Manual

Purusaqua
Ozone installation

Dear Customer

We are honoured that you have chosen for the products of **T**ol **W**ater**T**echniek (hereinafter referred to as TWT). Read this manual carefully so you will use the product correctly and so a correct functioning is guaranteed. If after reading this manual or while using our product you have any questions, please contact your dealer or TWT. We will be happy to help!

Table of contents

1 EG declaration

EC DECLARATION OF CONFORMITY

MANUFACTURER

Company name:	Tol Watertechniek
Full address:	Eesveenseweg 54
Postal code:	8347 JE
Place:	Eesveen
Country:	The Netherlands

DESCRIPTION AND IDENTIFICATION OF THE PRODUCT CONCERNED

Generic name:	Purusaqua® ozone installation
Function:	Ozone Installation for the treatment of (waste) water
Model:	HD
Type:	200, 250, 400, 500, 800
Serial number:	
Commercial name:	Purusaqua® ozone installation

COMPLIANCE

The manufacturer declares that the above mentioned machinery fulfils all relevant provisions of

Machine Directive 2006/42/EC Low Voltage Directive 2006/95/EC
EMC Directive 2004/108/EC

In conjunction with the following harmonised standards and where appropriate other technical standards and specifications

for the risk assessment

EN-ISO 12100:2010

for the design and manufacture

EN-ISO 12100:2010; EN-IEC 60204-1:2006/AC:2010; EN 349:1993+A1:2008; EN 61310-2:2008; EN-IEC 61310-3:2008; EN 61000-6-1:2007; EN-IEC 61000-6-2:2005/C11:2005; EN 61000-6-3:2007/A1:2001; EN 61000-6-4:2007/A1:2011; EN-ISO 3744:2010;

Place: Eesveen

Identity: Bas van Tol
Position: Owner

Date: 14 March 2013

Signature:

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Model:	AS
Type:	200, 250, 400, 500, 800
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Place: Eesveen

Identity: Bas van Tol
Position: Owner

Date: 14 March 2013

Signature:

2 Safety

Using ozone in a wrong way can result in life threatening situations. Carefully read this manual before you start using ozone equipment

Ozone inhalation can be very harmful to your health, avoid inhalation of ozone at all times. See the table below for possible symptoms and corresponding first aid.

Contact	Symptoms	First aid
Inhalation	Cough Irritation of lungs Headache Dyspnoea	Breath fresh air as soon as possible Visit the hospital if necessary
Eyes	Irritating eyes Running eyes	Breath fresh air as soon as possible Flush eyes at least a few minutes with clean water Visit the hospital if necessary

Note!
Ozone is very dangerous when used improperly, if you have doubts or want to know something about the use of ozone please contact us or one of our dealers.

2.1 Intended scope

The products described in this manual are intended to be used for the treatment of slightly contaminated water. Water of pools, ponds, aquariums and light industry or similar for example.

The use of these products in a different situation than recommended may result in personal injury and possible premature wear of the equipment.

2.2 Risks in the use of ozone equipment

Despite the fact that our products are designed in such a way that the risks are minimalized there is always a risk of dangerous situations. Ozone leakage is main risk involved in the use of ozone equipment. Often ozone leakage is caused by:

- The use of non-ozone resistant materials such as hoses, pipes and gaskets.
- Using too humid air.
- Non / poorly tightened couplings.
- poorly bonded joints in pipe work.

During the operation of the ozone installation no ozone smell may be present. If there is an ozone smell immediately turn Off the system and contact us or one of our dealers.

We strongly advise to annually service your ozone installation. This service includes the following points:

- The condition of hoses and tubing.
- Cleaning of the ozone generator and if desired the ozone tube is cleaned.
- The air dryer and residual ozone destroyer are checked.

3 Requirements regarding the installation environment

Ozone generators

Ozone generators should be placed in a dry and cool environment protected against direct sunlight and rain. Good ventilation should be provided as well. Around the high voltage electrodes a small amount of ozone can be formed. If insufficient ventilation is provided ozone can accumulate to dangerous levels.
Insufficient ventilation also will lead to condensation inside the ozone generator which can result in defects. Moist feeding gas results in the formation of nitric acid which will cause damage to the ozone tube. The air flow trough an ozone generator should be maintained at all times, even if the ozone generator is witched Off. The only exception is when if the ozone generator is stored for a long period of time.

Ozone reactors

Ozone reactors should be protected against freezing and direct sunlight as this may damage the plastic parts.

Peripherals

Peripherals such as ORP controllers and air dryers should be placed in a cool but frost-free and dry environment protected from direct sunlight and rain.

Electrodes

It is of great importance that the cable inlet of the electrode remains above water at all times. Therefore it is preferred to use a flow trough assembly to mount the electrode . Electrodes are not suited in systems operating under high pressure. The use only permitted in places with a pressure below 0.3 bar.

Defects caused by neglecting these installation requirements will not be covered by warranty!

4 Brief explanation about ozone

The use of ozone is a very good addition to your existing filter system but it never can replace your filter.
A lot of information about ozone can be found at internet but unfortunately a lot of it is incorrect or incomplete. Some of these point are explained below. More information can be found at our website: www.tolwatertechniek.nl

4.1 What does ozone do

- Removes discoloration, pheromones, medicine residues, etc.
- Converts nitrite into nitrate.
- Kills bacteria, parasites and viruses.
- Make pond water crystal clear.
- Reduces the oxygen consumption of ponds

4.2 Recommended configuration of a complete ozone system

A complete ozone system should contain the following components to assure a proper functioning::

- Condensate trap
- Air dryer
- Ozone generator
- Ozone reactor
- Residual ozone destroyer
- ORP controller
- ORP electrode
- Flow trough armature

4.3 Inaccuracies about ozone

- **Ammonia / Ammonium**
  Ozone barely oxidizes ammonia in contrast what is often claimed.

- **Oxygen**
  Ozone does not increase the dissolved oxygen level more as a normal air pump would do. Ozone does reduces the oxygen consumption of a pond, something which isn't possible by a normal air pump.

- **Risk of diseases**
  When used under normal conditions ozone will reduce the risk of diseases in your pond but not in such an extent that it is bad for the health of fish. When used in a wrong way fish can be susceptible for diseases. Ozone only reacts with substances which are pumped trough the ozone reactor, when properly used it will not affect your biological filter.

- **Required amount of ozone**
  In most cases 1 gram of ozone is enough to treat 20m³ of water if a good ozone reactor is used. Higher dosing rates are not only unnecessary but can even be dangerous due to the higher ozone concentration in the residual ozone.

5 Ozone generator

This chapter describes the Basic series ozone generator. The Basic series ozone generator exists out of the following types: O3-1000B, O3-3000B and the O3-5000B.

5.1 Explanation about the product

The connections and controls of the Basic series s ozone generator are described in this paragraph. Below the connections of the ozone generator are shown.

Mains lead

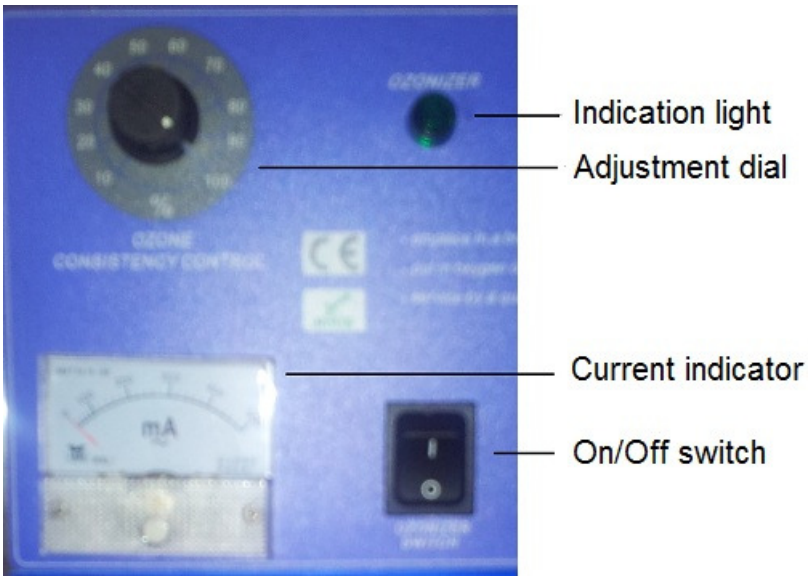
The mains lead is the power source of the ozone generator. The ozone generator only may be connected to earthed wall sockets. The operating voltage is 230V with a frequency of 50Hz.

