

## PRODUCT DESCRIPTION

The OZAT® range of compact ozone generators are manufactured from selected industrial quality components which reflect the latest technological developments.

In addition to Ozonia's patented Advanced Technology dielectrics, the units incorporate an optimised medium frequency power supply which takes advantage of the very latest application technology and IGBT components.

The technical features are exceptional:

- Very compact dimensions for easy installation
- Incorporated controls
- Suitable for either oxygen or air feedgas
- High ozone concentrations
- Easily integrated in ozone concentration control loops, etc.
- Robust industrial quality
- High reliability, safety and low maintenance
- Low harmonic current rejection

## PERFORMANCE DATA

	<u>Oxygen-fed</u>	<u>Air-fed</u>
Ozone production	730 g/h / 38.5 lb/d	470 g/h / 25.8 lb/d
Ozone concentration (nominal)*	10 wt%	3 wt%
Regulation range	10 to 100% without steps	
Operating pressure	1.5 barg / 17.4 psig	2.5 barg / 36.3 psig
Ozone outlet pressure	1.0 barg / 10.1 psig	2.0 barg / 29.0 psig
Feedgas requirement	5.11 Nm <sup>3</sup> /h / 3.30 scfm	12.1 Nm <sup>3</sup> /h / 7.75 scfm
Feedgas inlet pressure	2.5 to 8 barg / 35 to 115 psig	3 to 8 barg / 45 to 115 psig
Cooling water requirement	1.09 m <sup>3</sup> /h / 4.80 USgpm	
Cooling water inlet temperature	20 °C / 68 °F	
Cooling water Δp	5 °C / 9 °F	
Cooling water pressure	2 to 6 barg / 29 to 87 psig	
Power consumption at mains	8.55 kW	
Voltage	3 x 400/480 VAC ± 10%	
Frequency	50 / 60 Hz +5% / -4%	
Line current	12.3 A	
Mains circuit breaker	15 A	
Power factor	0.99	
Heat dissipation to air	0 to 2000 W	
Noise level	≤85 dB(A) measured at 1 metre	

\* = The recommended ozone concentration regulation range is between 6wt% to 12wt% when fed with oxygen and 3wt% to 5wt% when fed with air.

**STANDARDS** : Ozonia, SN/EN & IEC

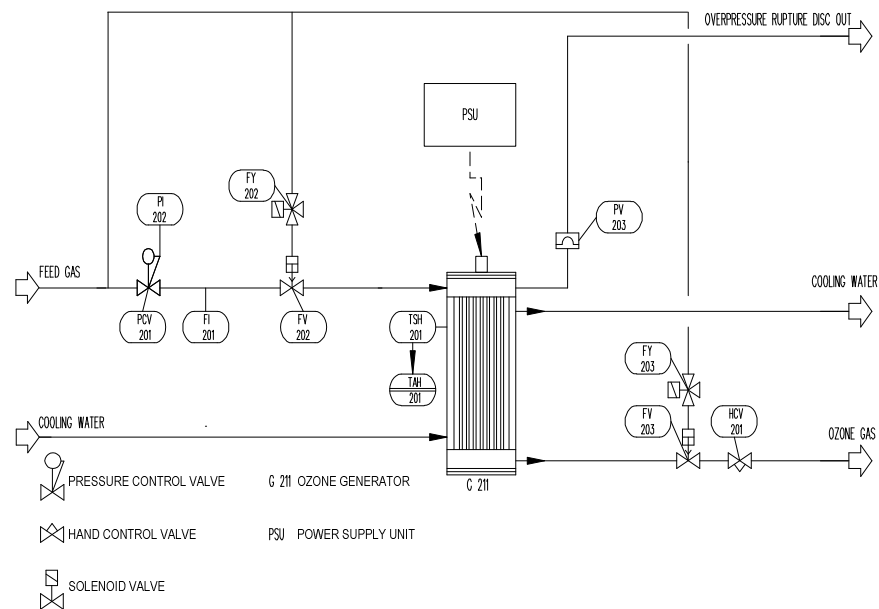
**CONFORMITY** : CE

**PROTECTION CLASS** : IP 42

### MATERIALS

- Enclosure : Powder coated mild steel, colour RAL 1013 (pearl white)
- In contact with ozone : 316 stainless steel, PTFE, PVDF, viton
- In contact with water : PE, brass, 304/316 stainless steel

