM-550
Size:	L 550mm x φ130mm
Voltage:	220-240V/50Hz, single phase
External Case:	Stainless Steel 304
Net Weight:	8.0kgs
Max. Flow Rate:	25L/Min
Heating Temperature:	It will be turned off while surface temperature is >46℃.
Inside Temperature:	160~200℃
Gas Inlet Temperature:	5~35℃
Gas Outlet Temperature:	<60℃

5.0 Installation

Plumbing Requirements

The ozonation skid comes pre-plumbed, however connections need to be made from the water supply side, as well as to the bottling line.

This includes the 1" connections from tank to feed pump as well as a ½" cooling water feed and return line for cooling water. The use of rubber-based suction lines should be avoided – PVC suction lines are acceptable.

- Gaseous Ozone Line: Tygon, Teflon, Kynar or stainless steel (already plumbed up)
- Oxygen Line: high resistance to ignition in oxygen include copper, copper alloys, and nickel-copper alloys - *Note:* Packaged system with internal PSA.
- Ozonated water line: CPVC, Teflon PE, SS304, SS316

Checks Before Installation

Please check the following:

- Check that no components have been damaged or dislodged during transit.
- 220V/50Hz Alternating Current- 10 Amp power supply.
- Emergency Stop Switch
- Environmental Ozone Monitor
- Water back flow prevention device installed
- Check that the ozone generator has been earthed.
- Check cooling water line, correct inlet and outlet connections and adequate flow. Cooling water should be good quality water with low levels of hardness and low levels of contaminants. We recommend the installation of a flow meter to measure flow rate of cooling water and cooling water temperature should range from 5-25°C.

Installation

After ensuring that the equipment is located on a flat surface, please follow the following guidelines:

Cooling Water

Connection of External Water-Cooling Circulation Systems for Ozone Generator

For Water flow rates, please refer to technical Parameters. The cooling water should have a positive pressure whether from water mains or water pump, alternatively via cooling water system. The water must be clean without precipitation and dirt. Install an

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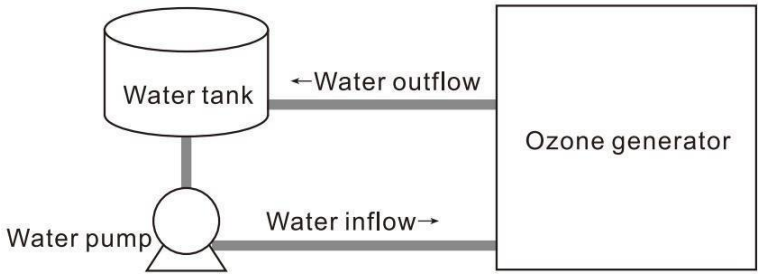
in-line filter and /or water softener for hard water. Otherwise, the scaling from the turbid cooling water in the chamber will influence the cooling effect even reduce the cooling efficiency and ozone output.



The cooling water inlet  and outlet  with DN20 female thread of circulating pump (or tap water) connection equipment should be connected in a circulation loop with water storage tank.

The flow of cooling water ranges from 0.2-0.5 m3/h (subject to the size of water tank): the water pressure is 1-3 bar, the cooling water should be able to circulate without any interruptions; when water flow is lower than 6-7 L/min or the water pressure is small, the safety interlocks of the ozone generator stop ozone generation automatically. Following water cooling failure or low flow, the equipment should be restarted manually. The capacity of the circulating pump should be based on the following flow of cooling water: 0.2-0.5m3/hr.

The difference between water inflow temperature and local temperature should be ±8°C. Water temperature should neither exceed 45°C nor be excessively low.

Note: Cooling water should be clean without impurities, such as tap water; unfiltered water should not be used.

Temperature: must be between 5 °C to 25 °C: If the temperature is too low, the moisture condensation in the ozone chamber will cause an electrical safety hazard. Too high temperature will result in decay in ozone production efficiency.

