

FINE series PURE

WVG

Water Vapor Generator



Safety & Clean Technology

Fujikin Incorporated

Creating the Future

WVG

In 1995, Fujikin succeeded in developing a device that produces ultra-high purity water vapor by means of a catalytic reaction - a radically different means than conventional pyrogenic water vapor generators.

Since then we have continued to gather data, perform exhaustive durability tests, and continually improved upon our process to create the present Water Vapor Generator (WVG).

The WVG catalytic reaction allows water vapor to be generated at a much lower temperature than is possible with conventional pyrogenic systems, and provides both high levels of safety and contamination-free output.

Now with an expanded range of flow control, the WVG may be used in a wide variety of processes.



Water Vapor Generator

Fujikin's Flow Control System has the WVG at its Core

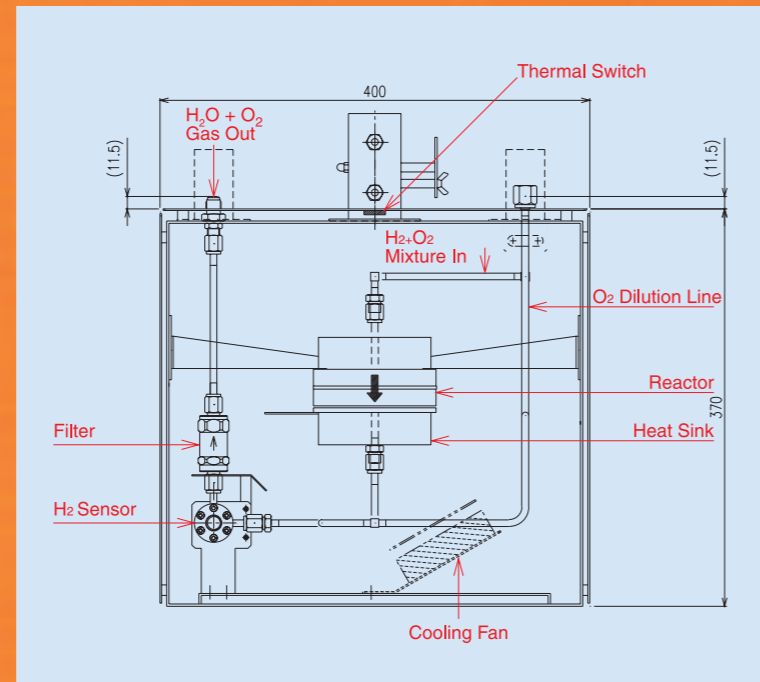
The Fujikin WVG:

The Consistent Leader in Flow Control Technology

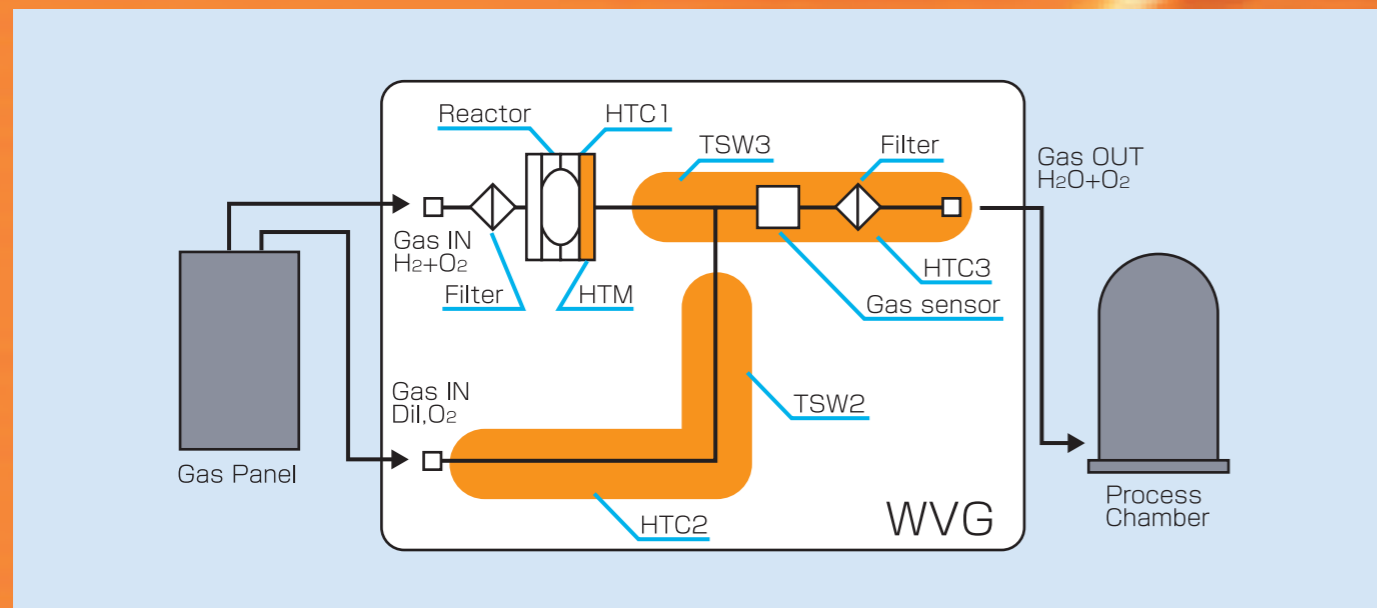
Water Vapor Generator

Water Vapor Generator

In recent years, ULSI device production technology has advanced in two major directions: miniaturization and increase in wafer diameter. However, the demand for device reliability continues to increase. Fujikin has developed a new water vapor generating system that generates water vapor through a catalytic reaction of O₂ and H₂ for wet oxidation processes where reliability is especially required.



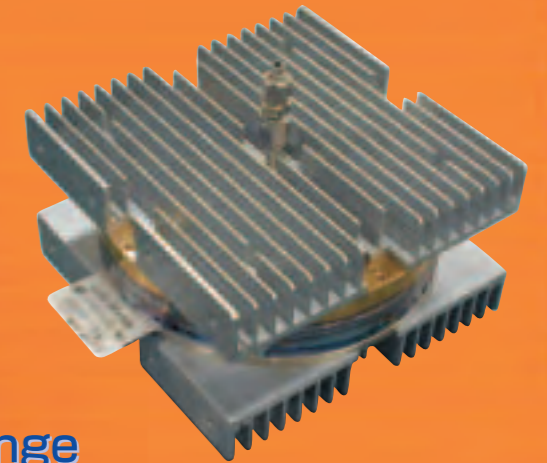
2 SLM Oxygen Rich Water Vapor Generator



Oxygen Rich Water Vapor Generator Gas Flow Schematic

Catalytic Reactor

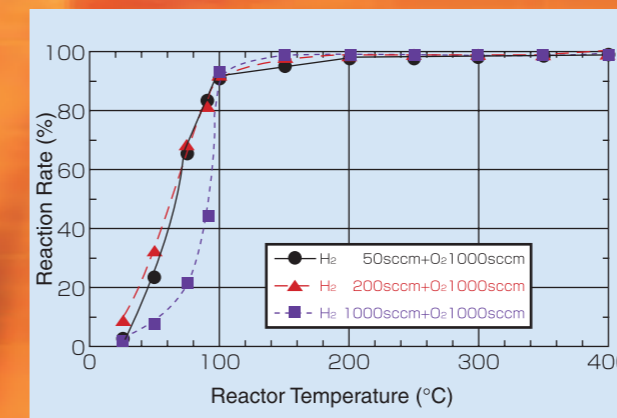
The Fujikin WVG supplies H₂ and O₂ into a reactor that uses a catalyst to produce water vapor. This makes it possible to produce water vapor at a lower temperature (350 °C / 662 °F) than is possible with conventional systems.



5 SLM Reactor

Wide Concentration Control Range

The WVG can control the water vapor concentration within a range of 1% to 100% - a range that is not possible to achieve with conventional pyrogenic water vapor generators. The concentration is controlled within high degree of accuracy according to the ratio of H₂ and O₂ supplied



Reaction Rate vs Reactor Temperature (H₂ X SCCM + O₂ 1000 SCCM)

Multiple Interlocks

The WVG is equipped with a multitude of warning signals. If a problem should occur, the device will issue a warning signal and will automatically discontinue power to the WVG reactor heater.

Safety Specifications

Superior Safety

The process of generating water vapor through a catalytic reaction is possible at 350 °C. This temperature is under the ignition boundary of hydrogen gas in an oxygen atmosphere at an atmospheric pressure of 760 Torr. Additionally, by means of an in-line gas sensor located downstream of the reactor, an alarm and warning signal will sound should the unreacted gas concentration increase above a pre-set level.

SEMI-S2 Compliant, CE Marking



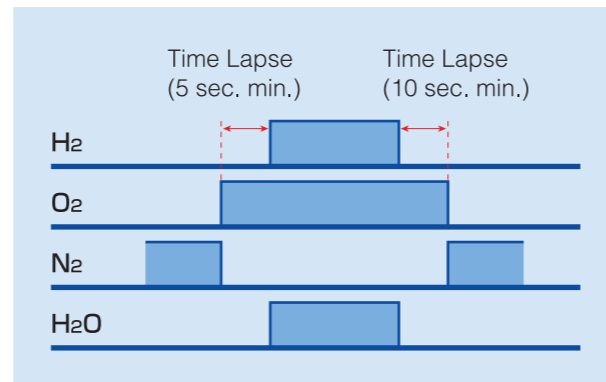
Control of Ultra-Thin Oxidation Films (Oxygen-Rich Type)

With the Fujikin WVG, hydrogen flow may start as soon as 5 seconds after initial oxygen flow. As soon as hydrogen is supplied, the reaction process begins immediately yielding instant water vapor.