### P&I DIAGRAM



### MECHANICAL CONNECTIONS

- Feed gas connection : SERTO bulkhead fitting type SO 41521-18 for pipe connections with an outside diameter of 18mm
- Ozone gas connection : SERTO bulkhead fitting type SO 51521-18 for pipe connections with an outside diameter of 18mm
- Pressure relief line : SERTO bulkhead fitting type SO 51521-18 for pipe connections with an outside diameter of 18mm
- Cooling water connections : SERTO bulkhead fitting type SO 41521-18 for pipe connections with an outside diameter of 18mm

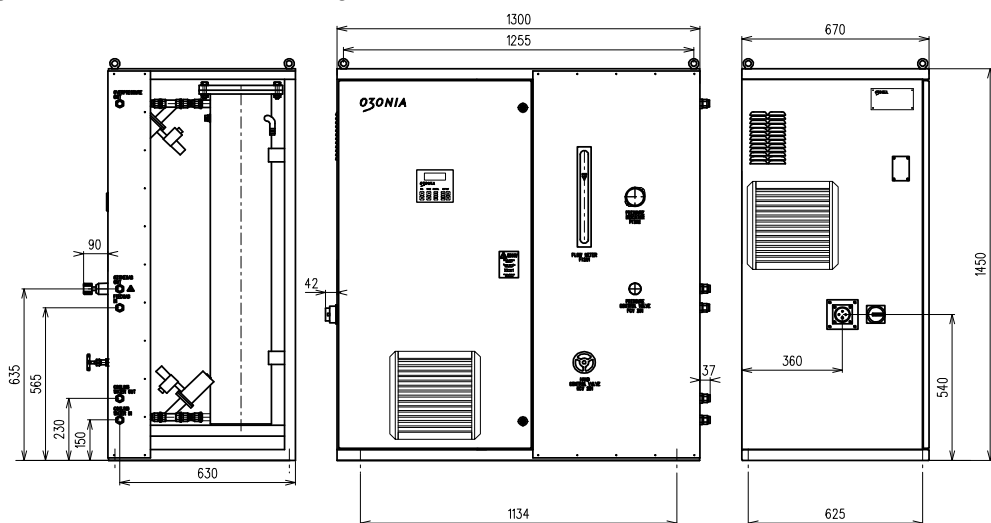
### Material recommended for the external connections

Ozone	:	Fluorised plastics (PTFE, PVDF) stainless steel (e.g. 1.4571,1.4435)
Oxygen	:	Fluorised plastics (PTFE, PVDF), brass, copper, stainless steel (e.g.1.4571, 1.4435)
Air	:	Fluorised plastics(PTFE, PVDF)Stainless steel (e.g. 1.4571,1.4435), copper, brass, galvanized steel
Water	:	Plastic (PVC, PTFE, PVDF, PE, PA), copper, brass, galvanized steel, stainless steel (e.g. 1.4571, 1.4435)

N.B.: When oxygen feedgas is used all pipes, fittings, etc, must be suitable for oxygen service as well as oil and grease free.

### DIMENSIONS

Length	:	1300 mm / 51.2"
Width	:	670 mm / 26.4"
Height	:	1450 mm / 57.1"
Weight	:	~ 420 kg / ~965 lb



### CLEARANCE

The given clearances are to be observed in order to assure enough space for access and cooling. The following dimensions are to be considered minimum and are to be taken into consideration when observing local codes and regulations:

Direction	Clearance	Reason
○ To the sides of the equipment	500 mm	Connections / Cooling
○ In front of the equipment	1000 mm	Access / cooling
○ Rear of the equipment	20 mm	Wall mounting
○ Above the equipment	500 mm	Lifting
○ Below the equipment	0 mm	Floor standing