The Ozone Generator Enclosure should have a drainage hole at the bottom to allow any cooling water leakage to drain out of the enclosure. **Check that this hole is not blocked or obstructed.**

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Gas Line Connections

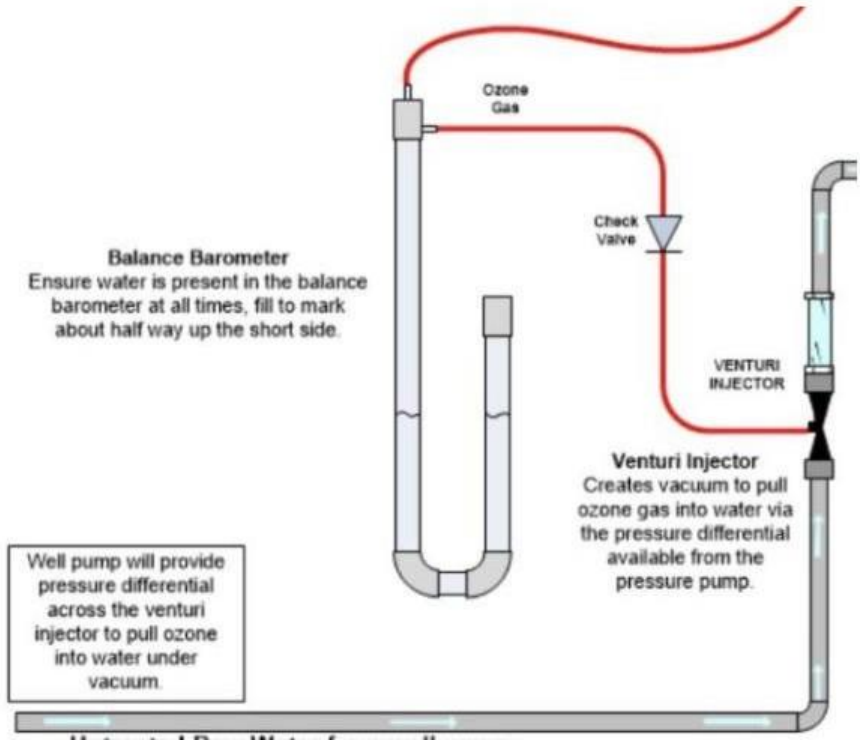
The oxygen line should be connected to the oxygen inlet port, with pressure reduced to not more than 300 kPa. Required oxygen flow should be 10 L/min for the 50 g/hr ozone generator. Compressed air supply into this unit is not recommended. A needle valve should be used to control flow rate unless the flow can be regulated at the flowmeter.

The oxygen supply line and valves need to be degreased and all hydrocarbons removed and properly prepared for oxygen service.

The ozone line should be a 1/4" or 3/8" ozone compatible material - recommended is Teflon or Tygon tubing, alternatively stainless steel SS316.

There should be a check valve installed in the ozone line preventing backflow of water. The check valve recommended is a spring-loaded Stainless Steel 316 check valve with Kynar seals and low crack pressure of 4 kPa.

A secondary level of backflow prevention is recommended which could be either a vacuum break, balance barometer or water trap.



Check that the ozone line has been connected to the ozone dissolver (venturi, ozone mixing pump or sparger). Ensure that there is water flow to create a vacuum, alternatively a flow switch can be installed in the water line to act as a permissive for ozone generator start-up.

Check that power switch at ozone generator is on and indicator light illuminated.

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Checklist -Start-up

1. Check power is on at the ozone generator panel and Emergency Stop is not engaged on the other control box.
2. Check that there is cooling water flow at least 7 lpm not warmer than 25ºC.
3. Make sure blue handle valve after the ozone contact tank is open.

4. Make sure blue handle valve at ozone by-pass loop (near venturi) is closed. Optimise venturi suction only once the system is up and running.

5. Check for any leaks.
6. Startup water flow to the unit – this is a prerequisite for unit to be started (flow switch and pressure switch provides two permissives)
7. Push start button on ozone generator panel (this may be bridged in some units to allow for automatic start-up)

8. Check that there is oxygen flow at oxygen flow meter on the side of the ozone generator.
9. Check that there are air bubbles in the static mixer.