Oxygen in

This is the air or oxygen input of the ozone generator. The Basic series ozone generators can be operated on oxygen and dry air. For pond and pool applications dry air will be sufficient.
Never disconnect the hose connected to this connection when the ozone generator is active. This can cause a back flow of water in some cases which may result in damage.

Ozone out

This is the ozone output connection. During operation this is the connection we're the ozone comes out. This connection is connected to the "ozone inlet" on your ozone reactor of static mixer. Never disconnect the hose connected to this connection when the ozone generator is active. This will cause in ozone leaking into the room with possibly injuries as a result.



Indication light
This light is ON if the ozone generator is active and is OFF if the ozone generator is inactive.

Adjustment dial
With the adjustment dial it is possible to adjust the ozone output between +/- 40% and 100%. If the adjustment dial is turned back to far the indication light will turn OFF. This indicates that there is no ozone produced.

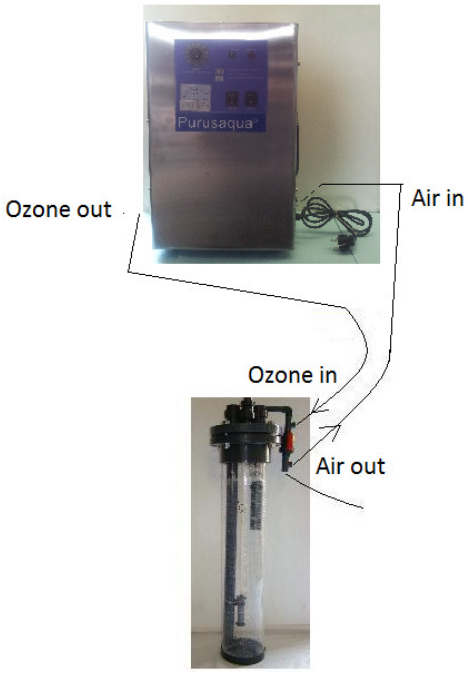
Current indicator
The current indicator indicates the actual power consumption of the ozone generator. De overconsumption is shown in milliampère. The lower the ozone output is set by the adjustment dial the lower the indicated power consumption will be.

On/Off switch
With this switch you turn the ozone generator On and Off.

5.2 Installation of the ozone generator

Place the ozone generator on a flat surface, preferably in a dry and well ventilated room protected form direct sunlight. Be sure that the ozone generator is placed level and stable. Placing the ozone generator in a moist environment can lead to defects. Only supply power to the ozone generator by a wall socked which is earthed. Connecting the ozone generator to a non earthed wall socket can have life threatening consequences.

In the image shown below an example is given how the ozone generator should be connected to the ozone reactor. The connections on the ozone generator and the ozone reactor are marked on the same way as shown in the image.



5.3 Control if the ozone generator is properly connected

First carefully check if all hoses are connected in the right way and if the ozone generator is connected to an earthed wall socket.
To check if the air flow is right disconnect the hose connected to the "ozone in" at the ozone reactor. You should be able to feel air flowing. If this is not the case re-check if all hoses are connected right. If you do feel air flowing don't forget to re-attach the hose to the "ozone in" connection of the ozone reactor!

5.4 Commissioning the ozone generator

Make sure the air pump is turned on before you turn on the ozone generator. Set the adjustment dial at approximately 50% and turn on the ozone generator by the On/Off switch. Now you can set the ozone output to the desired value by adjusting the adjustment dial.

5.5 Decommissioning the ozone generator

If you want to decommission the ozone generator but you want to remain it connected to the ozone reactor be sure that the air flow is maintained! This prevents the ozone tube from oxidizing. If you want to store the ozone generator during winter time it is preferred to store it at a dry and warm place such as an attic.

5.6 Maintenance

Before you start with maintenance on the ozone generator be sure that it is disconnected from the mains!
The maintenance on the ozone generator exists out of cleaning the ventilation screen and the housing. The housing can be cleaned with a moist cloth. The ventilation screen can be cleaned with a soft brush ort carefully with compressed air.

It is also recommended to send the ozone generator in for cleaning of the ozone tube. You can sent the ozone generator to your dealer for this. Inside the ozone generator there are no parts that you can replace yourself. By opening the ozone generator warranty is immediately voided.

5.7 Problem solving

The On/Off indication light doesn't lid:

- Check if the plug is inserted in the wall socket.
- Put the "On/Off" switch to On.
- Check the fuse and replace if needed with one of the same value.
- Set the adjustment dial to a higher value.

There is no ozone coming out the ozone outlet:

- Check the connected air pump.
- Check the hoses for leaks and kinks.

There is a gas flow coming out of the ozone outlet but it isn't ozone, the indication light doesn't light up:

- Check if the plug is inserted in the wall socket.
- Put the "On/Off" switch to On.
- Check the fuse and replace if needed with one of the same value.
- Set the adjustment dial to a higher value.

There is a gas flow coming out of the ozone outlet but it isn't ozone, the indication light doesn't light up:

- Set the adjustment dial to a higher value.
- High voltage power supply or ozone tube defective, get in contact with your dealer.

Water has entered the ozone generator:

- Immediately shut Off the ozone generator.
- Let it of for at least 24 hours while the air flow is maintained.
- Now adjust the ozone production to 50% by the adjustment dial and turn On the ozone generator. The indicated current should stabilize within one minute at a fixed value. If this isn't the case turn Off the ozone generator and get in contact with your dealer.
- If the current does stabilize let the ozone generator On at 50% for 24 hours.
- After 24 hours you can set the ozone production to any desired value by the adjustment dial.

Repair may only be performed by qualified personnel. Repairs performed by none authorized personnel will void warranty. Maintenance only should carried out after the plug is disconnected form the wall socket. If your problem is not solved by following one of the above procedures please get in contact with your dealer.

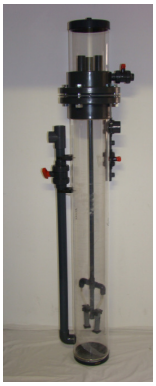
5.8 Technical data

	O3-3000B	O3-5000B
Ozone yield (air as feeding gas (gr/hr)	2	2,5
Recommended air flow (l/min)	15	20
Ozone yield (oxygen as feeding gas (gr/hr)	6,5	8
Recommended oxygen flow (l/min)	5	5
Cooling	Air	Air
Dimensions (cm)	35x25x52	35x25x58
Power consumption (watt)	85	105
Maximum operating pressure (bar)	0,5	0,5

6 Ozone reactor

In this chapter the different types of ozone reactors are described. Below a picture of the currently available ozone reactor is shown.

