



United Hydrogen
GROUP

Material Safety Data Sheet: Hydrogen

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| Product Name: Hydrogen | CAS: 1333-74-0 |
| Hydrogen, Compressed (D.O.T); Water Gas | DOT I.D No.: UN 1049 |
| Chemical Name and Synonyms: Hydrogen, Normal Hydrogen | DOT Hazard Class: Division 2.1 |
| Formula: H ₂ | Chemical Family: Inorganic Flammable Gas |

Health Hazard Data

Time Weighted Average Exposure Limit:

Hydrogen is defined as a simple asphyxiant (ACGIH 1994-1995); OSHA 1993 PEL (8 Hr. TWA) = No Listing

Symptoms of Exposure:

Inhalation: High concentrations of hydrogen so as to exclude an adequate supply of oxygen to the lungs causes dizziness, deeper breathing due to air hunger, possible nausea and eventual unconsciousness.

Toxicological Properties:

Hydrogen is inactive biologically and essentially nontoxic; therefore, the major property is the exclusion of an adequate supply of oxygen to the lungs.

Hydrogen is not listed in the IARC, NTP or by OSHA as a carcinogen or potential carcinogen.

Persons in ill health where such illness would be aggravated by exposure to hydrogen should not be allowed to work with or handle this product.

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| Hazardous Mixtures of other Liquids, Solids or Gases: Hydrogen is flammable over a very wide range in air. | |
| PHYSICAL DATA | |
| Boiling Point: -423°F (-252.8°C) | Liquid Density at Boiling Point: 4.43 lb/ft ³ (70.96 kg/m ³) |
| Vapor Pressure @ 70°F (21.1 °C) = Above the critical temperature of 399.8°F (-239.9°C) | Gas Density at 70°F, 1 atm .0052 |
| Solubility in Water: Very slightly | Freezing Point: -434.6°F (-259.2°C) |
| Evaporation Rate: N/A (Gas) | Specific Gravity(AIR=1) @ ⁷⁰F(21.1°C) =.069 |
| Appearance and Odor: Colorless, odorless gas | |

Fire and Explosion Hazard Data

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| Flash Point (Method used): N/A Gas | Auto Ignition Temperature: 1058°F (570°C) | Flammable Limits % by Volume: LEL 4 UEL 74.5 |
| Extinguishing Media: Water, carbon dioxide, dry chemical | | Electrical Classification: Class 1, Group B |
| Special Fire fighting Procedures: If possible, stop the flow of hydrogen. Cool surrounding containers with water spray. Hydrogen burns with an almost invisible flame of relatively low thermal radiation. | | |
| Unusual Fire and Explosion Hazards: Hydrogen is very light and rises very rapidly in air. Should a hydrogen fire be extinguished and the flow of gas continue, increase ventilation to prevent an explosion hazard, particularly in the upper portions. | | |

Reactivity Data

Stability: Stable

Incompatibility (Materials to Avoid): Oxidizers

Hazardous Decomposition Products: None

Hazardous Polymerization: Will not occur

Conditions to Avoid None

Spill or Leak Procedures

Steps to be taken in case material is released or spilled:

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact your closest supplier location or call the emergency telephone number listed herein.

Waste disposal methods:

Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to your supplier. For emergency disposal assistance, contact your closest supplier location or call the emergency telephone number listed herein.

Special Protection Information

Respiratory Protection (Specify type): Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

Ventilation: Hood with forced ventilation

Local Exhaust: To prevent accumulation above the LEL

Mechanical (Gen.): In accordance with electrical codes

Protective Gloves: Plastic or rubber

Eye Protection: Safety goggles or glasses

Other Protective Equipment: Safety shoes, safety shower

Special Precautions

Special Labeling Information:

DOT Shipping Name: Hydrogen, Compressed

DOT Hazard Class: Division 2.1

DOT Shipping Label: Flammable Gas

I.D. No.: UN 1049

Special Handling Recommendation:

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder. For additional handling recommendations, consult Compressed Gas Association's Pamphlets G-5, P-1, P-14, and Safety Bulletin SB-2.

Special Storage Recommendations:

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of I noncombustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125F (52C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in -first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area. For additional storage recommendations, consult Compressed Gas Association's Pamphlets G-5, P-1, P-14, and Safety Bulletin SB-2.

Other Recommendations or Precautions:

Earth-ground and bond all lines and equipment associated with the hydrogen system. Electrical equipment should be non-sparking or explosion proof. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

Special Packaging Recommendations:

Hydrogen is non-corrosive and may be used with any common structural material.