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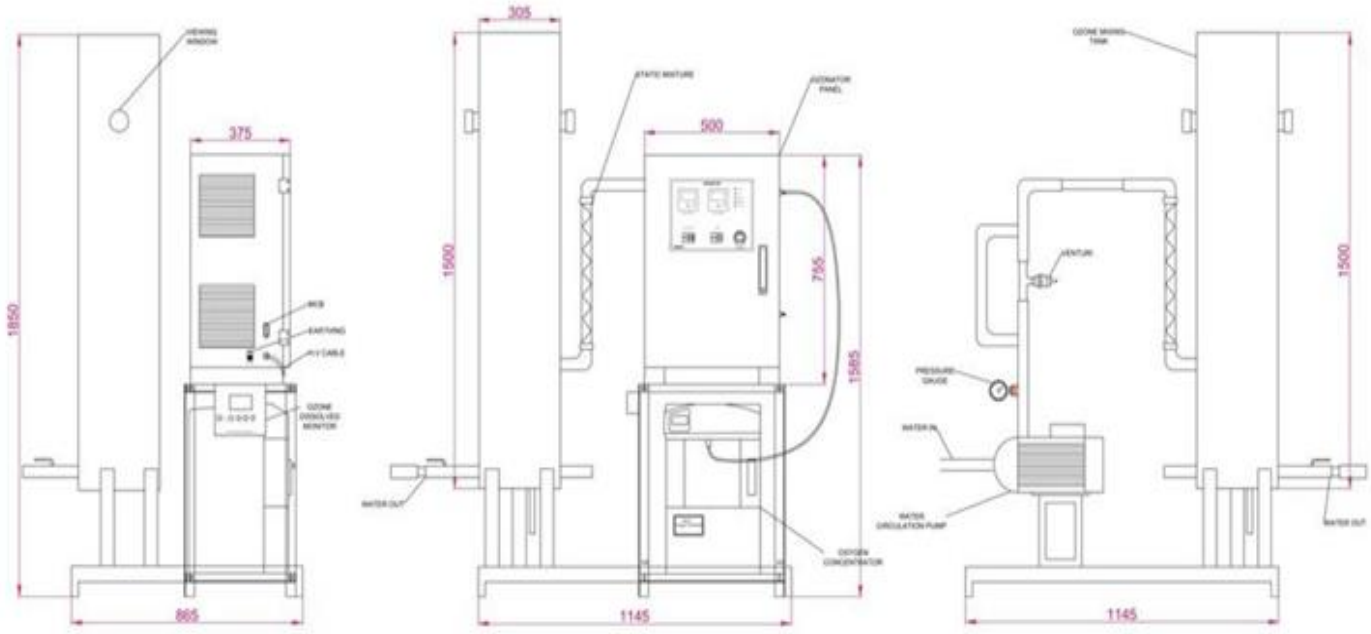
Ozone Generator Startup

1. Cooling Water system should be on.
2. Plug in the power, turn on the "Ozone Switch".
3. Adjust the "Oxygen Flowmeter" to max flow.
4. Adjust the "Ozone Concentration" to 100% or to the required concentration.
5. Press "Reset" in case of an emergency or Emergency Stop button

Ozone Generator Shutdown

1. Adjust ozone concentration to 0%
2. Turn off the ozone generator at the on/off switch
3. Turn off the water-cooling system.
4. Isolate cooing water supply at valve.

Ozone Skid Dimensions:



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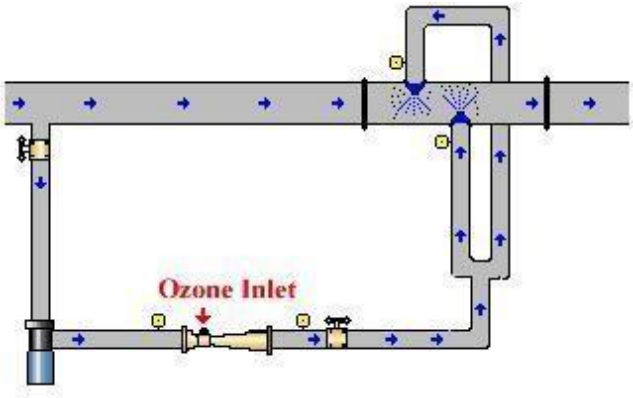
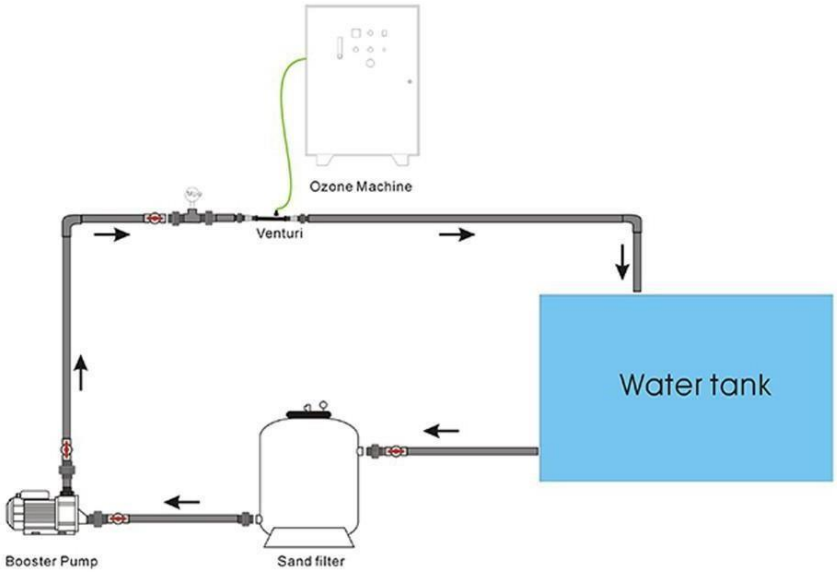
Ozone Generator Setups for Water Treatment

