

H2O2 Handling Safety Overview

Month, 2015





Overview of H2O2



- Hydrogen Peroxide is used in a variety of industries from medical, to paper processing, to propulsion systems.
- Peroxide is specified as the percentage of pure hydrogen peroxide to the amount of water in the solution.
 - 90% Peroxide is composed of 90% H2O2 and 10% H2O.
- Typical grades for propulsion applications range from about 80 to 99% peroxide.
 - These grades are commonly referred to as High Test Peroxide (HTP).
- At concentrations above 67% peroxide, the decomposition of peroxide produces enough energy to vaporize the water along with the peroxide.
- The rate of decomposition is a function of pressure.

Typical PPE for HTP



- The three main hazards from handling peroxide are
- 1) Ignition of clothing
- 2) Chemical Burns on skin, eyes, etc.
- 3) Injury resulting from rupture of Pressure Vessel of storage container.
- To mitigate against these hazards the following PPE is recommended:
 - Eye goggles
 - Face Shield
 - Fully Body suit of Neoprene or other suitable rubber (Can be overalls and coat with hood, just mitigating spill hazard).
 - Rubber boots
 - Rubber gloves

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• Covered in additional detail in Section 6.4 of AFRPL-TR-67-144



Pressure Sensitivity



- The rate of decomposition of Peroxide is a function of pressure.
- When handling peroxide it should only be transferred in, vented, unpressurized containers.
- Storage containers must be vented at all times.
 - Pressure will slowly build, raising the reaction rate, which can lead to a run away reaction that will destroy the storage container if it is not vented.
- For testing requiring the pressurization of hydrogen peroxide, the pressurization should always be done remotely with personnel protected in the event of a pressure vessel failure.
- In the event of a sudden build up of pressure in a hydrogen peroxide container, the container should be dumped and the peroxide neutralized with water.

H2O2 Material Compatibility



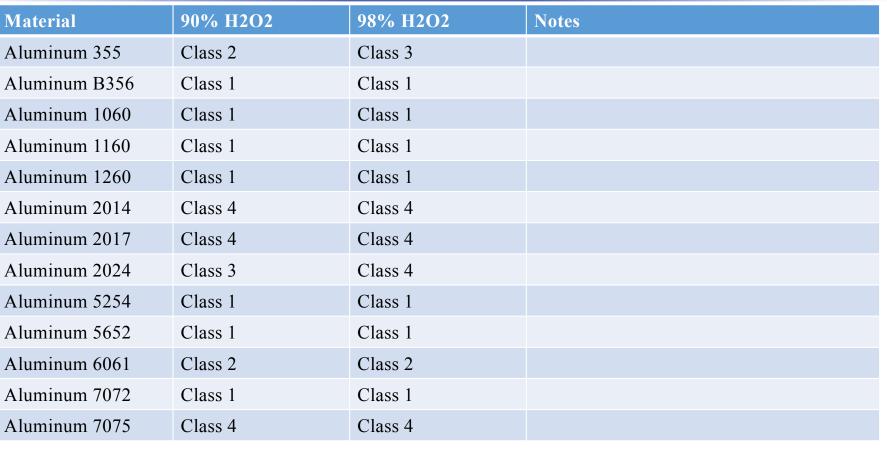
- Hydrogen Peroxide storability (and more generally, compatibility) is based off of the rate of decomposition when in contact with a given material.
- Hydrogen Peroxide Material compatibility is generally ranked through a class structure.
 - Class 1: Materials Satisfactory for Unrestricted use with H2O2
 - Class 2: Materials Satisfactory for Repeated Short-Time Contract with H2O2. Maximum of 4 hours at 160 F or 1 Week at 70 F.
 - Class 3: Materials Satisfactory for Short-Term Contact Only, Less than 1 minute at 160 F and 1 hour at 70 F for unpressurized systems. Single use only.
 - Class 4: Not recommended for use with H2O2.

Class System limitations



- The class system is only used to provide a relative guide, and is not a perfect system.
- The class of a given material is a function of concentration and temperature.
 - For example Material A may be a Class 2 material with 90% peroxide, but a Class 3 material with 98% peroxide at 70 F.
 - There are several materials that are Class 2 at 70 F and Class 4 at 160 F.
- Surface finish and surface treatment has a large impact on compatibility.
- Most Metals need to be passivated prior to service with HTP.

Aluminum @ 70 F



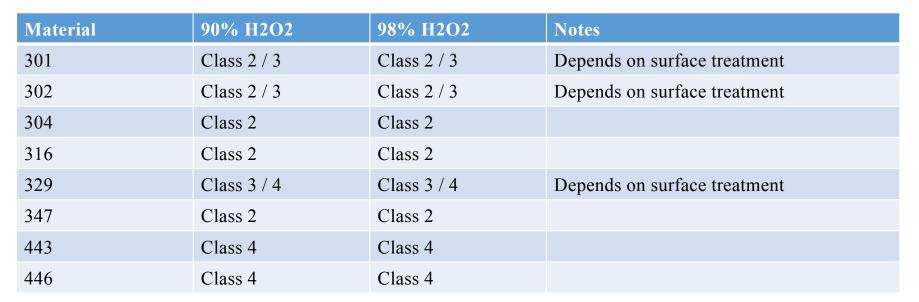
Source: AFRPL-TR-67-144

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Stainless Steel @ 70 F



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Inconel 718



Material	90% H2O2	98% H2O2	Temperature	Notes
718	Class 2	Class 2	70 F	Surface Finish must be better than 10 rms
718	Class 4	Class 4	151 F	

Source: AFRPL-TR-67-144

• Note: Surface finish and operating temperature is extremely important when using Inconel 718 with HTP.



Elastomers and Seal Materials @ 70 F

Material 90% H2O2 98% H2O2 Notes Class 4 Class 4 Buna N Class 4 Butyl Rubber Class 4 Delrin Class 4 Class 4 Kel-F Class 1 to 3 Class 1 to 3 Depends on actual grade Polyethylene Class 2 to 4 Class 2 to 4 Depends on actual grade / Vendor Silicon Class 2 to 4 Class 2 to 4 Depends on actual grade / Vendor Teflon (Virgin) Class 1 Class 1 Viton A Class 2 to 4 Class 2 to 4 Depends on actual grade / Vendor Unknown From Dupont, 1967 Vintage Viton B (805) Class 1

Source: AFRPL-TR-67-144

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Metals to avoid



Material	90% H2O2	
Beryllium	Class 4	
Cadmium	Class 4	
Chromium	Class 4	
Cobalt	Class 4	
Columbium	Class 4	
Copper	Class 4	
Gold	Class 4	
Iron	Class 4	
Lead	Class 4	
Magnesium	Class 4	

Material	90% H2O2	
Manganese	Class 4	
Mercury	Class 4	
Molybdenum	Class 4	
Nickel	Class 4	
Platinum	Class 4	
Silver	Class 4	
Sodium	Class 4	
Titanium	Class 4	
Tungsten	Class 4	
Zinc	Class 4	

Source: AFRPL-TR-67-144