HD series



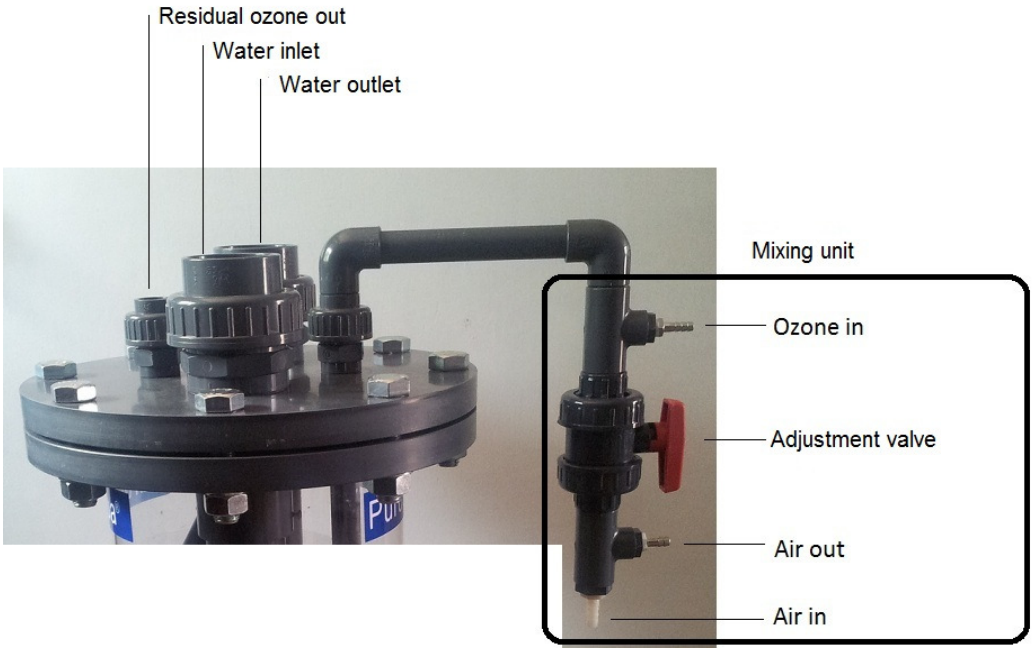
AS series

6.1 HD Ozone reactor

The HD series ozone reactors is one of the few ozone reactors which can be placed above and under the water level of a pond or pool. The HD series ozone reactor is also suited to operate with fluctuating flows. Is preferred to use a separate pump to feed the ozone reactor to keep the fluctuations within acceptable boundaries.
This type of ozone reactors are extremely efficient. This efficiency is achieved by an optimal use of the applied ozone and the injection of ozone under an elevated pressure. The HD series ozone reactors are currently available in three different models, he HD-200, HD-250 and the HD-400. The functioning of these models are identical, the only thing which is different is the diameter of the reactor.

6.1.1 Explanation of the product.

This paragraph describes how the ozone reactor should be connected and how it should be commissioned. In the picture below the different connections and controls are shown:



Residual ozone out
The injected mixture of air and ozone must be able to exit the ozone reactor, this happens via the residual ozone outlet. The gas which exits the ozone reactor still contains ozone because not all injected ozone will react with organic material and other debris present in the water. Therefore it is important that a residual ozone destroyer is used.

Water inlet
This is the water inlet of the ozone reactor, the water pump is connected to this connection.

Water outlet
This is the connection out which the with ozone treated water will come. This connection is easily recognized because it is the long tube which runs almost to the bottom of the ozone reactor. Keep the connected pipe diameter equal to the diameter of the couplings on top of the reactor. Don't connect narrower pipes!
We advise to place a ball-valve in the pipe connected to the outlet of the ozone reactor at a easily accessible place. If the reactor is placed in such a way that it can transfer water by gravity then you could adjust the water level inside the ozone reactor by this ball-valve.

Mixing unit
This is the part of the ozone reactor to which the ozone generator and the air pump are connected to.

Ozone in
The hose coming from the "Ozone out" connection of the ozone generator is connected to this connection on the ozone reactor.

Adjustment valve
If a large air pump is used which gives much more air then the ozone generator needs (see specifications), one can divert a part of the gas flow around the ozone generator. In most cases this ball-valve is closed!

Air out
A hose is connected to this connection and it is connected to the "Oxygen in" connection on the ozone generator.

Air in
The air/oxygen supply is connected to this connection. Usually this is an air pump or oxygen concentrator.

6.1.2 Installation of the ozone reactor

The HD series ozone reactors must be placed on a flat and stable surface. Be sure that the surface on which the reactor is placed is solid. A ozone reactor filled with water will weigh between 50 and 150 kg! Place the ozone reactor in a dry and well ventilated space out of direct sunlight.

There are a few points you should take into account:

- Don't narrow the pipes connected to the water inlet and outlet. The HD250 for example has water connections with a diameter of 63mm. The connected pipe work at least should be 63mm as well.
- Don't let flow the water out of the ozone reactor directly into your pond. Best is to let the water out of the reactor flow into your pre-filter such as a vortex or sieve, plant filter, or last filter chamber of a multichamber filter. If none of the above options can be applied in your situation it is best to let the water flow through a activated carbon filter before it enters your pond.
- Never place an UVC lamp at the output of the ozone reactor! This can lead to the formation of hydrogen peroxide and OH radicals, both are highly aggressive substances. A UVC lamp always should be placed before or in parallel with the ozone reactor.

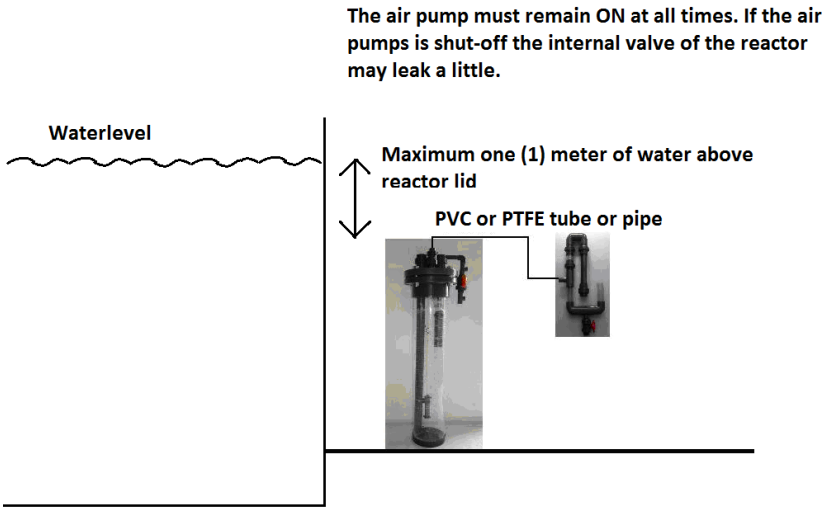
- Use ozone resistant materials such as PVC, stainless steel 300 series, PTFE and silicone to connect your ozone equipment. The use of other materials will lead to dangerous leakages of ozone gas!

Ozone reactor installed above water level:

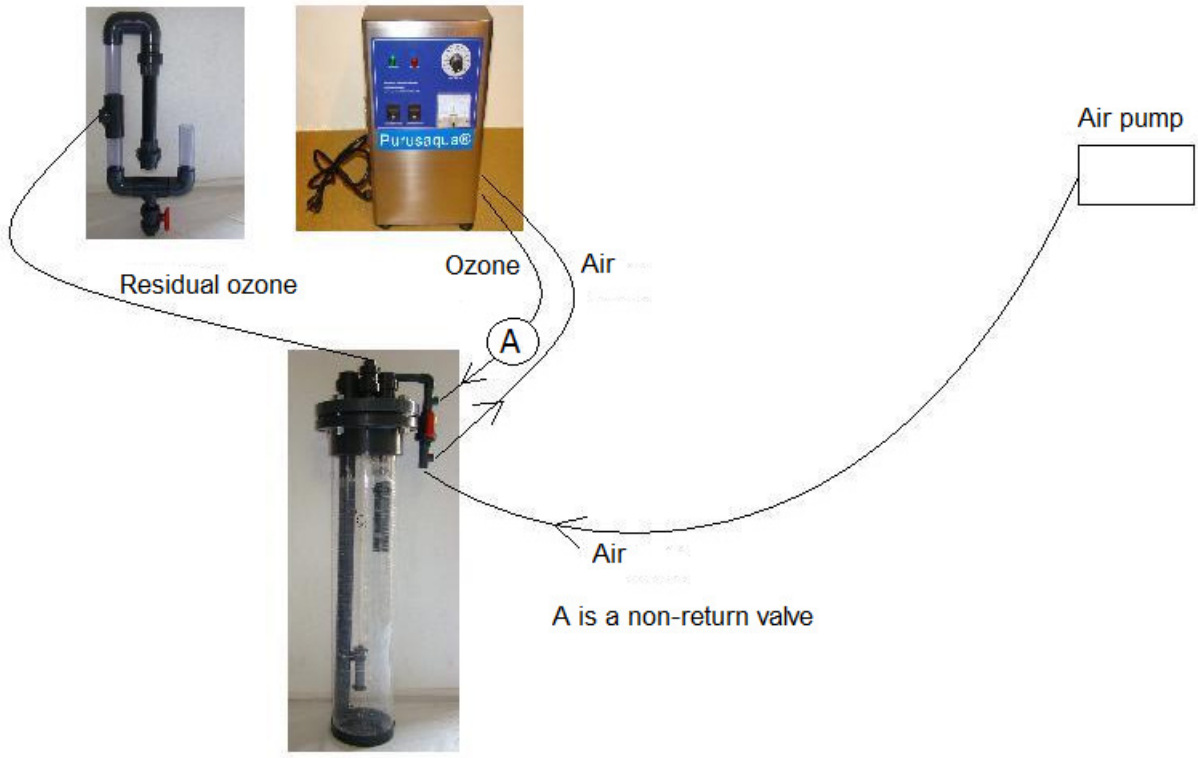
In this case it is wise to install a ball-valve in the outlet circuitry of the ozone reactor. This ball-valve should be turned completely open before commissioning the ozone reactor. By the use of this ball-valve the water level inside the ozone reactor can be adjusted in case the system have the tendency to transfer water on gravity base.