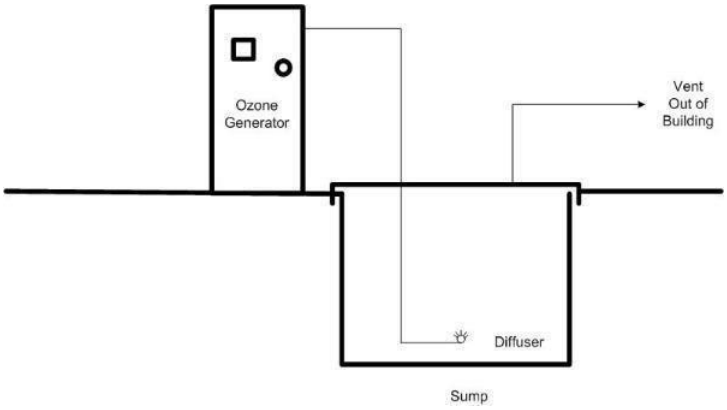
A: Venturi Injector (side stream)



B: Booster Water Pump and Venturi



C: Air Stone or Air Diffuser



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6.0 Maintenance

Cooling Fan

Remove the two screws and clean the fan grill. After working for some time, dust particles will clog the stainless grill, which is used prevent ingress of dust particles air, causing insufficient heat dissipation and damaging the equipment. Periodical washing, once per half or one month is necessary. In a clean environment, the period can be extended.

Ozone Tube

The ozone producing tube has a life expectancy of approximately two years, however, fluctuations in local line voltage may reduce the lamp's life. When the red indicator light stays on, it is time to change the ozone tube maintain optimal performance, we recommend replacing the lamp once a year.

1. Disconnect power before servicing unit.
2. Remove the Ozone Generator from its support if access is limited.
3. Separate the finned Aluminium lamp cartridge from its mounting bracket. It may require the use of a screwdriver to pry the unit loose as these clamps are specifically designed to hold the cartridge securely in place.
4. Separate the electrical connector from the end of the lamp cartridge by rocking the connector back and forth while pulling it in an outward direction.
5. Remove the compression nut, washer and rubber seal from the lamp cartridge by turning the compression nut in a counter-clockwise direction (should be hand-tight).
6. Remove the old ozone tube by sliding it out of the Aluminium cartridge.
7. Reverse this procedure to install the new tube. Ensure the ozone tube is fully seated and straight inside the cartridge.

Changing the Pump Filter

The pump filter may require cleaning or replacing up to every six months depending on the purifier's exposure. Disconnect power before servicing the unit. The filter can be removed and replaced by accessing it through the hole in the back of the purifier with a pair of tweezers or pliers. If there is no filter access hole on the back of your purifier, remove the pump by removing the two mounting screws on the back of the unit. Be careful not to over-tighten the screws when re-mounting the pump.

7.0 Technical Support Services

Technical Support Contact Details

Company	**Pacific Water Technology**
Contact Name	Helmut Dresselhaus
Daytime Contact	+61 7 3376 9009
After Hours Contact	+61 418 240 505
Email Address	sales@pacificwater.com.au

In addition to this Product Manual, if applicable System Operational Diagrams, and Installation Documentation will be provided with the supply of the system.

If relevant information relating to the installation or operation of the system (i.e., Equipment Manuals, Product Specifications) have not been provided, Pacific Water Technology will provide the necessary information at no extra cost.

