

**MEIDEN**

Quality connecting the next

# Ultra-High Concentration / High-Purity Pure Ozonated Water Generator

Functional Water  
That Returns  
to Nature

Environmentally-friendly and  
economical due to reduced post-processing load

One of the Highest Levels in the Industry<sup>※1</sup>

Ozonated Water Concentration **400** mg/L or More

Excellent  
cleaning  
effect

Sterilization  
effect

Environmental  
impact  
reduction





# Innovation from RCA cleaning.<sup>※2</sup> Meiden Pure Ozonated Water — For Environmental Friendliness and Disposal Cost Reduction

Switch from chemical cleaning and sterilization to ultra-high concentration, high-purity pure ozonated water cleaning and sterilization, for reduced environmental impact and treatment costs.



One of the Highest Levels in the Industry<sup>※1</sup>  
**Concentration 400mg/L or more**  
(Achieving an instantaneous maximum concentration of 450 mg/L<sup>※3</sup>)

## Pure Ozonated Water Generator

Reduces the burden of wastewater treatment.  
Effective in terms of both the environment and cost.

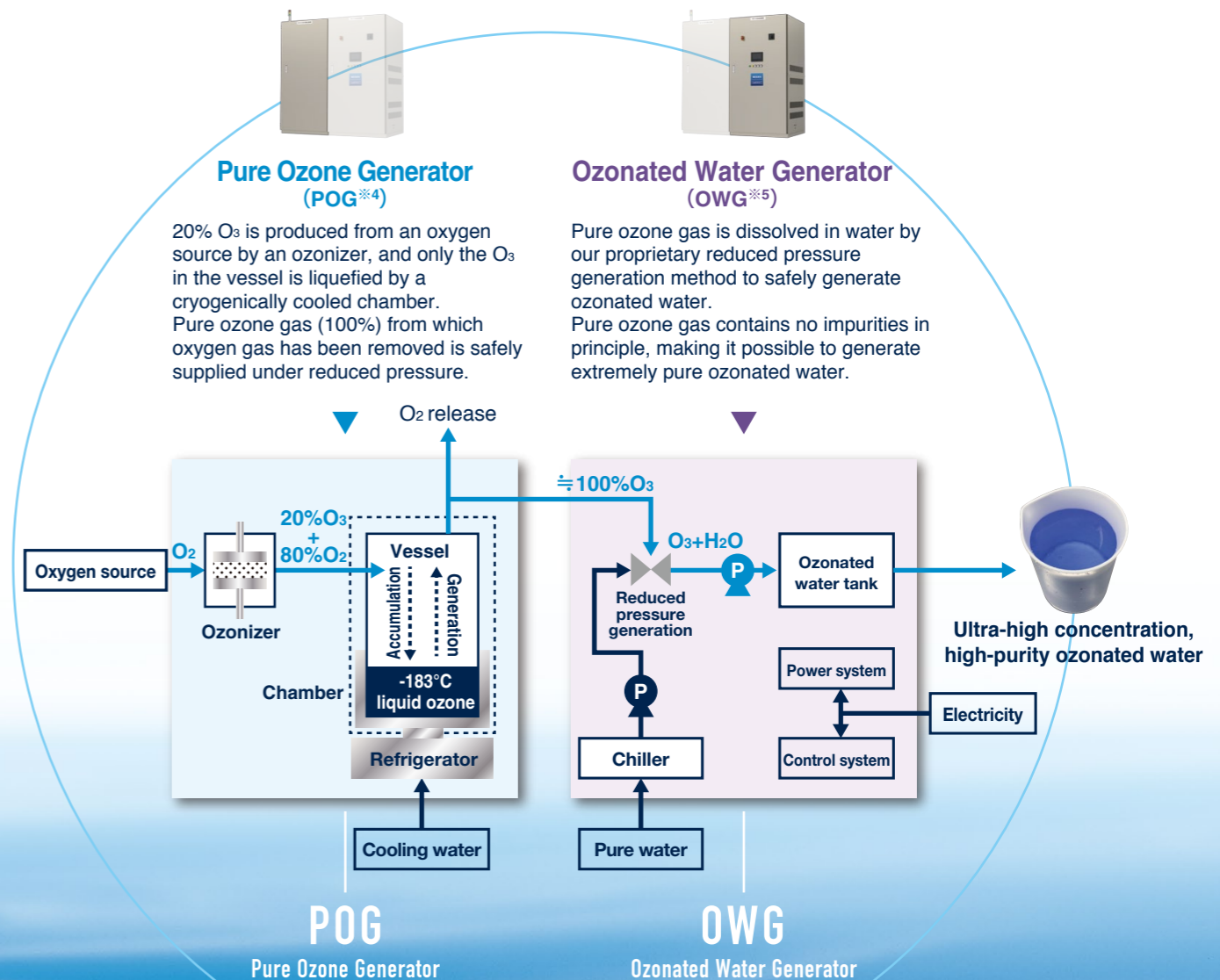
Pure ozonated water is extremely environmentally-friendly functional water because it decomposes into oxygen and water through self-degradation

