



Material Safety Data Sheet

1. Product and Company Identification

Product name : **Hydrogen, refrigerated liquid**

Chemical formula : H₂

Synonyms : Hydrogen (cryogenic liquid)

Company : Specialty Gases of America, Inc
6055 Brent Dr.
Toledo, OH 43611

Telephone : 419-729-7732

Emergency : 800-424-9300

2. Composition/Information on Ingredients

| Components | CAS Number | % Volume |
|------------|------------|----------|
| Hydrogen | 1333-74-0 | 99+% |

3. Hazards Identification

Emergency Overview

Extremely cold, flammable liquid and gas under pressure.
Can form explosive mixtures with air.
Can cause severe frostbite.
Burns with invisible flame.
Liquid or cold gas can freeze air in vent lines.
May cause dizziness and drowsiness.

Potential Health Effects

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.

Eye contact : No harm expected from vapor. Cold gas or liquid may cause severe frostbite.

Skin contact : No harm expected from vapor. Cold gas or liquid may cause severe frostbite.

Ingestion : An unlikely route of exposure, but severe frostbite of the lips and mouth may result from contact with the liquid.

Chronic Health Hazard : No harm expected.

4. First Aid Measures

Eye contact : For exposure to cold gas, liquid, or solid, immediately flush eyes thoroughly with warm water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure all surfaces are flushed thoroughly. See a physician, preferably an ophthalmologist, immediately.

Skin contact : For exposure to cold gas, liquid, or solid, immediately warm frostbite area with warm water not to exceed 105 F (41 C). In case of massive exposure, remove

- clothing while showering with warm water. Call a physician.
- Ingestion : An unlikely route of exposure; this product is gas at normal temperature and pressure.
- Inhalation : Immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician immediately.

5. Fire-Fighting Measures

- Suitable extinguishing media : CO2, dry chemical, water spray, or fog.
- Specific hazards : Highly flammable, extremely cold cryogenic liquid and gas. Flame is nearly invisible. Escaping gas may ignite spontaneously. Hydrogen has a low ignition energy. Fireball of gas cloud ignites immediately after release. Forms explosive mixtures with air and oxidizing agents. Liquid causes severe frostbite, a freezing injury resembling a burn. Liquid will solidify air, concentrating oxygen and creating a potential explosion hazard. Heat of fire can build pressure in container and cause it to rupture. Liquid hydrogen containers are equipped with pressure relief devices. No part of a container 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.
- Fire fighting : Evacuate all personnel from danger area. Immediately spray containers with water from maximum distant until cool, taking care not to direct spray onto vents on top of container. Do not discharge sprays into liquid hydrogen. Liquid hydrogen will freeze water rapidly. Shut off flow of gas if without risk, while continuing cooling water spray. Remove ignition sources if without risk. If flames are accidentally extinguished, explosive re-ignition may occur. All personnel including fire and rescue workers should leave the area immediately. Reapproach with extreme caution. When containers have cooled, move them away from fire area if without risk. Self-contained breathing apparatus may be required by rescue workers. On site fire fighters must comply with OSHA 29 CFR 1910.156.

6. Accidental Release Measures

- Personal precautions : Forms explosive mixtures with air. Immediately evacuate all personnel from danger area. Liquid hydrogen will condense moisture in the atmosphere, producing a vapor cloud. The zone of flammability may extend beyond this cloud, so personnel should be evacuated well beyond any visible moisture. Avoid contact with cold liquid, vapor, or frosty condensation. Liquid hydrogen can freeze air, oxygen, and other gases. Contact with liquid or solid gases can cause severe frostbite, a burn-like injury. Flammable gas may spread from leak. Before entering area, especially confined areas, check atmosphere with an appropriate device. Use self-contained breathing apparatus where needed. 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 container to a well-ventilated area.
- Environmental precautions : None.
- Methods for cleaning up : 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,

Additional advice : and local regulations. If necessary, call your supplier for assistance.
: None.