The fees schedule for alternative items are listed below:

Charge	**Cost**
Normal Time (between 7:45am – 4pm)	$105 plus GST
Saturday up to 10:30am overtime first 3 hours	$130 plus GST
Weekday overtime first hours	$130 plus GST
Saturday Noon State	$155 plus GST
Sunday / Double Time	$155 plus GST
Call Outs (4pm – 7:45am and all day weekend)	$155 plus GST (minimum 4 hours)
Call Out Termination Charge (within the first hour)	$155 plus GST (minimum 3 hours)
Public Holidays	$175 plus GST

8.0 Maintenance Services

Maintenance Contact Details

Company	**Pacific Water Technology**
Contact Name	Raymond Ngu Kek Kui
Daytime Contact	+61 7 3376 9009
Email Address	raymond@pacificwater.com.au

In addition to this Product Manual, if applicable System Operational Diagrams, and Installation Documentation will be provided with the supply of the system.

Please note that maintenance call out fees will be charged by the above contractors. Should you wish to claim under warranty, please liaise through Pacific Water Technology to process the warranty claim.

The fees schedule for non-warranty items are listed below:

Charge	**Cost**
Normal Time (between 7:45am – 4pm)	$105 plus GST
Saturday up to 10:30am overtime first 3 hours	$130 plus GST
Weekday overtime first hours	$130 plus GST
Saturday Noon State	$155 plus GST
Sunday / Double Time	$155 plus GST
Call Outs (4pm – 7:45am and all day weekend)	$155 plus GST (minimum 4 hours)
Call Out Termination Charge (within the first hour)	$155 plus GST (minimum 3 hours)
Public Holidays	$175 plus GST

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9.0 Warranty

General Warranty

Subject to the Pacific Water Technology Pty Ltd (PWT) Terms and Conditions of Sales, PWT warrants all the equipment manufactured by the Seller sold in Australia including service parts, to be free of defects in material or workmanship, under normal use and application for a period of twelve (12) months from the original date of installation, or eighteen (18) months from the date of shipment from the Seller, whichever occurs first.

Service parts furnished as replacements for an in-warranty situation automatically acquire only the unexpired portion of the warranty applied to the original product. The parts to be replaced must be made available, when requested by the Seller.

Reasonable proof of the original installation date or ship date of the product must be presented in order to establish the effective date of the warranty, failing which, the effective date will be based upon the date of manufacture plus thirty (30) days.

Any labour, materials, refrigerant, transportation, freight, crane or any other charges incurred in connection with the performance of this warranty will be the responsibility of the Buyer at the current rates and prices then in effect.

Exemptions

1. Any environmental damage caused by equipment not being located in a dry and cool environment resulting in corrosion of circuit boards and other componentry.
2. Damage caused by back-flow of water into the dielectric ozone tube, the customer is responsible to provide the necessary measures to prevent backflow of water.
3. Equipment being operated contrary to manufacturer's instructions, and any other unauthorised modifications to equipment.

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10.0 Troubleshooting

Common Causes for Ozone Generator not starting:

1. Inadequate flow and pressure – not energizing the two GPOs for the booster pump and ozone generator. Check pressure switch settings / check there is adequate water flow and pressure. Check there is no fault with water flow switch.
2. No oxygen flow – check there is no restriction downstream e.g., check valves. Check there is at least 6 lpm oxygen flow.
3. E-stop engaged
4. Cooling water problems causing Ozone generator to trip: Check there is adequate cooling water flow

Common Failures	Cause Analysis		Solutions
There is no power supply (the indicator light of power supply is off)	Leakage switch disconnects (originally set as being disconnected)		Connect the leakage switch
	Power supply line damaged		Replace power supply line
There is no ozone	There is no high pressure in ozone generation pipe	Condensation occurs resulting from the large temperature difference between cooling water and the surrounding environment, and thus result in damage to ozone generation dielectric tube	Replace damaged ozone dielectric tube
		Inadequate backflow prevention	Install backwater prevention system and replace damaged ozone generation pipe
		Power supply board damaged	Replace damaged power supply board
	There is high pressure but no air source in ozone dielectric tube	Flow meter range not in correct range or valve closed	Adjust flowmeter range or replace flowmeter

		The capacitor of air compressor has failed	Replace the capacitor of air compressor
		The tubing at the air outlet of air compressor is leaking	Replace damaged tubing or fitting
	Ozone leaks	The pipeline at the air outlet end of ozone generator leaks	Replace damaged tubing
		Inspect whether there is any other accessory corroded in the enclosure	Repair or replace corroded accessories
The generator fails to work after being started (the indicator light of power supply is on)	Open circuit failure occurs in the red key (STOP), following which the green key can be pressed to retest whether open circuit occurs		Replace stop switch (STOP)
	AC contactor damages		Replace damaged AC contactor
	The temperature of circulating water exceeds the setpoint value and may have triggered overtemperature protection.		Clean or replace the pipeline for circulating water, reduce the environmental temperature under which the equipment operates, and ensure that the source of circulating water is clean without impurities, and then restart the equipment after properly doing the above maintenance work or reducing the temperature of circulating water to below 45℃