### INSTALLATION

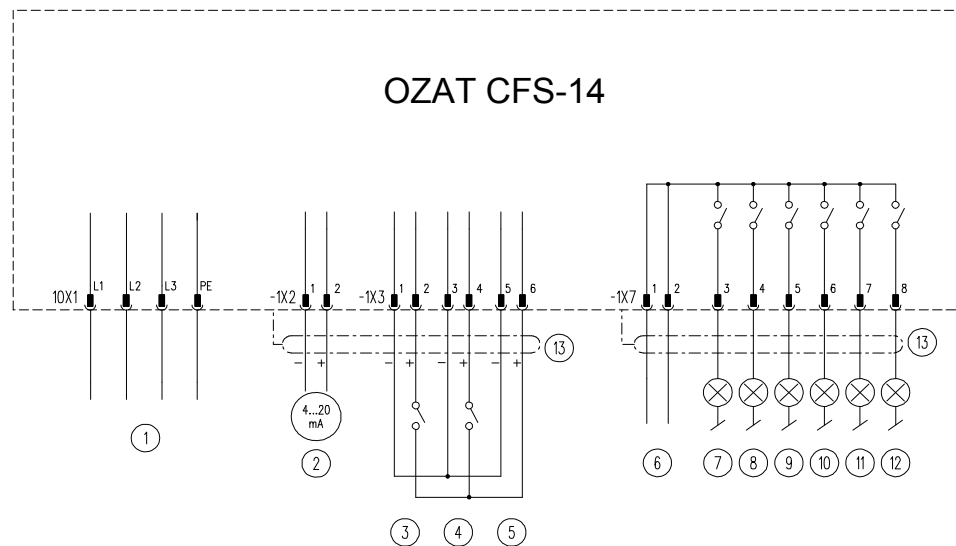
The ozone generator is for floor mounting.

### LIFTING

The OZAT® unit is fitted with 4 eye bolts, each with an eye diameter of 20mm, at the top of the unit.

### ELECTRICAL CONNECTIONS

- Mains connection : Three phase and earth (4 wire)
- Control / signal connections : External set-value: 4 - 20 mA (0 to 100%) (potential-free)
- Load impedance: 200 Ω
  - Max. permissible current: 25 mA
- 2 external control inputs: potential-free contacts (for 24 VDC, 2 mA)
- Supply ON/OFF
  - Gas valves OPEN
- 4 Signals to master controller: potential-free contacts (rating ≤50 VAC/DC, 1 A)
- Supply ON
  - Gas valves OPEN
  - Control REMOTE
  - ALARMBITS 0...2



Pos	Connection	Description
1	-10X1	Mains connection
2	-1X2	External set value 4...20 mA (0...100 %)
3	-1X3	External on command (contact closed)
4	-1X3	External gas valve open command (contact closed)
5	-1X3	24 VDC power supply For external commands
6	-1X7	Common potential
7	-1X7	PSU running (contact closed)
8	-1X7	Gas valve open (contact closed)
9	-1X7	Control remote (contact closed)
10	-1X7	Alarm Bit 0
11	-1X7	Alarm Bit 1
12	-1X7	Alarm Bit 2
13		Cable screen

### AMBIENT CONDITIONS

Altitude	:	0-3000 m.a.s.l. / 0-10000 ft.a.s.l. 10% reduction in performance per 1000 m / 3350 ft
Ambient operating temperature:		
○ Minimum	:	+5°C / 41°F
○ Maximum	:	+40°C / 104°F
○ Average over 24 hours	:	+35°C / 95°F
Ambient temp. for transport and storage:		
○ Minimum	:	-25°C / -13°F
○ Maximum	:	+55°C / +131°F
○ Total maximum over 24 hours	:	+70°C / +158°F
Relative humidity:		
○ Annual average	:	< 65%
○ For 60 continual days per year	:	< 75%
○ Occasionally	:	< 85%
Environment	:	Clean industrial environment
Atmosphere	:	Clean and non-corrosive
Vibration	:	To be avoided
Heat dissipation to environment	:	0 to 2000 W

### FEED GAS SPECIFICATIONS

Only filtered gas with the following specifications is to be used as feedgas for the ozone generator.

