

General Hydrogen Corporation

Material Safety Data Sheet

Product Details: Hydrogen Compressed

Manufacturer/Supplier: General Hydrogen Corporation

CGI Building, 1215 Henderson Avenue, Washington, PA 15301

1. Chemical Product and Company Identification

MSDS NO.: P-4604-G

Chemical Name: Hydrogen

Chemical Family: Permanent gas

Trade Names: Hydrogen

Synonyms: Dihydrogen, parahydrogen, refrigerant gas R702, water gas

Product Grades: Industrial, 4.5, 4.5-Zero, 4.5 TOC, 5.0-UHP, 5.0-SPG, 5.5-SPG, 6.0-SPG, 6.0-UHP, and 6.0-Research

24 Hour Emergency Telephone Number: 724-225-8700

Please Ensure That This MSDS Is Received By The Appropriate Person.

2. Hazards Identification

EMERGENCY OVERVIEW

DANGER! Flammable high-pressure gas.

Can form explosive mixtures with air.

May ignite if valve is opened to air.

Burns with invisible flame.

May cause dizziness and drowsiness.

Self-contained breathing apparatus may be required by rescue workers.

Under ambient conditions, this is a colorless, odorless, tasteless gas.

The Hazard Description of the Product has been rated by HMIS on a scale of 0-4.

Health= 0

Fire= 4

Reactivity= 0

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POTENTIAL HEALTH EFFECTS:

Effects of a Single (Acute) Overexposure

Inhalation. Asphyxiant. Effects are due to lack of oxygen. Moderate concentrations may cause headache, drowsiness, dizziness, excitation, excess salivation, vomiting, and unconsciousness. Lack of oxygen can kill.

Skin Contact. No harm expected.

Swallowing. An unlikely route of exposure; this product is a gas at normal temperature and pressure.

Eye Contact. No harm expected.

Effects of Repeated (Chronic) Overexposure. No harm expected.

Other Effects of Overexposure. Hydrogen is an asphyxiant. Lack of oxygen can kill.

Medical Conditions Aggravated by Overexposure. The toxicology and the physical and chemical properties of hydrogen suggest that overexposure is unlikely to aggravate existing medical conditions.

CARCINOGENICITY: This product is not listed by NTP, OSHA, or IARC

POTENTIAL ENVIRONMENTAL EFFECTS: None known. For further information, see section

3. Composition/Data on Components

Chemical Characterization:

COMPONENT CAS NUMBER:

Hydrogen

1333-74-0

CONCENTRATION

>99%*

*The symbol > means "greater than."

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4. First Aid Measures

INHALATION: Supply fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Consult doctor in case of complaints

SKIN CONTACT: Generally the product does not irritate the skin. This product is a gas at normal temperature and pressure

SWALLOWING: Not applicable

EYE CONTACT: Rinse opened eye for several minutes under running water. Then consult a doctor

NOTES TO PHYSICIAN: There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Flammable gas. Flame is nearly invisible. Escaping gas may ignite spontaneously. Hydrogen has a low ignition energy. Fireball forms if gas cloud ignites immediately after release. Forms explosive mixtures with air and oxidizing agents.

SUITABLE EXTINGUISHING AGENTS: CO₂, powder, water spray, alcohol resistant foam or fog

PRODUCTS OF COMBUSTION: Water (H₂O)

PROTECTION OF FIREFIGHTERS: DANGER! Flammable high-pressure gas. Evacuate all personnel from danger area. Immediately deluge cylinders with water from maximum distance until cool; then move them away from fire area if without risk. Continue cooling water spray while moving cylinders. Do not extinguish flames emitted from cylinders; allow them to burn out. Self-contained breathing apparatus may be required by rescue workers. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

Specific Physical and Chemical Hazards. Heat of fire can build pressure in cylinder and cause it to rupture. Hydrogen cylinders are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.) No part of a cylinder should be subjected to a temperature higher than 125 F (52 C). If venting or leaking hydrogen catches fire, do not extinguish flames. Flammable gas may spread from leak, creating an explosive re-ignition hazard. Vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with approved explosion meter.

Protective Equipment and Precautions for Firefighters. Firefighters should wear self-contained breathing apparatus and full fire-fighting turnout gear.

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6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

DANGER! Flammable high-pressure gas.