7. Handling and Storage

Handling

Never allow any unprotected part of your body to touch uninsulated pipes or vessels containing cryogenic fluids. Flesh will stick to the extremely cold metal and will tear when you try to pull free.

Use a suitable hand truck to move containers. Cryogenic containers must be handled and stored in an upright position. Do not drop or tip containers, or roll them on their sides. 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. All piped hydrogen systems and associated equipment must be grounded. Electrical equipment must be non-sparking or explosion-proof. Leak check system with soapy water; never use a flame. If valve is hard to open, discontinue use and contact your supplier.

Storage

Store and use with adequate ventilation. Store only where temperature will not exceed 125 F (52 C). Do not store in a confined space. Cryogenic containers are equipped with a pressure relief device and a pressure controlling valve. Under normal conditions these containers will periodically vent product. Use adequate pressure relief devices in systems and piping to prevent pressure buildup; entrapped liquid can generate extremely high pressures when vaporized by warming. Separate hydrogen containers 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. Post "No Smoking or Open Flames" signs in storage and use areas. There must be no sources of ignition. All electrical equipment in storage area must be explosion-proof. Storage areas must meet national electric codes for Class 1 hazardous areas. For full details and requirements, see NFPA 50A, published by the National Fire Protection Association.

8. Exposure Controls / Personal Protection

Engineering measures

An explosion-proof local exhaust system is acceptable. Use only in closed system.

Personal protective equipment

Respiratory protection : None required under normal use. An air-supplied respirator must be used in confined spaces. Respiratory protection must conform to OSHA rules as specified in 29 CFR 1910.134.

Hand protection : Wear loose-fitting, cryogenic gloves.

Eye protection : Safety glasses and a full-face shield are recommended.

Skin and body protection : Metatarsal shoes for cylinder handling. Protective clothing where needed. Cuffless trousers should be worn outside the shoes. Regardless of protective equipment, never touch live electrical parts.

9. Physical and Chemical Properties

Form : Cryogenic liquid.

Color : Colorless.

Odor : Odorless.

Molecular weight : 2.016

Vapor pressure : Not applicable.

Liquid density : 4.43 lb/ft³ (70.96 kg/m³) @ boiling point and 1 atm

Specific gravity : 0.06960 @ 32 F (0 C) and 1 atm (air = 1)

Boiling point : -422.97 F (-252.76 C)

Melting point : -434.56 F (-259.2 C)

Water solubility : 0.019 vol @ 60 F (15.6 C) and 1 atm

10. Stability and Reactivity

Stability : Stable under normal conditions.
Conditions to avoid : None known.
Materials to avoid : Oxidizing agents, lithium, halogens.
Hazardous decomposition products : None.

11. Toxicological Information

Acute Health Hazard

Ingestion : Not available.
Inhalation : Not available.
Skin : Not available.

12. Ecological Information

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

13. Disposal Considerations

Waste from residues / unused products : Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.
Contaminated packaging : Return cylinder to supplier.

14. Transport Information

DOT (US only)

Proper shipping name : Hydrogen, refrigerated liquid
Class : 2.1
UN/ID No. : UN1966
Labeling : Flammable Gas

Further information

Cylinders should be transported in a secure upright position in a well ventilated truck.
Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

15. Regulatory Information

OSHA Process Safety (29 CFR 1910.119) Hazard Class(es)

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.

TCSA

Material is listed in TSCA inventory.

SARA Sections 302/304 (40 CFR 355)

Threshold Planning Quantity (TPQ): None

Extremely Hazardous Substances (EHS) RQ: None

SARA Sections 311/312

Immediate: Yes

Delayed: No

Pressure: Yes

Reactivity: No

Fire: Yes

SARA Section 313 (40 CFR 372.65)

Hydrogen does not require reporting under Section 313.

CERCLA (40 CFR Parts 117 and 302)

Reportable Quantity (RQ): None

16. Other Information

Prepared by : Specialty Gases of America, Inc.

For additional information, please visit our website at www.americangasgroup.com.