Ozone reactor installed at or below water level:

The HD series ozone reactor are suited to be placed under the water level. The maximum water level above the ozone reactor is one (1) meter. This means that the lid of the ozone reactor may be placed below one (1) meter of water. There is one important condition, the air flow through the ozone reactor must be maintained at all times. The internal level adjusting valve can leak a little which causes a small amount of water to enter the residual ozone destroyer. Usually this no problem because excess water in the residual ozone destroyer is drained to the sewer. Maintaining the air flow prevents water spillage.
Keep in mind that your air pump must be strong enough to overcome the pressure caused by the ozone reactor AND the water column above the ozone reactor!



Schematic representation:
Below a schematic representation is given which shows how the ozone generator should be connected to the ozone generator:



6.1.3 Control if the ozone reactor is properly connected

Turn On the air pump before you start with this procedure. Now briefly start the water pump so that the water level inside the ozone reactor is just above the ozone diffuser (blue stone). During this brief period you should hear and feel air exiting the ozone reactor via the residual ozone connection. As soon as the water level is above the diffuser you should see small bubbles entering the water. If this is not the case please thoroughly check all connections related to the air pump, ozone generator and ozone reactor.

6.1.4 Commissioning the ozone reactor

In this paragraph commissioning the ozone reactor is described. First follow the steps described in chapter 5.1.3 before you start commissioning the ozone reactor!

First check the following point before you proceed with commissioning the ozone reactor:

- If a ball-valve is paced in the outlet of the ozone reactor be sure that it is fully open.
- Check if the air pump is switched On.

Switch On the water pump and observe the bubbles around the diffuser. These bubbles should remain visible all time during commissioning the ozone reactor. If at a given time the bubbles aren't visible anymore the pressure at the outlet of the ozone reactor is to large. Or the air pump is not powerful enough.

As soon as the reactor is filled with water the water should flow out to the outlet of the ozone reactor. If the ozone reactor start transferring water out of its own (the water level starts to decrease while the water pump is On) gently close the ball-valve in the water outlet a bit until the water level starts rising again.

Check again if there aren't any leaks and draw attention to the connection between the ozone reactor and the residual ozone destroyer. If you are convinced that there are no leaks you can switch On the ozone generator.

6.1.5 Maintenance

The maintenance at the ozone reactor exists out of regularly cleaning the outside of the reactor by a moist cloth.

You also should replace the diffuser annually. In order to do this unscrew the bolts which keep the lid in place. Now you can lift the lid of the reactor. The diffuser can be reached now and can be easily unscrewed. Be careful that the bolts are gently tightened when you place the lid back on the ozone reactor.

6.1.6 Problem solving

During normal operation water is coming out of the residual ozone outlet:

- The pressure applied to the outlet of the ozone reactor is to large. Open the ball-valve in the outlet of the ozone reactor.
- The internal level adjustment valve is dirty.
- The reactor is placed to far below the water level, lid of the reactor more as one (1) meter below the water surface.
- A too small diameter of the pipe connected to the outlet of the ozone reactor.
- The water flow is to large.
- The air flow is to little.

The water level inside the reactor is to low:

- Gently close the ball-valve in the outlet of the ozone reactor. Adjust it so the water level is just high enough.
- The interval level adjustment valve is stuck.

No bubbles can be seen around the diffuser:

- One of the hoses is kinked or contaminated.
- The diffuser is dirty.
- The air pump is defective or not capable of delivering the required pressure.
- The ball-valve in the outlet of the ozone reactor is closed.
- The pressure applied to the outlet of the ozone reactor is to big.
- The non-return valve in the hose between the ozone generator and ozone reactor is placed the wrong way around.

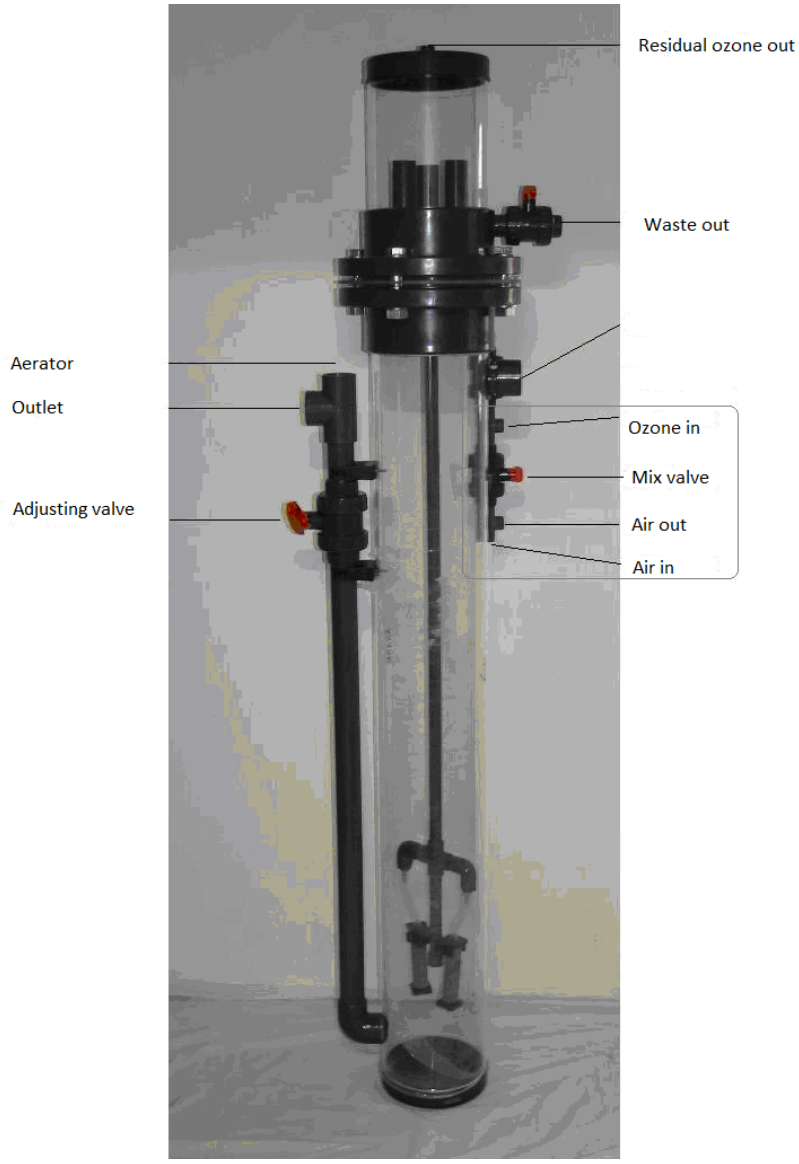
6.1.7 Technical data

	HD200	HD250	HD400
Height (cm)	~112	~114	~116
Diameter (cm)	20	25	40
Largest dimensions (cm)	30x40	40x50	60x65
Dimensions water in- and outlet (mm)	50	63	75
Dimension ozone connection (mm)	6	6	6
Dimension air connection (mm)	10	10	10
Dimension residual ozone outlet (mm)	25	25	25
Dimension sewer connection (mm)	N/A	N/A	N/A
Amount of diffusers	1	1	2
Maximum ozone supply (gram)	1	2,5	5
Maximum air/ozone flow (l/min)	10	20	35
Maximum waterflow (l/h)	8000	12000	30000
Pressure loss (bar)	~0,15	~0,15	~0,15
Maximum pond size (l)	20.000	50.000	80.000
Maximum operating pressure (bar)	0,2	0,2	0,2

