

# Water-Free Hydrogen Peroxide Gas for Thin Film Processing

*Enables lower processing temperatures & increased choice in precursors*

RASIRC BRUTE Peroxide provides a breakthrough method to deliver virtually water-free hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) gas into Atomic Layer Deposition (ALD) and Etch (ALE) processes. BRUTE Peroxide solution is pre-loaded in a RASIRC vaporizer. This solution combines H<sub>2</sub>O<sub>2</sub> liquid and a proprietary solvent, which ensures that the liquid source remains below 30% by weight H<sub>2</sub>O<sub>2</sub>.

### RASIRC BRUTE Peroxide Benefits

- Provides H<sub>2</sub>O<sub>2</sub> gas with minimal water
- Differentiates between H<sub>2</sub>O<sub>2</sub> and water in process reactions
- Reacts faster and at lower temperatures than water
- Removes carbon and hydroxylates interface surfaces
- Improves compatibility with metal surfaces—less aggressive oxidant than ozone or O<sub>2</sub> Plasma
- Superior penetration into 3D high aspect ratio microstructures
- Allows high concentration H<sub>2</sub>O<sub>2</sub> delivery into vacuum and low pressure applications
- Increases interface hydroxyl density on Si, Ge and SiGe films
- Enables in situ cleaning without liquid
- Proprietary delivery process, ensuring higher purity

### Background

Oxidants such as oxygen, water, oxygen plasma, and ozone have all been used for cleaning and growing oxide in thin film processes. However, oxygen and water have low effectivity with today's lower thermal budgets. Ozone and plasma can be difficult to control and cause surface damage.

With RASIRC BRUTE Peroxide, H<sub>2</sub>O<sub>2</sub> is now a superior alternative to these older chemical methods. H<sub>2</sub>O<sub>2</sub> has a rapid and straightforward reaction pathway and lower pH for rapid proton transfer. BRUTE Peroxide overcomes historical concentration control issues by virtually eliminating water in the H<sub>2</sub>O<sub>2</sub> solution.

Traditional water/H<sub>2</sub>O<sub>2</sub> solutions produce relatively low H<sub>2</sub>O<sub>2</sub> gas concentrations. Water vaporizes at significantly higher pressures compared to H<sub>2</sub>O<sub>2</sub>, causing continuous change in the ratio of water to hydrogen peroxide. Frequently misunderstood, the gas outputted at 30C and 1 atm of traditional 30% hydrogen peroxide solution is 300ppm, which is only 0.03% H<sub>2</sub>O<sub>2</sub> gas by volume. The H<sub>2</sub>O<sub>2</sub> partial gas pressure is about 0.22 torr.

In contrast, RASIRC BRUTE Peroxide now provides H<sub>2</sub>O<sub>2</sub> partial pressure ranges from 0.4 to 3.6 torr with negligible water content.



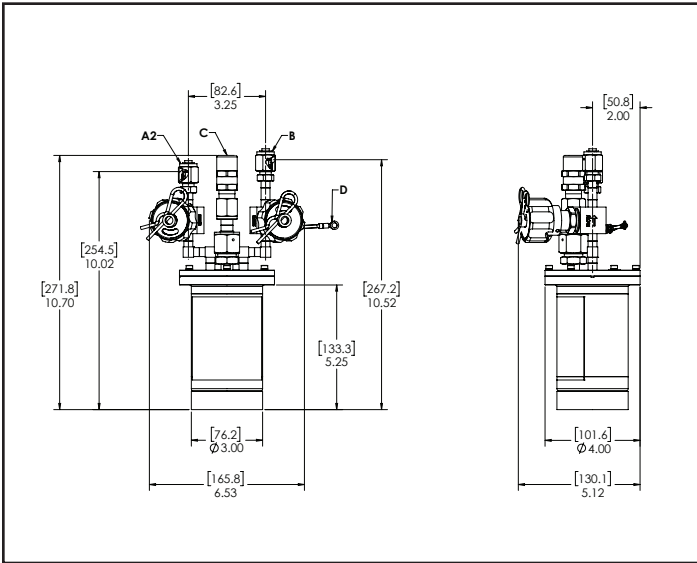
### Product Specifications

- Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) gas pressure from 0.4 to 3.6 torr
- Vacuum or carrier gas flow rate up to 2000 sccm