Personal Precautions. Forms explosive mixtures with air. Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Approach suspected leak area with caution. Remove all sources of ignition if without risk. Reduce gas with fog or fine water spray. Shut off flow if without risk. Ventilate area or move cylinder to a well-ventilated area. Flammable gas may spread from leak. Before entering area, especially confined areas, check atmosphere with an appropriate device.

Environmental Precautions. Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN HANDLING: *Keep away from heat, sparks, and open flame.* Use only spark-proof tools and explosion-proof equipment. *Protect cylinders from damage.* Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop.

Hydrogen is the lightest known gas. It may leak out of systems that are air-tight for other gases and may collect in poorly ventilated upper reaches of buildings. Leak check system with soapy water; never use a flame. *All piped hydrogen systems and associated equipment must be grounded.* Electrical equipment must be non-sparking or explosion-proof. *Do not crack or open hydrogen cylinder valves unless connected to utilization equipment;* escaping gas may ignite spontaneously. Open valve slowly. If valve is hard to open, discontinue use and contact your supplier. Close cylinder valve after each use; keep closed even when empty. *Never attempt to lift a cylinder by its cap;* the cap is intended solely to protect the valve. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Do not mix with air or oxygen above atmospheric pressure

PRECAUTIONS TO BE TAKEN IN STORAGE: *Store and use with adequate ventilation.*

Store only where temperature will not exceed 125 °F (52 °C). *Separate hydrogen cylinders from oxygen, chlorine, and other oxidizers* by at least 20 ft (6.1 m), or use a barricade of noncombustible material. This barricade should be at least 5 ft (1.53 m) high and have a fire resistance rating of at least ½ hour. *Always secure cylinders upright to keep them from falling or being knocked over.* Install valve protection cap, if provided, firmly in place by hand when the cylinder is not in use. *Post “No Smoking or Open Flames” signs in storage and use areas.* There must be no sources of ignition. All electrical equipment in storage areas must be explosion-proof. Storage areas must meet national electric codes for Class 1

hazardous areas. *Store full and empty cylinders separately.* Use a first-in, first-out inventory system to prevent storing full cylinders for long periods.

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Exposure Controls/Personal Protection

Additional Information About Design of technical Systems: adequate local ventilation

Local Exhaust. An explosion-proof local exhaust system is acceptable.

Mechanical (General). Inadequate; see special.

Special. Use only in a closed system.

8. PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Wear work gloves for cylinder handling and metatarsal shoes for cylinder handling.

Regardless of protective equipment, never touch live electrical parts. Wash hands before breaks and at the end of work

Eye/Face Protection. Tightly sealed goggles.

Respiratory Protection. None required under normal use. Use atmosphere supplying respirators (e.g. supplied air: demand, pressure -demand, or continuous flow or self contained breathing apparatus : demand or pressure demand or combination supplied air with auxiliary self contained air supply atmosphere supplying respirator) in case of insufficient ventilation.

9. Physical and Chemical Properties

APPEARANCE:	Colorless gas
ODOR:	Odorless
ODOR THRESHOLD:	Not applicable.
PHYSICAL STATE:	Gas at normal temperature and pressure
pH:	Not applicable.
MELTING POINT at 1 atm:	-434.56°F (-259.2°C)
BOILING POINT at 1 atm:	-422.97°F (-252.76°C)
FLASH POINT (test method):	Not available.
EVAPORATION RATE (Butyl Acetate = 1):	Not
FLAMMABILITY:	Flammable
FLAMMABLE LIMITS IN AIR , % by volume:	LOWER: 4.0% UPPER: 75.0%

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LIQUID DENSITY at boiling point and 1 atm:

4.43 lb/ft³ (70.96 kg/m³)

VAPOR PRESSURE at 68°F (20°C): Not

applicable

VAPOR DENSITY at 70°F (21.1°C) and 1 atm:

0.0052 lb/ft³ (0.083 kg/m³)

SPECIFIC GRAVITY (H₂O = 1) at 19.4°F (-7°C):

Not available.

SPECIFIC GRAVITY (Air = 1) at 32°F (0°C) and 1 atm: 0.07

SOLUBILITY IN WATER vol/vol at 60°F (15.6°C) and 1 atm:

0.019

PARTITION COEFFICIENT: n-octanol/water:

Not available.

AUTOIGNITION TEMPERATURE:

932°F (500°C)

DECOMPOSITION TEMPERATURE:

Not available.

