

HYDROGEN

CHEMICAL PRODUCT

PRODUCT NAME: Hydrogen, compressed

CHEMICAL NAME: Hydrogen

CHEMICAL FAMILY: Flammable gas

SYMBOL: H₂

SYNONYMS: None

[USES]: Various

INGREDIENT COMPOSITION INFORMATION

INGREDIENTS NAME	PERCENTAGE	OHSA PEL-TWA	ACGIH TLV
Hydrogen	>99%	None	Simple Asphyxiant

HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

DANGER! Flammable, high pressure gas.
Can form explosives mixtures with air.
Burns with an invisible flame

POTENTIAL HEALTH EFFECTS:

ROUTES OF EXPOSURE:

INHALATION: Asphyxiant. It should be noted that before suffocation could occur, the lower flammability limit of hydrogen in air would be exceeded; possibly causing both an explosive and oxygen-deficient atmosphere.

Exposure to moderate concentrations may cause dizziness, headache, nausea and unconsciousness. Exposure to atmospheres containing 8% to 10% or less oxygen will bring about unconsciousness without warning, and so quickly that the individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death.

EYE CONTACT: None

SKIN CONTACT: None

SKIN ABSORPTION]: None

[INGESTION]: None

CHRONIC EFFECTS: None

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None

OTHER EFFECTS OF OVEREXPOSURE: None

POTENTIAL HEALTH EFFECTS: Hydrogen is not listed.

FIRST AID MEASURES

INHALATION: Persons suffering from lack of oxygen should be removed to fresh air. If victim is not breathing, administer artificial respiration. If breathing is difficult, administer oxygen. Obtain prompt medical attention.

EYE CONTACT: None

SKIN CONTACT: None

INGESTION: None

NOTES TO PHYSICIAN: None

FIRE FIGHTING MEASURES

FLASH POINT: Flammable gas

AUTOIGNITION: 571.2°C

FLAMMABLE LIMITS IN AIR VOLUME:

LOWER: 4% UPPER: 75.0%

EXTINGUISHING MEDIA: CO₂ dry chemical, water spray or fog for surrounding area. Do not extinguish until hydrogen source is shut off.

SPECIAL FIRE FIGHTING INSTRUCTIONS: Evacuate all personnel from danger area. Immediately cool container with water spray from maximum distance, taking care not to extinguish flames. If flames are accidentally extinguished, explosive re-ignition may occur. Stop flow of gas if without risk while continuing cooling water spray.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Burns with a pale blue, nearly invisible flame. Hydrogen is easily ignited with low ignition energy. Hydrogen is lighter than air and can accumulate in the upper sections of enclosed spaces. Pressure in container can build up due to heat and it may rupture if pressure relief devices should fail to function.

HAZARDOUS COMBUSTION PRODUCTS: None

[SENSITIVITY TO STATIC DISCHARGE]: Ignitable by static electricity

[SENSITIVITY TO MECHANICAL IMPACT]: None

ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Evacuate immediate area. Eliminate any possible sources of ignition, and provide maximum explosion-proof ventilation. Shut off source of hydrogen, if possible. If leaking from cylinder, or valve, contact your supplier. The presence of a hydrogen flame can be detected by approaching cautiously with an outstretched straw broom to make the flame visible. Never enter a confined space or other area anywhere the concentration is greater than 10% of the lower flammable limit, which is 4%.

HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN STORAGE: Cylinder storage locations should be well protected, well-ventilated, dry, and separated from combustible materials. Cylinders should never knowingly be allowed to reach a temperature exceeding 125 °F (52 °C). Cylinders of hydrogen should be separated from oxygen cylinders or other oxidizers by a maximum distance of 20 ft, or by a barrier of non-combustible material at least 5 ft high having a fire resistance rating of at least 1/2 hour. Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling or being knocked over. Protect cylinders from physical damage; do not drag, roll, slide or drop. Post "No Smoking or Open Flames" signs in the storage areas.

There should be no sources of ignition. All electrical equipment should be explosion proof in the storage and use areas. Storage areas must meet national electric codes for Class 1 hazardous areas.

PRECAUTIONS TO BE TAKEN IN HANDLING: Use a suitable hand truck for cylinder movement. Do not "crack" hydrogen cylinder valve before connecting it, since self-ignition may occur. Hydrogen is the lightest gas known and may collect in the top of buildings without proper ventilation. It may leak out of a system that is gas-tight for air or other gases. Leak check system with leak detection solution, never with flame. If user experiences difficulty operating cylinder valve, discontinue use and contact supplier. Never insert an object (e.g., wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit. Non-sparking tools should be used. For additional precautions in using hydrogen see other Information.

EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS:

VENTILATION: Provide natural or explosion-proof ventilation adequate to ensure hydrogen does not reach its lower explosive limit of 4%.

RESPIRATORY PROTECTION (SPECIFY TYPE):

General Use: None required

Emergency Use: Air supplied respirators are required in oxygen-deficient atmospheres; air purifying respirators will not function. Before entering area you must check for flammable or oxygen-deficient atmospheres.

PROTECTIVE GLOVES: Work gloves are recommended when handling cylinders.

EYE PROTECTION: Safety glasses are recommended when handling cylinders.

OTHER PROTECTIVE EQUIPMENT: Safety shoes recommended when handling cylinders. Cotton clothing is recommended for use to prevent static electricity build-up.

PHYSICAL AND CHEMICAL PROPERTIES

MOLECULAR WEIGHT: 2.016

BOILING POINT normal H₂ @ 101.325 kpa = -252.8°C

RELATIVE DENSITY, normal H₂ gas 101.325 kpa @ 25°C (Air=1) = 0.0695

TRIPLE POINT, normal H₂ temperature -259.2°C

VAPOR PRESSURE (at 20°C): Not applicable

ABSOLUTE DENSITY, normal H₂ @ 101.325 kpa @ 25°C = 0.082.35 1 kg/m³

EVAPORATION RATE (Butyl Acetate=1): Not applicable

SOLUBILITY IN WATER: @ 101.325 kpa (Partial pressure H₂ @ 20°C = 0.0182 cm³/cm³ water

EXPANSION RATIO: Not applicable (gas)

[pH]: Not applicable

APPEARANCE, ODOR AND STATE: Colorless, odorless and tasteless gas at normal temperature and pressure.

[COEFFICIENT OF WATER/OIL DISTRIBUTION]: Not available

[ODOR THRESHOLD]: Not applicable (odorless)

STABILITY AND REACTIVITY

STABILITY: Stable

CONDITIONS TO AVOID: None

INCOMPATIBILITY (Materials to Avoid): Oxidizing agents. Some steels are susceptible to hydrogen embrittlement at high pressures and temperatures.

REACTIVITY:

- A) **HAZARDOUS DECOMPOSITION PRODUCTS:** None
- B) **HAZARDOUS POLYMERIZATION:** Will not occur

TOXICOLOGICAL INFORMATION

Hydrogen is a simple asphyxiant

(IRRITANCY OF MATERIAL): None

(REPRODUCTIVE EFFECTS): None

(TERATOGENICITY): None

(SYNERGISTIC MATERIALS): None

(SENSITIZATION TO MATERIAL): None

(MUTAGENICITY): None

ECOLOGICAL INFORMATION

No adverse ecological effects are expected. Hydrogen does not contain any Class I or Class II ozone-depleting chemicals. Hydrogen is not listed as a marine pollutant.

DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused product in the cylinder. Return cylinder to supplier for safe disposal.

Residual product within process system may be vented at a controlled rate to the atmosphere through a vent stack that discharges to an elevated point. This vent stack should be in an isolated area away from ignition sources.

TRANSPORT INFORMATION

DOT/IMO SHIPPING NAME: Hydrogen, compressed

HAZARD CLASS: 2.1 (Flammable Gas)

PRODUCT RQ: None

SHIPPING LABEL(s): Flammable gas

PLACARD (When required): Flammable gas

SPECIAL SHIPPING INFORMATION : Cylinders should be transported in a secure upright position, in a well ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards and should be discouraged.

OTHER INFORMATION

SPECIAL PRECAUTIONS: Use piping and equipment adequately designed to withstand pressures to be encountered. Use a check valve or other protective apparatus in any line or piping from the cylinder to prevent reverse flow.

MIXTURES: When two or more gases or liquified gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist, or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have their properties that can cause serious injury or death.

OTHER INFORMATION:

NFPA RATINGS:

HEALTH: =0

FLAMMABILITY: =4

INSTABILITY: =0

SPECIAL: =SA (CGA Recommends this to designate simple asphyxiant.)

HMIS RATINGS:

HEALTH: =0

FLAMMABILITY: =4

REACTIVITY: =0