6.2 AS Reactor

6.2.1 Explanation of the product.

The AS ozone reactor is a ozone reactor which also serves as a protein skimmer. Oxidized waste is directly removed from the water..
The various connections of the AS ozone reactor are discussed below.



Inlet
This connection is connected to the water pump which pumps the water into the ozone reactor.

Outlet
This connection is where the with ozone treated water leaves the ozone reactor. The pipe diameter which is connected may not be smaller as the connection of the ozone reactor!

Adjusting valve
With this valve the water level inside the reactor is adjusted. Closing this valve will result in an increasing water level.

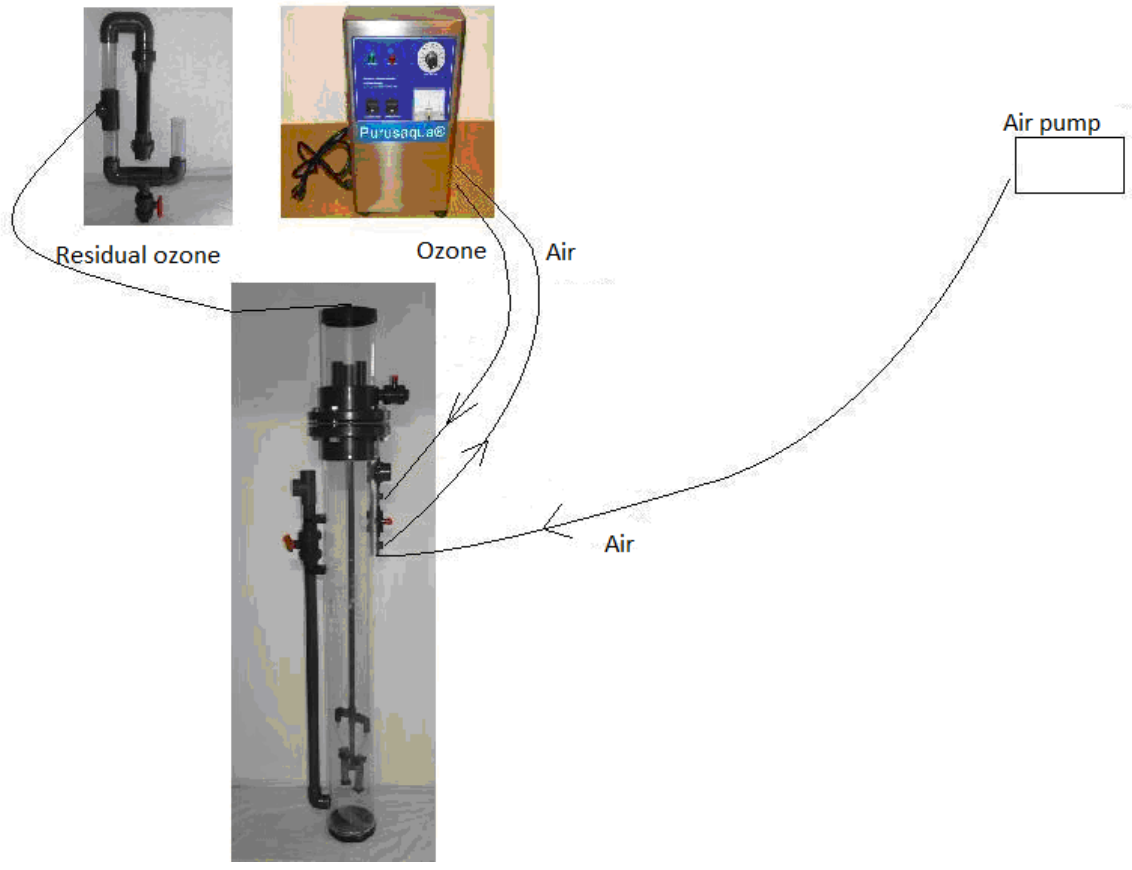
Aerator
The supplied loose piece of pipe need to be connected to this connection. The aerator ensures that no siphon effect occur.

Ozone mix unit
This is the part of the reactor to which the air pump and the ozone generator are connected. The air pump is connected to the bottom connection (Air inlet). The two outputs at the side are for the connection of the ozone generator. The lower connector (Air outlet) goes to the air/oxygen input of the ozone generator.
The upper connection (Ozone inlet) is connected to the ozone output connection of the ozone generator. By adjusting the mix valve the air flow through the ozone generator is adjusted. There are separate air flow meters available in order to see exactly how much air is flowing through the generator, please contact your dealer for more information.

Waste out
With this valve you can drain the waste collection cup which need to be done on a regular base. Otherwise the waste will flow back into the ozone reactor.

Residual ozone outlet
The injected mixture of air and ozone must be able to leave the reactor, this is done through the residual ozone outlet. The gas flow leaving this connection will contain ozone because not all of the injected ozone will react with contaminants in the water. Therefore it is important that a residual ozone destroyer is used.

Schematic overview
In the drawing below the connection of the ozone reactor is shown:



6.2.2 Installation of the ozone reactor

The AS series ozone reactors should be installed so that the outlet of the reactor is at least 30cm above the water level. A protein skimmer works best when fed with relatively dirty water, for example from a skimmer.

It is important that the water leaving the ozone reactor is not directly entering your pond. Preferably the water leaving the ozone reactor is fed into the pre-filter (sieve, vortex, etc) or in the last filter chamber. If this is not possible in your situation then it is advisable to place an activated carbon filter after the ozone reactor. Don't place an UV lamp at the output of the reactor because this may produce harsh chemicals due to the reaction of UV with residual ozone.

6.2.3 Commissioning of the ozone reactor

This paragraph describes how the ozone reactor must be commissioned and how you can adjust the water level.

Commissioning the ozone reactor is as follows:

1. The ball valve at the outlet of the ozone reactor should be open.
2. Turn on the air pump.
3. Adjust the air flow trough the ozone generator by adjusting the mix valve.
4. Turn on the water pump.
5. The water level in side the reactor will rise now.
6. Adjust the water level inside the reactor in such way that occasionally large bubbles can be seen in the waste collection cup.
7. Let the system run for a few hours with this settings and repeat the above steps if necessary.
8. Turn on the ozone generator only when the ozone reactor is fully tuned.

6.2.4 Adjusting the ozone reactor:

When the ozone reactor has been operational for a few days a fluid must be collected in the waste collection cup. If this is not the case the water level inside the ozone reactor must be adjusted so that it is slightly higher. This can be done by closing the adjusting valve a bit.
The collected liquid must be light brown in colour. At ponds which have lots of (suspended) algae the colour can be light green as well.
If the liquid is dark in colour than the water level must be adjusted slightly higher. If the liquid is an aqueous or very light in colour than the water level should be reduced.

6.2.5 Maintenance of the ozone reactor

The maintenance of the AS series ozone reactors mainly consist out of regularly draining the waste collection cup. Also the outside of the reactor should be cleaned with a damp cloth few times a year. The air stone inside the ozone reactor should be replaced annually.