#### Minimum requirements for all types of gases

○ Dew-point at 1.013 bar absolute	:	drier than -65°C
○ Hydrocarbons (expressed as CH <sub>4</sub> )	:	< 20 ppm volume
○ Freon or similar chemicals	:	none
○ Particle size	:	< 0.01 µm
○ Temperature	:	5°C to 40°C / 41°F to 104°F
○ Inlet pressure:		
- For air feed gas	:	3 to 8 barg / 45 to 115 psig
- For oxygen feed gas	:	2.5 to 8 barg / 35 to 115 psig

#### Oxygen from a VSA/VPSA/PSA system

Oxygen	:	90 to 93 % by weight
Nitrogen	:	5.1 to 1.9 % by weight
Argon	:	remainder

VAS/VPSA/PSA systems are to be optimised in order to assure a constant residual nitrogen content in the feed gas as required by the layout specification of the ozone generator unit.

#### Oxygen from a LOX system

Oxygen	:	98 to 100 % by weight
Remainder	:	nitrogen and argon

N.B.: A minimum nitrogen content in the feed gas to the ozone generator is necessary in order to ensure optimum performance and constant, long-term, ozone generation. If the nitrogen content is below 0.2 % by weight, nitrogen gas must be added to the feed gas.

#### Nitrogen Gas Specification

Oxygen from a LOX source does not contain sufficient nitrogen to ensure optimum performance. An average nitrogen concentration of approximately 2.3 wt% is required and this has to be adjusted depending on the actual performance layout of the ozone generator.

Essentially there are three methods dosing nitrogen to the main gas feed to the ozone generator. The method chosen depends on the size of the plant and the level of operator comfort required:

- Nitrogen gas from a high pressure storage cylinder (small applications)
- Nitrogen gas from a liquid source (medium / large applications)
- Dry air from a small compressor / dryer unit (medium / large applications)

#### *Nitrogen gas*

Nitrogen purity : > 99.996 % volume (type 4.6)

If nitrogen is selected, special attention must be given to the dew-point and the hydrocarbon content necessitating the use of high purity nitrogen.

#### *Dry air*

It is also possible to use clean, dry, oil-free air. Special attention must be given to the selection and design of the compressor/ dryer unit. The nitrogen gas or dry air must comply with the given Minimum Requirements for feed gases.

### **COOLING WATER SPECIFICATION**

A small amount water is required for the cooling of the ozone generator unit. In order to ensure adequate cooling the water should have the following specification:

Cooling medium	:	Water
Inlet temperature range	:	4 to 35°C / 36 to 95°F
Temperature rise ( $\Delta_t$ )	:	5°C / 9°F
Inlet pressure	:	2 to 6 barg / 29 to 87 psig
Water quality	:	drinking water or equivalent
pH	:	6 to 8
Chloride content	:	< 100 mg/ltr
Conductivity	:	< 500 $\mu$ S/cm
Total suspended solids	:	< 50 mg/ltr
Particle size	:	< 0.5 mm / 0.02"
Fe / Mg content	:	< 0.3 mg/ltr
Hardness	:	< 2.68 mMol/l*

\* 2.68 mMol/l = 15°dH or 26.7°fH or 18.8°eH or 267ppm (mg/l)

### **SCOPE OF SUPPLY**

The OZAT® ozone generators are supplied as fully assembled and tested units. The scope of supply includes: The ozone generator tube(s); the power supply to the ozone generator; all internal piping and fittings; all internal wiring and connections and the enclosure for the equipment. Not included is all that is not specifically mentioned, such as: The feed gas supply; the ozone contacting system; installation and commissioning; etc..

### APPLICATIONS

The OZAT® units have been designed for universal application and, depending on the selected ancillary equipment, can be easily integrated in to all types of processes.

Some examples are:

- Drinking water plants
- Waste treatment
- Recycled water plants
- Fish farms
- Swimming pools
- Washing in the foodstuffs industry
- Influent water treatment
- Cooling systems and towers
- Deodorisation
- Intermediate oxidation
- Laboratory applications
- Pure water, etc.

In many cases the application determines the ancillary scope of supply.

### ANCILLARY SUPPLY

Unless otherwise agreed, the OZAT® ozone generators will be supplied as units that have to be complimented with other ancillary equipment in order to create a functional plant.