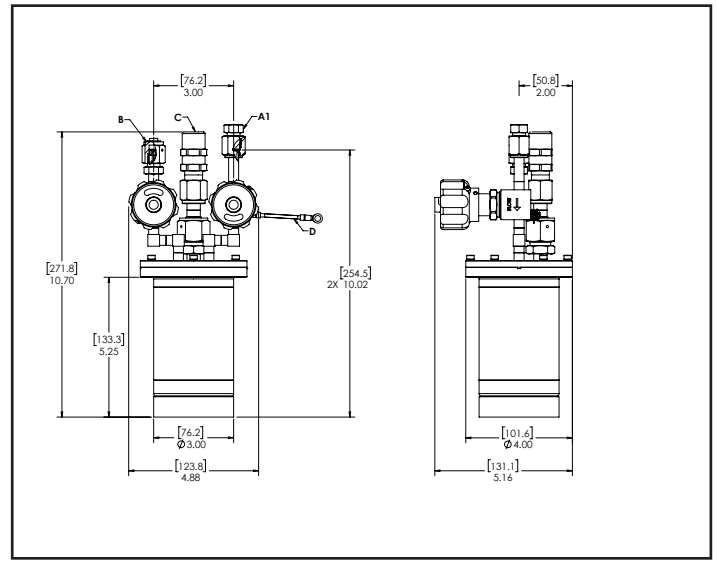
Table 1: BRUTE Peroxide vs. Traditional Water : H<sub>2</sub>O<sub>2</sub> Solutions (25°C, 760 torr) (based upon theoretical calculations)

Solution Concentration (%w/w)	H <sub>2</sub> O <sub>2</sub> Concentration (ppm)	H <sub>2</sub> O Concentration (ppm)
30	203	24131
50	533	17143
70	1142	9241
BRUTE	1514	151
90	2054	2405

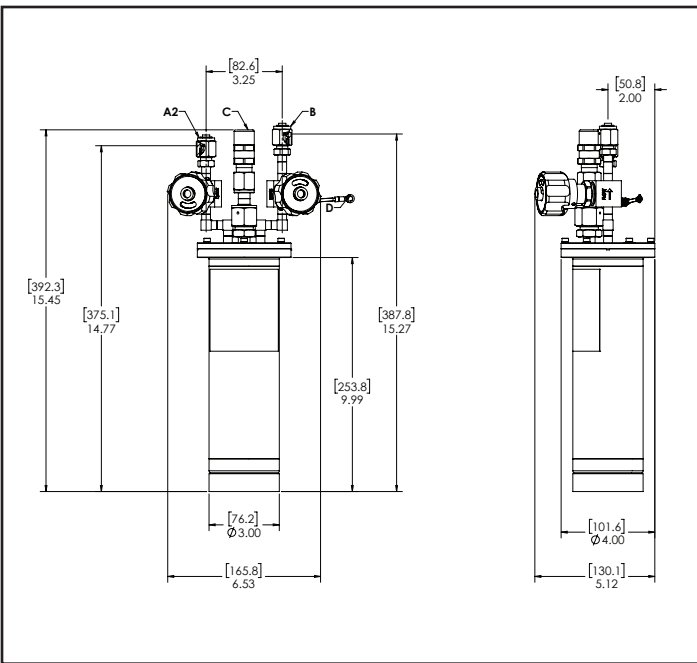




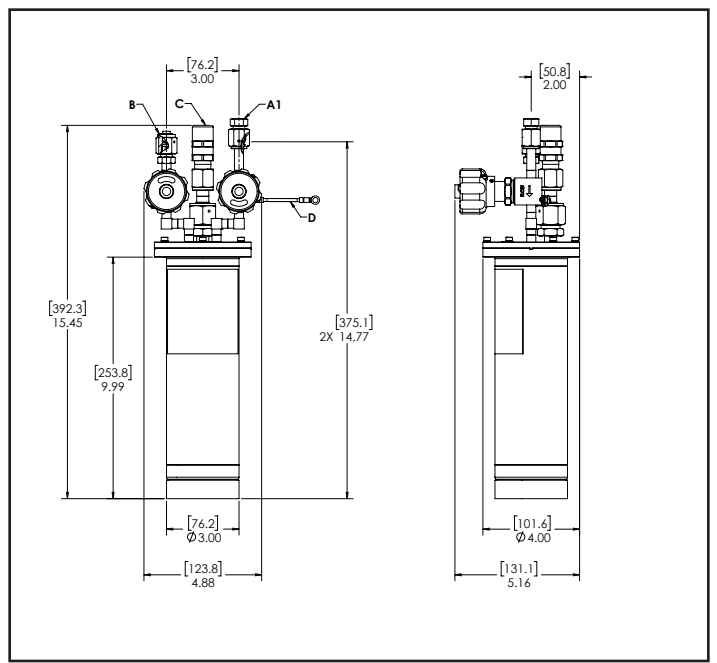
**Figure 1: 300g BRUTE Peroxide, Standard Lid**  
P/N: 100810