6.2.6 Solving problems

No foam is formed:

- The water level is to low, adjust it higher.
- There is to less air fed into the reactor, check the air pump and tubing

The foam is transparent or the colour is very clear:

- The water level is to high. Lower the water level to such an level that the collected liquid is light brown or light green.

The foam has a very dark colour:

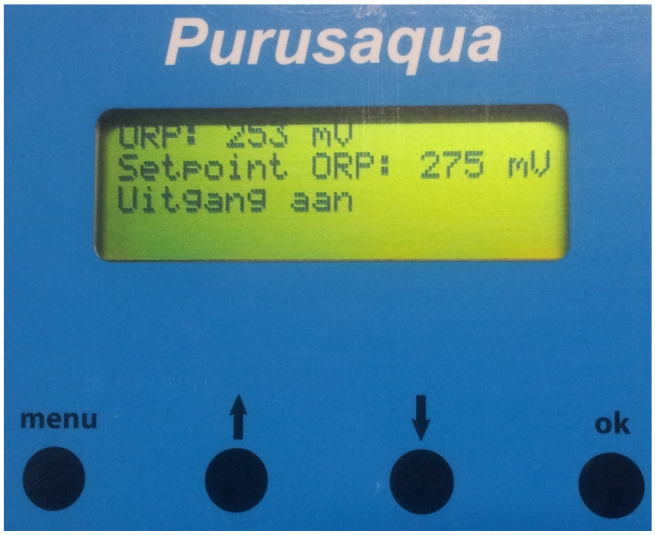
- The water level is to low. Increase the water level to such an level that the collected liquid is light brown or light green.

6.2.7 Technical data

	AS200	AS250	AS400
Height (cm)	~195	~195	~200
Diameter (cm)	20	25	40
Largest dimensions (cm)	35 x 35	40 x 40	55 x 55
Diameter water in- and outlet (mm)	50	63	75
Diameter ozone connection (mm)	6	6	6
Diameter air connection (mm)	10	10	10
Diameter residual ozone outlet (mm)	25	25	25
Diameter waste connection (mm)	25	25	25
Number of air stones	1	2	4
Maximum ozone supply (gram)	1	2,5	5
Maximum air/ozone flow (l/min)	20	40	80
Maximum water flow (l/h)	2800	4500	11.000
Generated pressure loss (mwk)	~1,5	~1,5	~1,6
Maximum pond size (l)	22.000	35.000	80.000
Maximum operating pressure (mwk)	4	4	4

7 ORP controller

7.1 Explanation of the controls



Display (green screen)
On the display the measured values are shown such as the current ORP value, setpoint and the status of the output. In the shown photo the "value screen" is shown.

Menu button
If the menu button is pressed while the value screen is shown the setting menu will be shown. In this menu the controller can be calibrated en the parameters of the output can be set. If the menu button is pressed a second time the display will show the value screen again.

↑ Scroll button "up"
The up button is used to navigate through the menu and to adjust settings. The setpoint and calibration parameters can be adjusted with this button.

↓ Scroll button "down"
The down button is used to navigate through the menu and to adjust settings. The setpoint and calibration parameters can be adjusted with this button.

Ok button
The Ok button is used to select a menu item or to confirm a setting.

7.2 Installing the ORP controller

Uninstall the lid by turning the 4 screws in the lid one quarter. De screws will pop up en are raised above the lid. Now you can fold the lid open.

Mount the ORP controller on a flat surface in a dry environment en screw the lid back in place. Only mount the ORP controller in a dry and well ventilated environment protected from direct sunlight. Only connect the ORP controller to a wall socket with a safety earth connection!

It is advised to use a flow trough assembly to mount the electrode (available by your dealer).You can place the electrode in a sieve or vortex as well but be careful that the wire connection on the electrode remains above the water level at all time.

7.3 Checking the right connection of the ORP controller

There are a few simple tests which you could perform to test if the controller is connected right.

- Place your electrode in a glass of tap water, the controller should show a value between 150 and 300mV.
- Gently wipe your finger over the electrode tip, the shown value should change quite rapidly.

7.4 Setpoint and hysteresis

The ORP controller has an adjustable relay output. This can be used to control a dosing pump or a ozone generator.
The value at which this relay should be controlled is referred to as "setpoint". You also can adjust the hysteresis. The hysteresis prevents that the relay will flicker around its setpoint, below an example.

Assume that the setpoint is set to 275mV and the hysteresis is set to 5mV. As soon as the measured value becomes below 270mV (setpoint - hysteresis) the relay will be activated. The measured value need to be raised to 280mV (setpoint + hysteresis) to get deactivate.
At a hysteresis of 0mV the relay would be activated at a measured value below 275mV and deactivated at a value higher as 275mV. Thus the relay would flicker around the setpoint of 275mV, this is prevented by the hysteresis.

7.4.1 Adjusting the setpoint

We advice you to adjust the setpoint according to the table shown on this page. The hysteresis is preset at 5mV in the factory, for most applications this is a good setting.

pH	Max. mV
6	330
6,1	330
6,2	320
6,3	320
6,4	310
6,5	310
6,6	300
6,7	290
6,8	290
6,9	280
7	270
7,1	270
7,2	260
7,3	260
7,4	250
7,5	250
7,6	240
7,7	230
7,8	230
7,9	220
8	210

To adjust the setpoint press the menu button once, the screen below is shown:

Next press the "ok" to confirm that you want to adjust the setpoint. The following screen appears which ask you to adjust the setpoint:

You can adjust the setpoint to the desired value by pressing the ↑ and ↓ buttons. If the setpoint is adjusted to the desired value you must confirm the setting by pressing the "ok" button. The following screen appears which ask you to set the hysteresis:

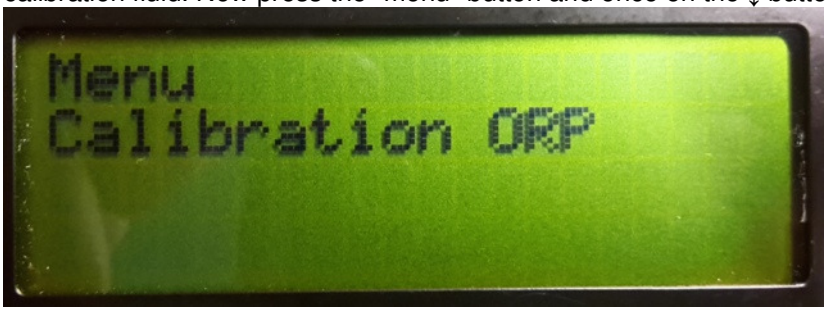
7.4.2 Setting the hysteresis

The hysteresis is set by pressing the ↑ and ↓ buttons. If the hysteresis is adjusted to the desired value you need to confirm the setting by pressing the "ok" button. The setpoint and hysteresis are now set and the display of the ORP controller now will show the menu again. By pressing the ↑ and ↓ buttons you can scroll through the menu. By pressing the "menu" button the ORP controller will return to the value screen.

7.5 Calibrating the controller

In order to get reliable measuring data the ORP controller should be calibrated on a regular base (2 to 4 times a year). Before the ORP controller is used it should be calibrated too and also if you will replace the electrode in the future. **If you have bought this controller including an electrode the controller will be calibrated for you in our factory before delivery.**

To calibrate the ORP controller you need to walk through the following steps. Put the electrode in the calibration fluid with the highest value. The tip of the electrode should be fully submersed in the calibration fluid. Now press the "menu" button and once on the ↓ button, the following screen is shown:



Press the "ok" button to confirm that you want to calibrate the controller. The next screen appears:

The upper value is the current value measured by the electrode. The bottom value is the value of the calibration fluid. Wait for the upper value to stabilize, a fluctuation of 2mV within 10 second is acceptable. By pressing the ↑ and ↓ buttons you should adjust the lower value so it corresponds with the value shown on the bottle of calibration fluid. Now press the "ok" button to confirm the first calibration parameter. In the shown example the value of the calibration fluid is 468mV.