PERCENT VOLATILES BY VOLUME:

100

MOLECULAR WEIGHT:

2.016

MOLECULAR FORMULA:

H₂

10. Stability and Reactivity

CHEMICAL STABILITY: Unstable

CONDITIONS TO AVOID: None known.

INCOMPATIBLE MATERIALS: Oxidizing agents, lithium, halogens

HAZARDOUS DECOMPOSITION PRODUCTS: None

POSSIBILITY OF HAZARDOUS REACTIONS: Will Not Occur

Flammable gas. Forms explosive mixtures with air and oxidizing agents.

11. Toxicological Information

ACUTE DOSE EFFECTS: Hydrogen is a simple asphyxiant. It does not have any primary irritant effect on skin and in the eye. Sensitizing effects are not known

STUDY RESULTS: None known.

12. Ecological Information

ECOTOXICITY: Generally not hazardous for water

OTHER ADVERSE EFFECTS: Hydrogen does not contain any Class I or Class II ozone-depleting chemicals.

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13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return cylinder to vendor. Disposable cylinder must be disposed off in accordance with local regulations.

14. Transport Information

DOT/IMO SHIPPING NAME: Hydrogen, compressed

HAZARD CLASS:	PACKING GROUP/Zone:	IDENTIFICATION NUMBER:	PRODUCT RQ:
2.1	NA	UN1049	None

SHIPPING LABEL(s): FLAMMABLE GAS

PLACARD (when required): FLAMMABLE GAS

*NA-Not applicable.

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law

MARINE POLLUTANTS: Hydrogen is not listed as a marine pollutant by DOT.

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (ENVIRONMENTAL PROTECTION AGENCY)

CERCLA: COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): None

SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

SECTIONS 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of Extremely Hazardous Substances (EHS) (40 CFR Part 355):

TPQ: None

EHS RQ (40 CFR 355): None

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: No

PRESSURE: Yes

DELAYED: No

REACTIVITY: No

FIRE: Yes

SECTION 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372. Hydrogen is not subject to reporting under Section 313.

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40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Hydrogen is listed as a regulated substance in quantities of 10,000 lb (4536 kg) or greater.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Hydrogen is listed on the TSCA inventory.

OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Hydrogen is not listed in Appendix A as a highly hazardous chemical. However, any process that involves a flammable gas on site in one location in quantities of 10,000 lb (4536 kg) or greater is covered under this regulation unless the gas is used as a fuel.

STATE REGULATIONS:

CALIFORNIA: Hydrogen is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: Hydrogen is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Be sure to read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: *Flammable high-pressure gas. Use only in a closed system. Use piping and equipment adequately designed to withstand pressures and temperatures to be encountered.* Use a backflow prevention device in the piping. *Gas can cause rapid suffocation due to oxygen deficiency.* Store and use with adequate ventilation. *Never work on a pressurized system.* If there is a leak, close the cylinder valve. Blow the system down in a safe and environmentally sound manner in compliance with all federal, state, and local laws; then repair the leak. *Never place a compressed gas cylinder where it may become part of an electrical circuit.*

Mixtures. When you mix two or more gases or liquefied gases, you can 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 evaluate the end product. Remember, gases and liquids have properties that can cause serious injury or death.

HAZARD RATING SYSTEMS:

NFPA RATINGS:

HEALTH	= 0
FLAMMABILITY	= 4
INSTABILITY	= 0
SPECIAL	= None

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STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED: 0-3000 psig CGA-350
3301-5500 psig CGA-695
5501-7500 psig CGA-703

PIN-INDEXED YOKE: Not applicable.

ULTRA-HIGH-INTEGRITY CONNECTION: CGA-724

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlet V-1 listed below.

Ask your supplier about free safety literature as referred to in this MSDS and on the label for this product. Further information can be found in the following materials published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923; telephone (703) 788-2700, <http://www.cganet.com/Publication.asp>.

- AV-1 Safe Handling and Storage of Compressed Gases
- G-5 Hydrogen
- G-5.3 Commodity Specification for Hydrogen
- P-1 Safe Handling of Compressed Gases in Containers
- SB-2 Oxygen-Deficient Atmospheres
- V-1 Compressed Gas Cylinder Valve Inlet and Outlet Connections
- Handbook of Compressed Gases, Fourth Edition

The opinions expressed herein are those of qualified experts within General Hydrogen Corporation. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of General Hydrogen Corporation, it is the user's obligation to determine the conditions of safe use of the product.