**Figure 2: 300g BRUTE Peroxide, S2 Lid**  
P/N: 100808



**Figure 3: 900g BRUTE Peroxide, Standard Lid**  
P/N: 100809



**Figure 4: 900g BRUTE Peroxide, S2 Lid**  
P/N: 100807

	Description	Size/Type
A1	Inert Gas Inlet	1/4" Female VCR
A2	Inert Gas Inlet	1/4" Male VCR
B	Process Gas Outlet	1/4" Male VCR
C	Vent Relief Port	3/8" Female NPT
D	Grounding Cable Assembly	18" length of wire with M5 Terminal Ring (included with vaporizer) - Part number 201990

**Table 2: Specifications**

Operating Conditions	<ul style="list-style-type: none"> <li>Temperature: 10-40° C</li> <li>Max Pressure: 760 torr</li> </ul>
Carrier Gas (optional)	<ul style="list-style-type: none"> <li>0-2000 sccm (user controlled MFC)</li> <li>Filtered to 0.003 µm</li> <li>Purified to &lt; 1ppb contaminants</li> <li>CDA, Oxygen, Nitrogen or inert gas</li> </ul>
H <sub>2</sub> O <sub>2</sub> Vapor Pressure	<ul style="list-style-type: none"> <li>3.6 torr at 40° C</li> <li>1.3 torr at 25° C</li> <li>See Figure 5 for graph</li> </ul>
Tools & Supplies Required	<ul style="list-style-type: none"> <li>PPE (see SDS for BRUTE Peroxide RASIRC P/N 110153)</li> <li>(2) 1/4" SS VCR gaskets no silver plating (Swagelok PN: SS-4-VCR-2-VS)</li> <li>3/4" and 5/8" wrenches</li> </ul>
Required Facilities	<ul style="list-style-type: none"> <li>Facility approved abatement system for H2O2</li> <li>H2O2 safety gas monitor</li> <li>Electrical ground connection</li> <li>Proper ventilation</li> </ul>
Shelf Life	<ul style="list-style-type: none"> <li>6 months at 25° C</li> <li>Shelf life can be extended if stored at 0-10° C</li> </ul>
Vent Relief Cracking Pressure	<ul style="list-style-type: none"> <li>Vessel will relieve pressure when above 5.0 psig</li> </ul>

**How to Order**

To place an order for **BRUTE Peroxide**:

1. Use Table 3 to identify the part number for the desired chemistry weight (g)
2. Use Table 4 to identify the part number for the corresponding chemistry weight (g) and lid type for the Vessel
3. Contact RASIRC at sales@rasirc.com.

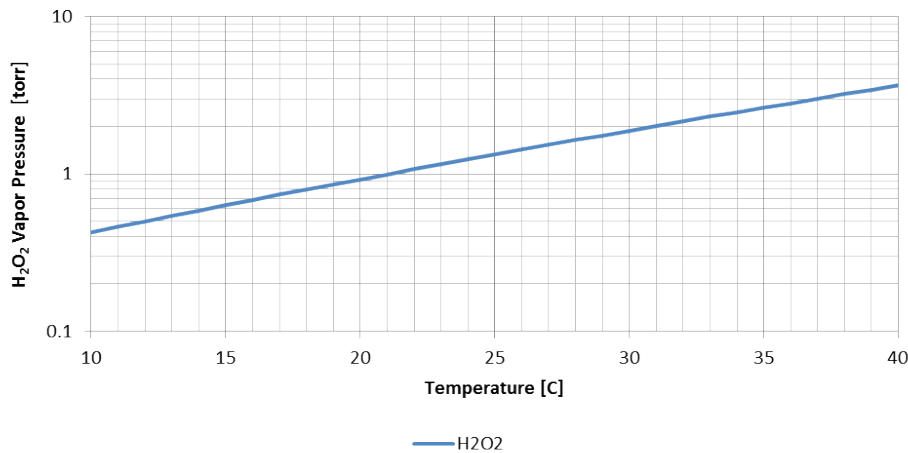
*Table 3: BRUTE Peroxide Chemistry*

Name	Mass of Solution	Part Number
BRUTE Peroxide	300g	100727
BRUTE Peroxide	900g	100729

*Table 4: BRUTE Peroxide Vessel Rental*

Name	Mass of Solution	Lid Type	Part Number
BRUTE Peroxide Vessel	300g	Standard	100810
		S2	100808
	900g	Standard	100809
		S2	100807

**BRUTE Peroxide Vapor Pressure Curve**



**Figure 5:** Vapor Pressure of H2O2 for BRUTE Peroxide based upon theoretical calculations

**About RASIRC**

RASIRC products purify and deliver ultra-pure gases from liquids. First to generate ultra-high purity (UHP) steam from de-ionized water, RASIRC technology now also delivers hydrogen peroxide gas in controlled, repeatable concentrations. It reduces cost, increases yield, and improves safety. RASIRC gas delivery systems, humidifiers, closed loop humidification systems, and steam generators are critical for many applications in semiconductor, photovoltaic, pharmaceutical, medical, biological, fuel cell, and power industries.