After you pressed the "ok" button the following screen appears:

Rinse the tip of the electrode with tap water and shake of the drops of water. Now place the electrode in the calibration fluid with the lowest value. Take care again that the tip of the electrode is fully submersed. Now wait for the upper value to stabilize, a fluctuation of 2mV within 10 second is acceptable. By pressing the ↑ and ↓ buttons you should adjust the lower value so it corresponds with the value shown on the bottle of calibration fluid. Now press the "ok" button to confirm the second calibration parameter. In the shown example the value of the calibration fluid is 240mV.
By pressing the "menu" button the ORP controller will shown the value screen.

If you just have one type of calibration fluid then you perform both steps with the same calibration fluid. The rinsing of the electrode in between the two calibration steps can be skipped. Be sure that if you use only one calibration fluid that you set the **Cal.1 and Cal.2 values exactly the same**!

This is a so called "one point calibration" which is less accurate a standard "two point" calibration.
If the calibration procedure is aborted before completion your ORP controller will not function properly, so always perform a complete calibration procedure!

7.6 Maintenance

The maintenance of the controller exists out of cleaning the enclosure with a damp cloth. The electrode should be cleaned every 2 to 4 weeks, the interval deepens on the situation and application. The best way to do this is to gently wipe the electrode tip with your fingers. Never use brushes or clothes!

7.7 Storing the electrode

Never store the electrode dry, this will damage the electrode within hours. To store the electrode just fill the delivered storage bottle with water to about 1/3. Put the electrode in the bottle and take care that the tip of the electrode is submerged.

7.8 Problem solving

The display stays blank:
- Check if the mains cable is connected to a working wall socket.
- Check the fuse and replace with a fuse with the same value if necessary (the fuse is located inside the controller on the printed circuit board) **Be sure to disconnect the controller from the mains before opening the housing!**

The ORP controller doesn't switch off the ozone generator if the measured value is above the setpoint:
- Check if the setpoint is set correctly and if the hysteresis is set to the correct value.

The ORP controller doesn't switch on the ozone generator if the measured value is below the setpoint:
- Check if the setpoint is set correctly and if the hysteresis is set to the correct value.

The first line of the display shows "ORP out of range L" or "ORP out of range H":
- The measured signal is above 1000mV (H) or below -1000mV (L). Replace the electrode.

The measured value shown on the display is unstable:
- Check if the electrode if submersed and placed in flowing water.
- Check if the cable inlet of the electrode is above the water level.
- Rinse or replace the electrode.
- Check if there is interfering equipment near the controller or electrode such as: frequency converters, adjustable water pumps, TL lighting, UV lamps with electronic ballasts, etc.

The measured value hardly changes:
- Check if the electrode if submersed and placed in flowing water.
- Check if the cable inlet of the electrode is above the water level.
- Rinse or replace the electrode.

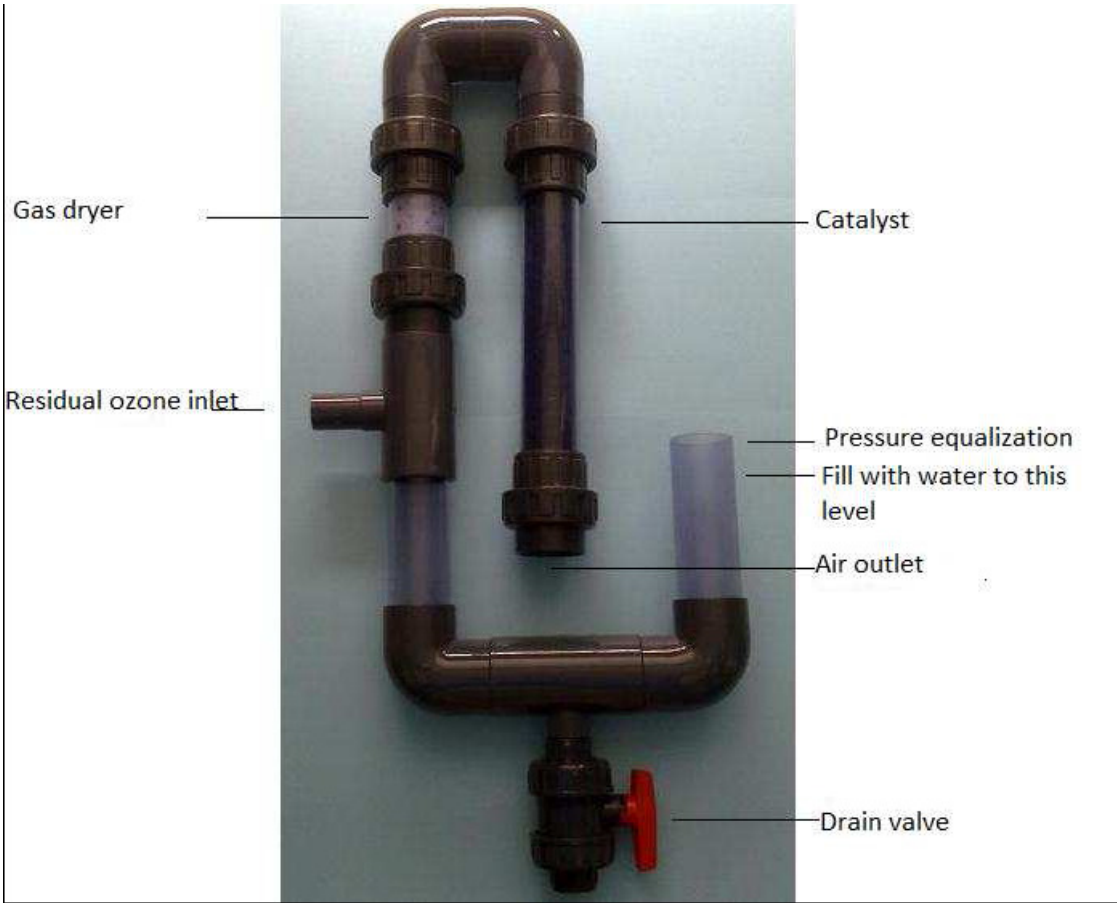
7.9 Technical data

	RC2304
Max switching power	600 watt (resistive)
Electrode connection	BNC
Measuring range	-999 tot 999 mV
Setpoint range	-999 tot 999 mV
Hysteresis range	1 to 50 mV
Resolution (accuracy displayed value)	1mV
Deviation	+/- 5mV
Voltage	230V 50Hz
Relay	1x NC/NO
Length	200 mm
Width	150 mm
Height	115 mm

8 Residual ozone destroyer

8.1 Explanation of the product.

A stream of air containing ozone is flowing out of the residual ozone outlet of your reactor. This gas flow must neutralized before it is released into your shed for example because ozone is harmful to humans and animals.
A residual ozone destroyer is used to convert the ozone, which is present in the air stream, into harmless oxygen.
The various connections of the residual ozone destroyer are discussed below.



Residual ozone inlet
The residual ozone outlet of your ozone reactor is connected to this inlet.

Air dryer
The air dryer removes moist from the gas stream. Moist in the gas stream can cause malfunction of the catalyst therefore the air dryer should be checked regularly.

Catalyst
The catalyst converts the ozone into harmless oxygen. For proper functioning it is very important that the catalyst remains dry! NEVER US THIS DEVICE WITH OXYGEN AS FEED GAS!