Comparing with conventional chemical solutions in semiconductor and industrial cleaning, such as sulfuric acid, pure ozonated water can contribute to resolving issues about wastewater treatment and landfill sites.

## Product concept

## Design Concept of the Pure Ozonated Water Generator

Applying pure ozone gas ( $\approx 100\%$ ) produced by proprietary technology, Meiden has developed the world's top-class pure ozonated water based on a design concept for safe handling at normal pressure.



※1 Based on Meiden research as of September 2023

※2 Contamination is a serious issue for semiconductor devices, on which circuits are etched at the nano-level. Since the presence of contamination causes circuit breaks and metal contamination alters the electrical properties of wafers, the current standard formulation in the cleaning process is RCA cleaning, which uses chemicals that require wastewater treatment.

※3 Maximum concentration that can be generated only under certain conditions. Refer to product specifications for equipment performance under normal use.

※4 Pure Ozone Generator

※5 Ozonated Water Generator

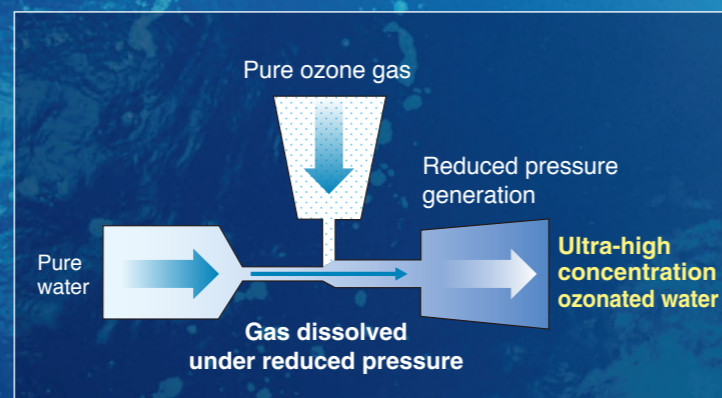


# Product characteristic

## Reduced Pressure Generation Method

(Patent pending)

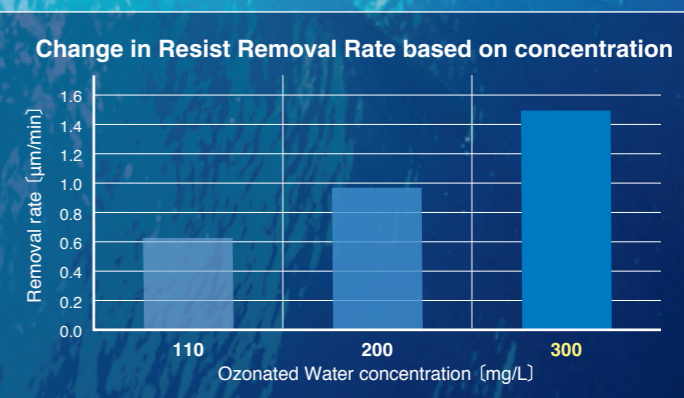
Meiden's pure ozonated water uses a reduced pressure generation method in which pure ozone gas ( $\approx 100\%$ ) supplied from the POG under reduced pressure is dissolved in water by ejector method. Since the ozone gas is not pressurized, rapid foaming and concentration decrease can be suppressed even if ozonated water is used at the use point under atmospheric pressure.