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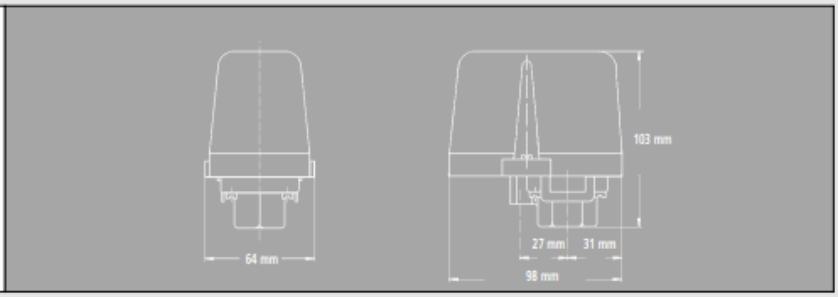
PACIFIC WATER TECHNOLOGY

11.0 Appendix

Pressure Switch:

Control pressure switch MDR 43

max. cut-out pressure 16 bar
transparent cover
1 N.C. + 1 N.O.



TYPES

Control pressure switch
1 N.C. + 1 N.O.

Order reference	ON/OFF Switchknob	Pressure range Poff (bar)	Flange	Weight (g)	Part No.
MDR 43 BAA BAAA xxxA020 XAA XXX	-	0.5 - 3	1/2"	420	212775
MDR 43 BBA BAAA xxxA020 XAA XXX	-	0.5 - 3	1/4"	420	212782
MDR 43 DAA BAAA xxxA040 XAA XXX	-	2.5 - 6	1/2"	420	212799
MDR 43 DBA BAAA xxxA040 XAA XXX	-	2.5 - 6	1/4"	420	212805
MDR 43 GAA BAAA xxxA090 XAA XXX	-	5 - 11	1/2"	420	212812
MDR 43 GBA BAAA xxxA090 XAA XXX	-	5 - 11	1/4"	420	212829
MDR 43 HAA BAAA xxxA120 XAA XXX	-	8 - 16	1/2"	420	212836
MDR 43 HBA BAAA xxxA120 XAA XXX	-	8 - 16	1/4"	420	212843

Cut-in pressure is tightest possible pressure differential

The cut-out pressure is preset

Cable glands for retrofit assembly to be ordered separately, see Accessories!

TECHNICAL DATA

acc. to EN 60947

Rated insulation voltage U_i	500 V
Rated operating current I_e (AC 15)	8 A
Rated operating voltage U_e (AC 15)	250 V
Electrical life (AC 15) Cycles	> 15 x 10^4
Mechanical life Cycles	> 1 x 10^4
Max. electrical cycles Cycles/h	120
Max. mechanical cycles Cycles/h	600

Rated operating current I_e	10 A
Bursting strength Pz	> 60 bar
Permissible medium temperature Air	-5...+ 80 °C
Permissible medium temperature Water	+ 80 °C
Protection acc. to EN 60529	IP 44
Conductor cross-section 1 ... flexible cable 1 x / 2 x	2.5 / 2.5 mm²
Conductor cross-section 1 ... rigid cable 1 x / 2 x	4 / 2.5 mm²

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PACIFIC WATER TECHNOLOGY

Flow Switch:

UB25 SERIES DATA

Electrical Data

MODEL	MODULE TYPE	CONTACT CONFIGURATION	SWITCHED POWER MAXIMUM	SWITCHED VOLTAGE MAXIMUM	SWITCHED CURRENT RESISTIVE AC (RMS)	INDUCTIVE LOADS POWER FACTOR 0.6	TYPICAL APPLICATION
UB25-S	Dry Reed Switch	S.P.S.T. N.O.	48W	240V AC 200V DC	1 Amp	Not Suitable	PLC and General Control Circuits
UB25-C	Dry Reed Switch	S.P.D.T. Break Before Make	28W	140V AC 100V DC	1 Amp	Not Suitable	PLC Control and Safety Shutoff.
UB25-P	Solid State Relay	S.P.S.T.	750W	12 TO 240V AC	Cycle to 40 Amp	44 at 240V AC	AC Control Circuits and AC Motor Controls. Maximum of 1 HP, 2.75kW

Operating Parameters

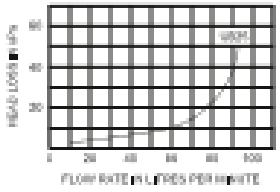
The UB25 Series flow switches are supplied standard fitted with a magnetic piston retainer that allows the switch to be oriented in any required position in pipework. Horizontal pipe work flow can be either upward or downward through the switch.

