

High Concentration Hydrogen Peroxide Gas Delivery System

Safe, stable, consistent H₂O₂ gas delivery

The Peroxidizer vaporizer provides a safe, reliable way to deliver high-concentration hydrogen peroxide gas into ALD, annealing, dry surface preparation, and cleaning processes.

Peroxidizer Benefits

- Safely concentrates H₂O₂ from semiconductor grade 30% weight H₂O₂
- Flows H₂O₂ gas to process at up to 50,000 ppm, depending on flow rate
- Delivers high purity H₂O₂ without entrained droplets or decomposition
- Delivers low H₂O to H₂O₂ ratios

Benefits for Annealing and ALD

- Allows low temperature processing
- High oxide growth rates
- More reactive to metal-organic precursors
- Useful for in situ surface pre-cleaning
- Enables high-density, uniform hydroxylated surfaces
- Reduces number of defects

Benefits for Surface Preparation and Cleaning

- Delivers stable H₂O₂ gas at a wide range of concentrations to remove films and residues
- Cleans in situ, requiring less chemical than wet cleaning
- Oxidizes organic hydrocarbons and metals, enabling their removal
- Removes carbon contamination without damaging the surface

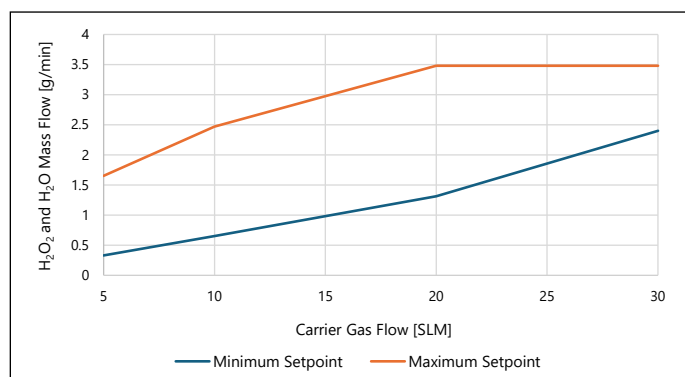


Figure 1 (left): H₂O₂/H₂O mass flow setpoints for a range of carrier gas flow rates. Contact RASIRC if calibration is needed outside this range.

H₂O₂ Delivery Challenges

H₂O₂ presents a multitude of difficulties:

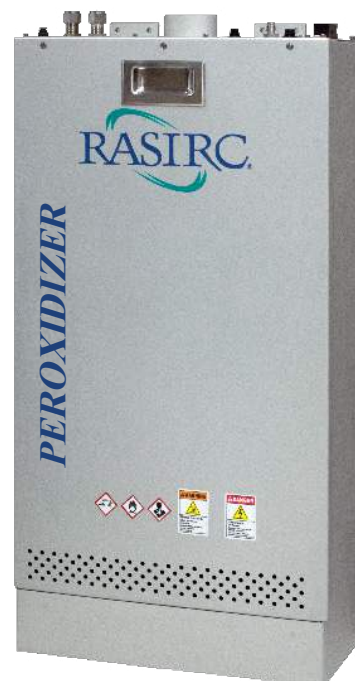
- Users wish to use standard two-component 30% weight H₂O₂
- Low volatility
- Easily condenses in the gas stream to form droplets, which can lead to particles on wafer surfaces
- Decomposes to form water and oxygen at elevated temperatures, undermining the use of hot-plate vaporizers
- Generates particles when used with flash vaporizers

Overcoming Raoult's Law

H₂O₂ gas has not been used extensively in oxidation, surface preparation, and cleaning applications because of the obstacle described by Raoult's Law. When a two-component solution is vaporized, the individual components will do so at different rates. In the case of 30% weight H₂O₂, the H₂O component vaporizes significantly faster than H₂O₂. H₂O dominates the vapor stream, and the H₂O₂ concentration is too low to be effective for the process.

Bubblers and traditional vaporizers do nothing to counteract the effect of Raoult's Law. If a carrier gas is bubbled through 30% weight H₂O₂ solution, less than 300 ppm of H₂O₂ will be delivered along with about 25,000 ppm of H₂O. For traditional vaporizers, high temperature operation leads to H₂O₂ decomposition. Lack of temperature control leads to entrained droplets.

For both bubblers and traditional vaporizers, the differential vaporization rate causes



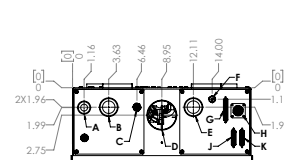
the liquid solution to concentrate and the composition of the process gas to constantly change. This prevents repeatable process control. Process recipes cannot be written around continuously changing mixtures.

The Peroxidizer vaporizer overcomes the issues of Raoult's Law by using a patented in situ liquid concentration method. Its unique vaporizer concentrates the liquid 30% weight H₂O₂ solution to a stable and consistent level that allows up to 50,000 ppm of H₂O₂ gas to flow to process along with H₂O at a ratio of four to one.

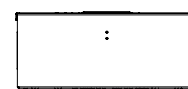
Table 1: Typical maximum H₂O₂/H₂O mass flow output using 30%

Carrier Gas (SLM)	H ₂ O ₂ Vapor (ppm)	Total H ₂ O ₂ and water mass flow (g/min)
5	50,000	1.65
10	40,000	2.47
20	30,000	3.5
30	20,000	3.5

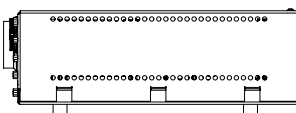




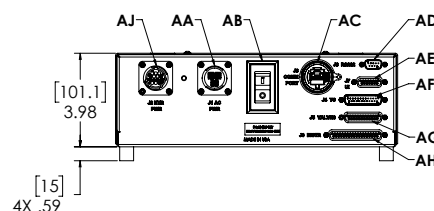
Chemical Cabinet Top View



Chemical Cabinet Bottom View



Electronics Box Side View



Electronics Box Back View

Description	Size/Type	Specification
H ₂ O ₂ /H ₂ O Process	1/4" male face seal, SS	Can be configured for delivery into atmospheric or subatmospheric process pressures
H ₂ O ₂ /H ₂ O Bypass Vent	1/2" male compression, SS	Must be maintained at atmospheric pressure and connected to an abatement system
Carrier Gas Supply	1/4" male face seal, SS	<ul style="list-style-type: none"> Argon, Oxygen, Nitrogen, XCDA Purity: 99.999999% Filtration: 0.003µm Pressure: Min - 0.30MPa, Max - 0.85MPa Temperature: 17-24 °C Mass flow controller included in the unit
Pneumatic Gas Supply	1/4" Push-to-Connect	<ul style="list-style-type: none"> Argon, Nitrogen, XCDA Pressure: Min - 0.52MPa, Max - 0.59MPa Filtration: 0.1µm
Cabinet Exhaust	3" duct adapter	30-50 cfm @ -0.13 to -0.16 inches H ₂ O, connected to an H ₂ O ₂ monitor
H ₂ O ₂ Liquid Source	N/A	<ul style="list-style-type: none"> Manually filled (4L bottle inside of the unit) Semiconductor grade H₂O₂ Concentration: 30% ± 1 % (w/w)
AC Power	CPC Type XIII, Male	100-120VAC, 10 amps max
Environment	N/A	17-24 °C

RASIRC products generate and deliver water vapor, hydrogen peroxide, and hydrazine gas to enable critical processes.