## OUR Process Technology

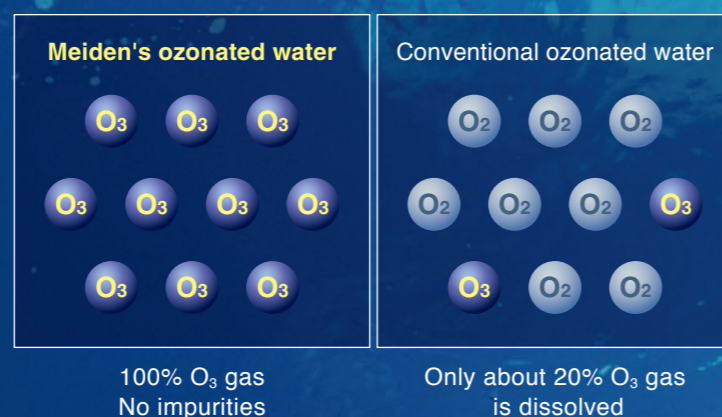
(Patent pending) \*Ozonated water Used Radical generation

Currently, photoresists implanted with a high concentration of ions in semiconductor processes are removed with chemicals which have high environmental impacts. We invented ozonated water Used Radical generation (OUR) method which can generate a large amount of radicals in pure ozonated water, and the successfully decomposed photoresists implanted with a high concentration of ions.



## Ultra-High Concentration / High-Purity

The pure ozonated water is ultra-high concentration and high purity because ozone gas, which contains no oxygen or other gases, heavy metals, or other impurities, is dissolved into it.



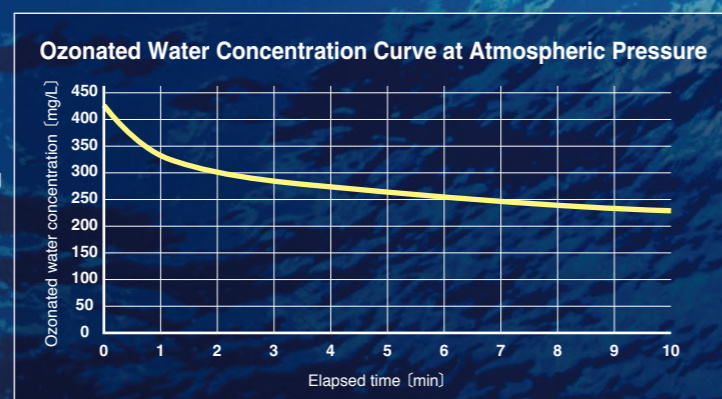
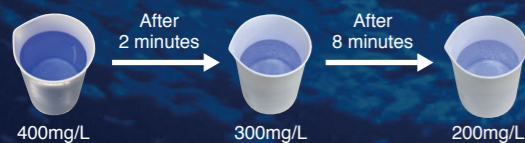
## Safety Measures

This system produces ozone gas and ozonated water under reduced pressure. The safe equipment design follows the proven design concept developed for POG: Ultra-high purity, low temperature, and reduced pressure to prevent dangerous reactions.

- 01 Explosion-proof design of ozone gas generation unit as a precaution
- 02 Backflow prevention design to prevent water from flowing into the ozone gas generator
- 03 Gas/leak installed detectors in case of ozone gas or ozonated water leakage
- 04 Ozone decomposition catalyst installed in the exhaust gas system to prevent ozone gas leakage
- 05 EMO (emergency off) switch enables manual shutdown of equipment in the event of an abnormality
- 06 Emergency purge mechanism for safe discharge of residual ozone in the equipment by diluting it in the process gas line in the event of a power failure / emergency shutdown
- 07 Improved maintenance by separating the gas supply unit and the ozonated water generator unit into different levels in the equipment

## Long-Lasting Concentration

The reduced pressure generation method enables the ozonated water to maintain its concentration for a long period of time without rapid reduction even when the ozonated water is used under atmospheric pressure.



## Standards Certification

International safety standards (SEMI-S2, UL, NFPA, CE, etc.) \*Scheduled to be acquired from FY2024

## Quality Assurance

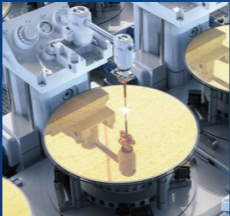
Performance is verified and operation is checked at the customer's site before delivery of the equipment to the customer. Safety is demonstrated through a trace gas test by a third-party certification body.