In addition to the standard magnetic piston retainer, a non-magnetic piston retainer is also supplied with each switch. When the non-magnetic piston retainer is fitted to the switch, the switch must be oriented vertically with flow passing upward through its body. When set up this way the flow rate required to activate the switch will be approximately 0.3 times lower than it is with the magnetic piston retainer fitted. The non-magnetic piston retainer is commonly used to enhance the sensitivity of the switch in gravity feed applications such as boosting water pressure in gravity fed hot water systems.

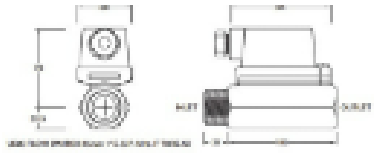
The table below sets out the main operating limitations of the UB25 Series flow switches.

Parameter	As Supplied (Standard with Magnetic Piston/Retainer Fitted)	With Non-Magnetic Piston Retainer Fitted
Switching Point on a Slowly Rising Flow +/- 10%	1.5 L/min	0.35 L/min
Switching Point on a Slowly Falling Flow +/- 10%	1.0 L/ min	0.2 L/min
Minimum Gravity Head Required to Activate the Switch	1.0 Metres	
Maximum Recommended Continuous Flow (Water)	100 L/min	
Maximum Recommended Operating Pressure, Static or Dynamic	200 Bars (2900 PSI)	
Minimum Burst Pressure	400 Bars (5800 PSI)	
Maximum Liquid Temperature	90°C	
Minimum Liquid Temperature	0°C	
Ingress Protection Rating (Weatherproof Rating)	IP67	

Head Loss Data



Dimensions



Helco Engineering Pty Ltd ABN 33 002 824 841

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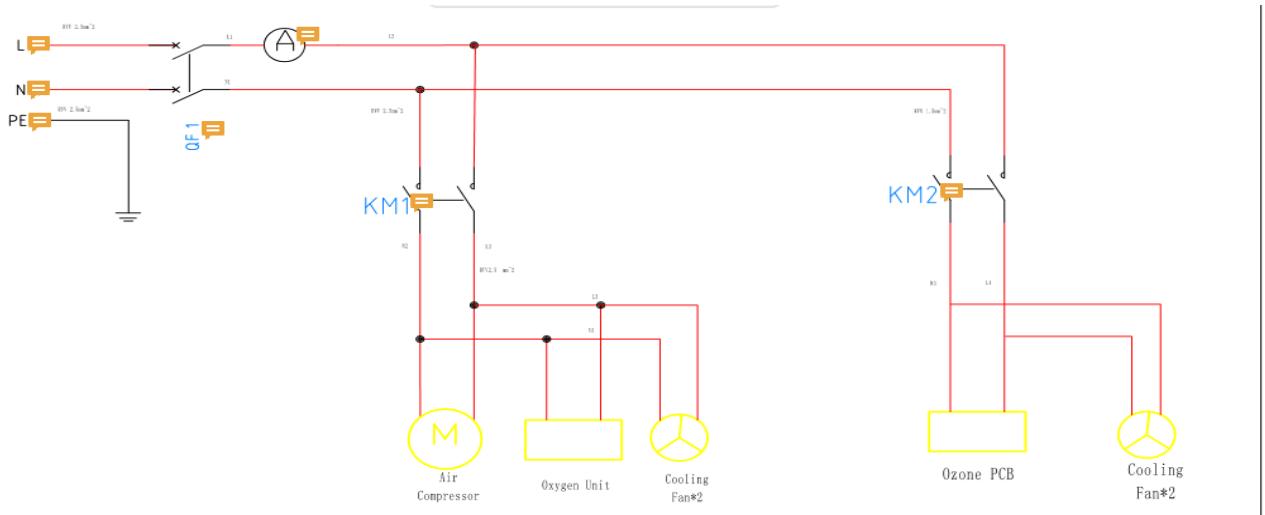
PACIFIC WATER TECHNOLOGY