The amount of water vapor generated is based upon the control range of the MFC supplying the individual gases. Thus, ultra-low levels or large amounts of water vapor are possible.

Water Vapor Generation Conditions

Since water vapor may be generated in either oxygen rich or hydrogen rich atmospheres, the system may be utilized in new processes such as selective oxidation.



Gas Supply Sequence Into Reactor for Oxygen-Rich Water Vapor Generator

(Unit: ng/ml = ppb)

WVG Up Time	Fe	Cr	Ni	Catalyst
10 Hours	<0.1	<0.1	<0.1	<0.1
1,000 Hours	<0.1	<0.1	<0.1	<0.1
2,000 Hours	<0.1	<0.1	<0.1	<0.1
3,000 Hours	<0.1	<0.1	<0.1	<0.1
3,500 Hours	<0.1	<0.1	<0.1	<0.1
5,000 Hours	<0.1	<0.1	<0.1	<0.1
6,000 Hours	<0.1	<0.1	<0.1	<0.1
7,000 Hours	<0.1	<0.1	<0.1	<0.1
9,000 Hours	<0.1	<0.1	<0.1	<0.1

Mass Spectrometry Analysis of Contaminants in Water Vapor Output

Pressure Conditions

The required pressure for reaction is atmospheric (0.2 MPa / 30 psi or less). Low-pressure or high-pressure models are optionally available.

Contamination-Free

Since water vapor is generated by means of a catalytic reaction, contaminants are not present or created. Furthermore, all piping within the WVG is stainless steel 316L with Fujikin UPG fittings. Therefore, consistent, ultra-high purity water vapor is assured.

Applications

The Fujikin WVG may be utilized in various process applications such as in diffusion equipment, RTP equipment, etc., which are all heat-processing systems.

SPECIFICATIONS (STANDARD MODELS)

Flow Range

2SLM Model

Reaction Type	H ₂ Flow Rate (sccm)	O ₂ Flow Rate (sccm)	H ₂ /O ₂ Flow Rate Ratio	Reactor Secondary Flow Rate	Dilution Line Flow Rate
H ₂ O+O ₂ (O ₂ Rich)	2000 or less	600~2000	10/6 (1.67) or less	5SLM or less	As Required (20 SLM or less)
H ₂ O+H ₂ (H ₂ Rich)	600~4000	1000 or less	12/5 (2.4) or more	5SLM or less	As Required (20 SLM or less)

5SLM Model

Reaction Type	H ₂ Flow Rate (sccm)	O ₂ Flow Rate (sccm)	H ₂ /O ₂ Flow Rate Ratio	Reactor Secondary Flow Rate	Dilution Line Flow Rate
H ₂ O+O ₂ (O ₂ Rich)	5000以下	600~5000	10/6 (1.67) or less	10SLM or less	As Required (20 SLM or less)
H ₂ O+H ₂ (H ₂ Rich)	600~7500	2500 or less	12/5 (2.4) or more	10SLM or less	As Required (20 SLM or less)

Temperature Control Range

Controller Number	Heater Installation Position	Set Point (°C)	Normal Range (°C)
HTC 1	Reactor Outlet (HTC1)	350	±50
HTC 2	Dilution Gas Cooling Piping (HTC2)	140	±30
HTC 3	Reactor Outlet Piping, Gas Sensor, Filter, Outlet Piping (HTC3)	140	±30
HTM	Reactor Surface (Outlet Side) Temperature Monitor HTM for Operational Error Prevention	350	400 or less

Connections

Port	Connection Type
GAS IN (H ₂ +O ₂)	1/4" UJR MALE
GAS IN (Dilution Gas)	1/4" UJR FEMALE
GAS OUT (H ₂ O + Excess Gas)	1/4" UJR MALE

Piping

Design Pressure	0.2 MPa
Material	SUS 316L
End-Connection	Metal Gasket Fittings (UJR, UPG)

Power Supply and Consumption

Power Supply	100~110 VAC, 50/60Hz
Consumption	Rated 15kw or less

Fujikin®



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The Year 2005
The 1st Monozukuri (manufacturing)
Nippon Grand Awards
: Excellence Prize