# Use example

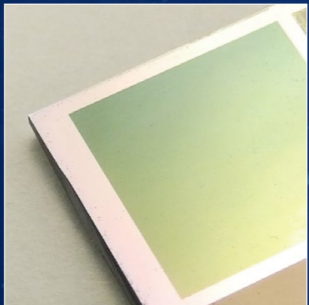
### Semiconductor Wafer Removal of Resist Implanted with High Concentration of Ions

Our process is expected to replace conventional chemical treatment. In addition, since ozonated water decomposes into water and oxygen, the burden of wastewater treatment can be reduced compared to conventional chemical treatment.




Resist Coating

Coated condition



Before washing

Complete removal



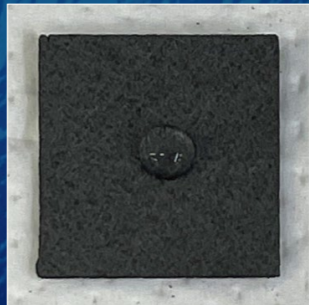
After washing

Resist type: KrF resist; Implanted ion: P; Dose amount:  $10^{14}$ cm<sup>-2</sup>

### Surface Modification of Carbon Resin and Other Carbon Fibers

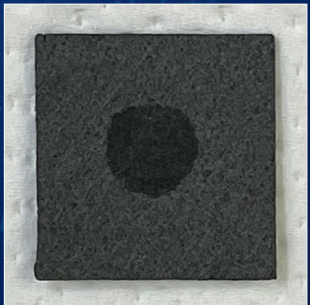
This ozonated water can be expected to improve the hydrophilicity and adhesiveness of organic materials that cannot be modified by conventional ozonated water due to the high oxidizing power given by its ultra-high concentration

Hydrophobicity



Before treatment

Hydrophilicity



After treatment

### Degreasing and Cleaning Industrial Products

This process is expected to replace chemical cleaning in the removal of press oil and other organic materials.

Oil film



Before washing

No oil film



After washing

### Property Modification of Pigments and Other Powder Paint Materials

Improvement of dispersion characteristics of hydrophobic powders, etc., can be expected.



Carbon dye powder

Sedimentation



Dispersion by water

No sedimentation



Dispersion by pure ozonated water



## Product Specifications

<b>Concentration</b>	10~400mg/L
<b>Water temperature</b>	5~20°C
<b>Flow rate</b>	0.3~1.0L/min
<b>Purity</b>	Impurity concentration below ppt
<b>Ozonated water generation method</b>	Reduced Pressure Generation Method
<b>Operation method</b>	Batch type (continuous type to be released in FY2024)
<b>Dimensions (excluding protrusions)</b>	Low capacity type: W1,900xD1,000xH1,980mm High capacity type: W2,200xD1,000xH1,980mm
<b>Mass</b>	Low capacity type: 1,345kg High capacity type: 1,501kg

## Utility Installation (Small Capacity Type)

<b>Power</b>	Voltage: 3φ 200 V; Frequency: 50/60 Hz; Capacity: 10 KVA
<b>Source gas (oxygen)</b>	<b>For ozone gas generation</b> Gas: High-purity oxygen (99.9%) or higher Flow rate: 3 L/min (540 L used per instance of maximum volume accumulation) Pressure: 0.3 to 0.9 MPa
<b>Nitrogen gas</b>	<b>For purging / ozonated water tank pressure adjustment</b> Gas: Nitrogen purity (99.99%) or higher Flow rate: 10 SLM (minimum 600 L used per emergency purge) Pressure: 0.3 to 0.5 MPa
<b>Carbon dioxide gas</b>	<b>For ozonated water concentration adjustment</b> Gas: Liquefied carbon dioxide gas (99.995%); Flow rate: 500 sccm max.
<b>Dry air</b>	<b>For valve drive</b> Specifications: Dry air (or nitrogen gas); Pressure: 0.5 to 0.9 MPa
<b>Source water</b>	<b>For ozonated water generation</b> Flow rate: 1 L/min or more; Pressure: 0.2 to 0.3 MPa; Water temperature: 10 to 20°C
<b>Cooling water</b>	<b>For refrigerator / Ozonizer</b> Flow rate: 10 L/min; Pressure: 0.2 to 0.5 MPa; Water temperature: 10 to 30°C
<b>Exhaust duct</b>	<b>For housing exhaust</b> Differential pressure: 100 P or more; Exhaust air volume: 1 m <sup>3</sup> /min (exhaust port)
<b>Ozone decomposer</b>	<b>For wastewater treatment of supplied ozonated water</b> Available as option