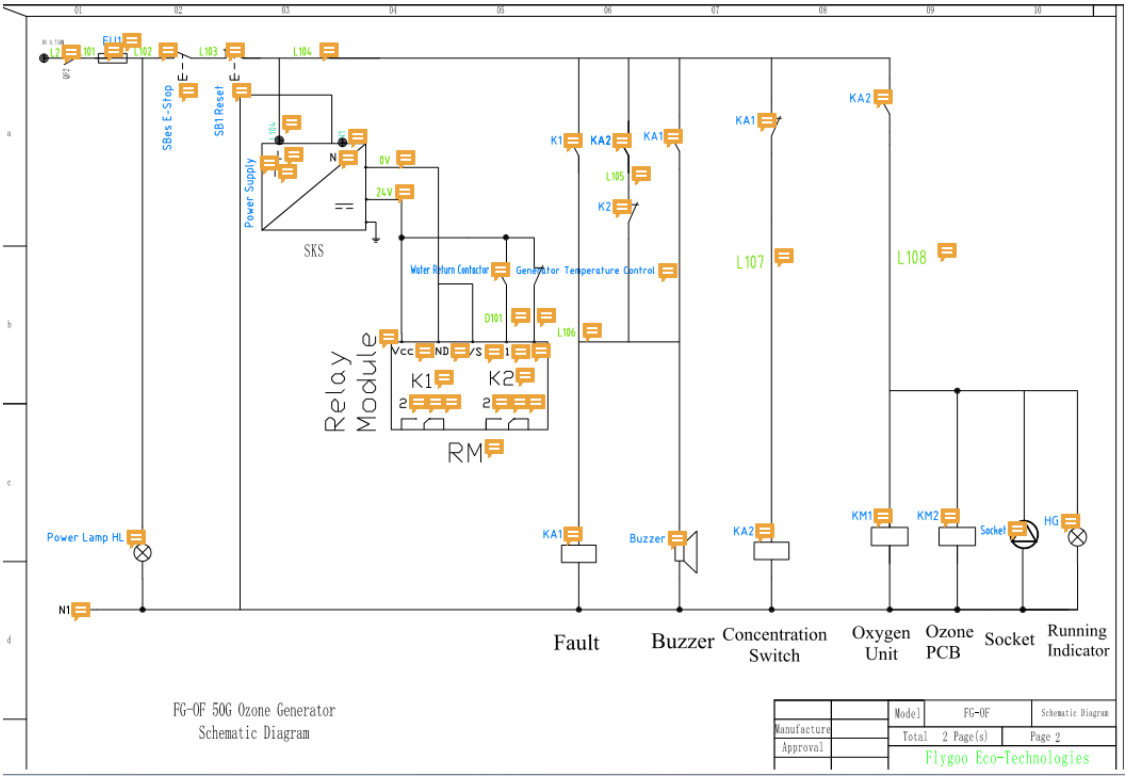
Wiring Diagram:



No.	Symbol	Name	Model	Specification	Qty	No.	Symbol	Name	Model	Specification	Qty
1	QF1	MCB	D16 2P		1	12	SBes	E-stop	Manual type	AC220V 5A	1
2	QF2	MCB	D6 2P		1	13	SKS	Power Supply	S-25-24	25VA	1
3	KM1	AC Contactor	CJX2S-0910	AC 220V	1	14	RM	Relay Module		DC24V 2Line	1
4	KM2	AC Contactor	CJX2S-0910	AC 220V	1	15		Cooling Fan		AC220V	4
5	KA1-KA2	Inter Relay	CDZ9-54P	AC 220V 14feet	1	16	HR	Red Indicator Lamp		AC220V 5A	1
6	M	Air Compressor	Oxygen Unit	AC 220V	1	17	HG	Green Indicator Lamp		AC220V 5A	1
7		10A Socket	Cooling Water	AC 220V	1	18		Buzzer		AC220V 5A	1
8	A	Ammeter	85L1 10A	AC 220V	1	19	SB1	Red Button	Manual type	AC220V 5A	1
9	FU1	Fuse	RT18-32X 2A	AC 220V	1						
10		Oxygen Unit	Adjustable	AC220V	1						
11		Ozone PCB	Adjustable	AC220V	1						

FG-OF 50G Ozone Generator
Schematic Diagram

Manufacture		Model	FG-OF	Schematic Diagram
Approval		Total 2 Page(s)	Page 1
		Flygoo Eco-Technologies (Guangzhou) Co., Ltd.	



FG-OF 50G Ozone Generator
Schematic Diagram

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Approval		Total 2 Page(s)	Page 2
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