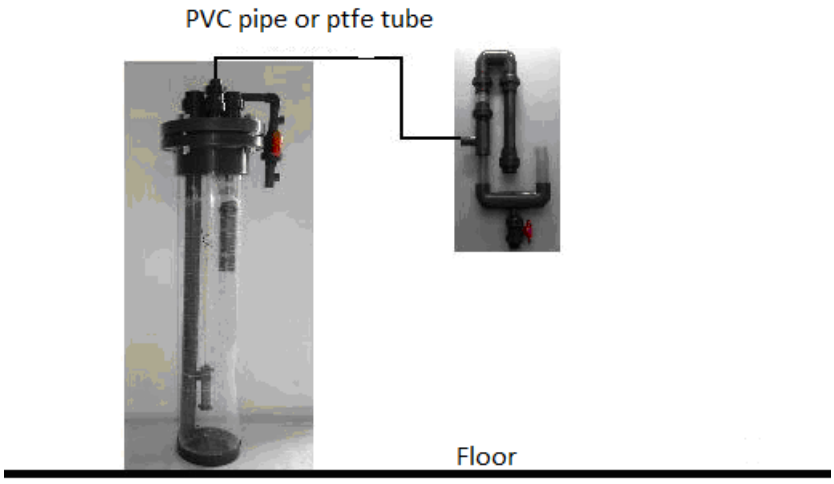
Pressure equalization
The residual ozone destroyer is provided with a water trap in order to be able to discharge excess water into the sewer without releasing ozone gas. The pressure equalizing connection carry off excess water, this terminal is preferably connected to the sewer.

Air outlet
This connection releases the ozone which is converted to oxygen. Preferably this connection is guided to the outside atmosphere. So in case of malfunctioning of the catalyst residual ozone is fed to the outside atmosphere.

Drain valve
This valve is used to drain the water out of the water trap.

8.2 Installation of the residual ozone destroyer

The residual ozone destroyer is preferably mounted on a flat wall. Mount the residual ozone destroyer at such a level so that the water trap can function properly. Place the residual ozone destroyer in such a way that the residual ozone destroyer is approximately at the same height as the residual outlet connection of the ozone reactor. Below a schematic representation shows how the residual ozone destroyer should be placed:



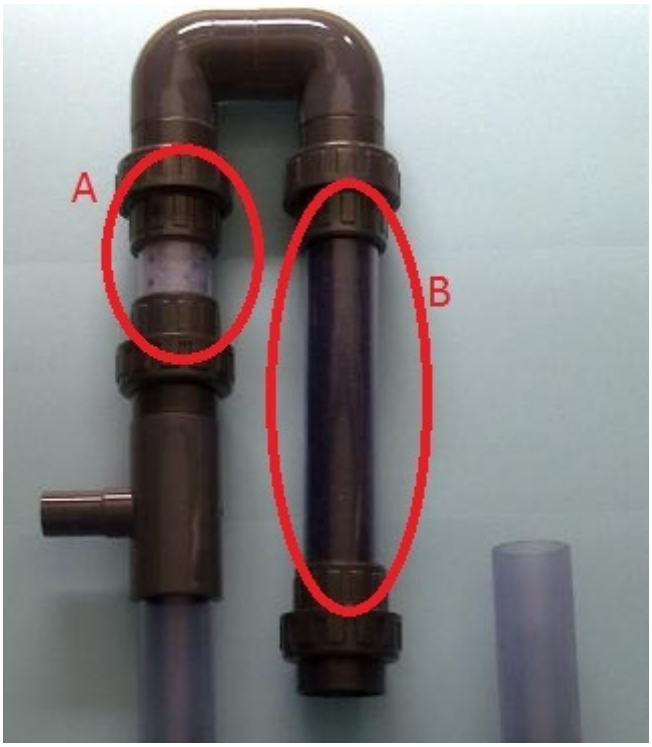
8.3 Commissioning the residual ozone destroyer

Commissioning of the residual ozone destroyer only consist out of filling the water trap to the appropriate water level. In the picture shown in paragraph 7.1 the water level is shown.

8.4 Maintenance

The maintenance of a residual ozone destroyer consists of regular replacement of the dry granules. This should happen when the blue indicator granules are coloured white. It is also wise to replace the catalyst annually or as it has become damp. Disconnected the lower coupling shown at "A", next you unscrew the top coupling en now you can replace the dry granules. During the reassembly first screw tight the upper coupling and next the lower one.

It is also advised to annually replace the activated carbon or if its is become wet. Disconnected the upper coupling shown at "B". Now you can replace the activated carbon an reassemble the whole thing again.



8.5 Solving problems

During normal use water is released out of the pressurization connection

- The air flow is too high.
- The catalyst is damp or contaminated.
- Air outlet is blocked.

Water is coming out of the air outlet

- The pressurization connection has to much back pressure.

There is an ozone smell:

- The water trap isn't filled with water.
- The catalyst is damp or contaminated.
- The air dryer is damp.

9 Miscellaneous peripherals

9.1 Flow-trough assembly

For a proper ORP measurement it is important that the electrode is located in a proper water flow. By the use of a flow-through assembly you can be sure that the electrode is placed in sufficient flow, and that it can not submerged.

Before and after the flow-through assembly a staright piece of pipe must be placed. The length of these pipes should at least be 4x the pipe diameter. At a diameter of 50mm this means that there must be a piece of pipe of 20cm before and after the flow trough assembly.
A flow trough assembly must be placed at the water inlet of the ozone reactor.

9.2 Condensate trap (CV50 / CV50A)

It is of great importance that the air flow which is fed through an ozone generator is free from moisture. A condensate trap remove moisture droplets from the air flow. These droplets are collected in the condensate container which need to be drained regularly.
In order to dry the air properly an additional adsorption dryer need to be used.
A condensate trap should be placed between the air pump and the ozone generator as close as possible to the ozone generator. A condensate trap may not come in contact with ozone!

9.3 Adsorption air dryer (AD50)

An adsorption dryer adsorbs moisture from an air stream. As a result the air humidity can be reduced which increases the life span of an ozone generator.
The granules which are used in an adsorption dryer become saturated with moisture when used for a while. It is recommended ro replace these granules every 3 to 4 weeks.

An air dryer should be placed between the air pump and the ozone generator as close as possible to the ozone generator. An air dryer may not come in contact with ozone!

The drying granules for the air dryer contain dust. This dust must be removed as far as possible before connecting the air dryer to the ozone generator.

Before using the air dryer, or after you have filled the air dryer, proceed as follows:

- Turn off the ozone generator
- Leave the air pump on
- Disconnect the hose between the air dryer and the ozone generator (make sure that no water can flow back into the ozone generator !!
- Shake the air dryer back and forth several times while air is flowing through it
- After shaking several times, no more dust should come out
- Reconnect the hose between the air dryer and the ozone generator
- The air dryer can now be put into use

10 Warranty determination

Our products come with one year warranty, defects caused by the manufacturing process within the warranty period will be repaired free of charge. The following aspects are not covered by the guarantee. Defects in our products caused by:

General
- not following the guidelines given in this manual.
- incidents or deliberate destruction of the product.
- changes made to the products by the customer.
- natural disasters such as floods, hurricanes, etc.
- not able to submit purchase bill or warranty bill.
- placing the product in a non suited environment (direct sunlight, rain, etc)

Reactors
- freezing.
- the use of chemical agents.
- applying to much pressure on the reactor.

Generators
- entering of water inside the ozone generator.
- condensation of moisture inside the ozone generator.
- applying to much pressure on the ozone generator.
- by replacing the fuse by a fuse of a different value.

ORP controllers
- overload
- by replacing the fuse by a fuse of a different value.
- damage caused by placing the controller in an excessively damp environment.

Air dryers / condensate traps
- using the product in an ozone gas flow rather than in an air stream.
- coming into contact with nitric acid instead of water/moist.

Electrodes
- cleaning the electrode with chemicals.
- damaging the electrode tip.
- immersion of the whole electrode.
- the use of electrodes in liquids other then clean water.
- entry of foreign liquids in the electrode.
- dry storage of the electrode.

The cost for sending the product to the service point are for the customer. If the repair is under warranty, the costs for returning the goods are on our behalf. In all other cases, all shipping costs must be paid by the customer. TWT and its dealers are not responsible for damage caused by the use of our products.

11 Disclaimer

TWT has written this manual with advice to the best of intentions. However, TWT does not accept any liability with regard to this manual, nor for the application of our products in whatever form or nature whatsoever.

TWT reserves the right to change the information in this manual without prior notice. All photos in this manual are designed to serve as explanation element, the pictures may differ from the real product.

12 Contact information

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