Basically, an ozone installation can be broken down in to the following sections:

- Ozone generator proper
- Feed gas equipment
- Contacting system
- Ozone destruct unit
- Measuring instruments
- Ambient surveillance

### Feed gas equipment

There are 3 main types of feed gas systems for ozone generator plants:

- Air preparation with compressor and dryer
- Pressure swing adsorption (PSA) with compressor and oxygen concentrator
- Liquid oxygen (LOX) with nitrogen admix system

Air preparation system made-up from:

Article No.	Qty.	Equipment	
	1	Compressor <i>Scope of supply:</i> - Compressor - Motor - Air receiver with auto drain - Filters	
	1	Air dryer <i>Scope of supply:</i> - Desiccant columns & control system - Inlet filter (MF) - Outlet filter (AK)	
	1	Feed gas filter <i>Retention rate of particles &gt; 0.01µm : 99.999%</i>	

Liquid oxygen (LOX) with nitrogen admix system made-up from:

Article No.	Qty.	Equipment
Not Ozonia supply	1	LOX tank system <i>Size, layout, scope of supply, etc. to be determined by the plant operator and the LOX supplier.</i>
Not Ozonia supply	1	Nitrogen source <i>Size, layout, scope of supply, etc. to be determined by the plant operator and the nitrogen supplier.</i>
	1	Set of fittings for the nitrogen/air admix gas <i>Made-up from:</i> - Pressure reducer - Flow control - Non-return valve - Solenoid isolation valve
	1	Feed gas filter <i>Retention rate of particles &gt; 0.01µm : 99.999%</i>

Pressure swing adsorption (PSA) system made-up from:

Article No.	Qty.	Equipment
	1	Compressor <i>Scope of supply:</i> - Compressor - Motor - Air receiver with auto drain - Filters
	1	Oxygen concentrator (PSA unit) <i>Scope of supply:</i> - Desiccant columns & control system - Inlet filter - Outlet filter
	1	Feed gas filter <i>Retention rate of particles &gt; 0.01µm : 99.999%</i>

### **Contacting equipment**

After the ozone has been produced it is necessary to introduce it to the process. The object of the contacting system is to create a large contact area between the ozone containing gas and the medium being treated so that there is the highest possible mass transfer of ozone to medium.

There are 2 main ways of introducing ozone:

#### Ozone Injector System:

Depending on the service parameters, there are several ways of introducing ozone with an injector. However, in order to establish stable conditions for the injector system, Ozonia suggests that a small side stream is used as the motive flow for an injector which draws in the ozone gas being produced by the OZAT®. An injector system has the advantage that the system pressure can be maintained and the mass transfer coefficient is very high.

	Qty.	Equipment
	1	Injector
	1	Motive water pump

N.B.: The above specified components are typical. The injector unit and the motive water pump must be dimensioned, in each and every case, to suit process conditions such as line pressure, etc..



### Porous Diffuser System

Porous diffusers are mounted at the bottom of the contact chamber through which the ozone gas can be introduced as small bubbles:

Article No.	Qty.	Equipment
	1 set	Porous diffuser

After the mass transfer has taken place, both systems require a reaction volume/time to enable the required reactions to take place. Typically, the height of these chambers is between 4 -6 metre and the volume depends on the process in question.

### Ozone destruct unit

Exhaust gases from a process normally contain small amounts of un-reacted ozone. Before this exhaust can be vented to atmosphere it is necessary to decompose these traces of residual ozone. When selecting the vent ozone destruct equipment it is essential to ascertain if the contact chamber is absolutely gas-tight or if there is a possibility of leakage. If the chamber is un-tight, or if there is doubt regarding the gas-tightness, then it will be necessary to install a vent gas extraction fan.

Article No.	Qty.	Equipment
	1	Vent ozone destruct unit
	1	Vent gas extraction fan

### Plant instruments

#### Dew-point of feed gas

Article No.	Qty.	Equipment
	1	Dew-point monitor

#### On-line ozone measurement in the gas phase

Article No.	Qty.	Equipment
	1	Gas phase ozone monitor

#### On-line residual ozone in water

Article No.	Qty.	Equipment
	1	Residual ozone analyser

#### Spot-check residual ozone in water

Article No.	Qty.	Equipment
	1	Residual ozone analyser

#### Ambient surveillance

Article No.	Qty.	Equipment
	1	Control panel

Article No.	Qty.	Equipment
	1	Gas detector

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