## Design plan

### Installation environment

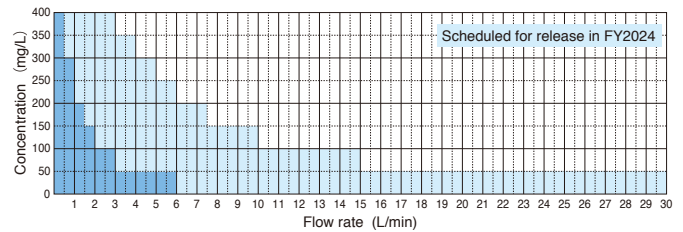
- Ozone gas volatilizes from highly concentrated ozonated water. When handling, provide adequate ventilation or local exhaust ventilation, and take care not to inhale ozone gas.
- Ensure the area is free of dust and corrosive gases.
- The floor should be P-Tiled or otherwise finished to prevent dust.

- Provide air conditioning. The ambient temperature should be about 25°C (77°F).
- Since highly-concentrated ozonated water may deteriorate piping, etc., ensure wetted parts are made of ozone-resistant Teflon, and provide an ozonated water decomposer for the drainage system.

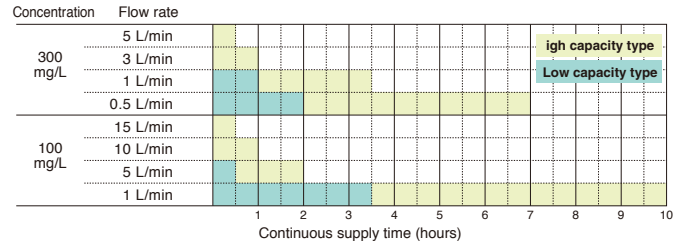
### Maintenance

- This equipment is manufactured under strict quality control. However, maintenance and inspections must be performed to ensure it continues to function as designed. Therefore, we recommend entering into contract with Meiden Service Network for periodic maintenance and inspection.

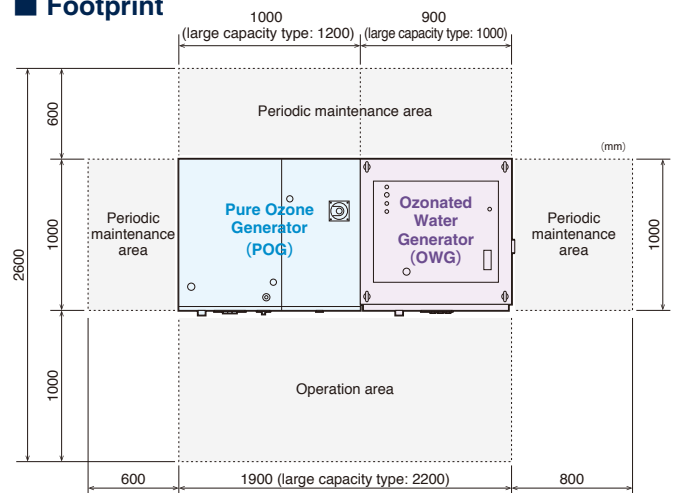
## Applicable Concentration and Flow Rate Range



## Continuous ozonated water supply time



## Footprint



## Applications/Notifications (for the Domestic Use in Japan)

- ◆ When installing this equipment, various types of notification applications are required to be submitted to the prefectural government. Meiden will provide support with documentation and applications
  - High Pressure Gas Production Notification
  - High Pressure Gas Production Facilities Change Notification
  - Class 2 Storage Place Establishment Notification
  - Class 2 Storage Place Position Change Notification



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