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# MATERIAL SAFETY DATA SHEET

## SECTION 1. PRODUCT IDENTIFICATION

**PRODUCT NAME:** Hydrogen, compressed  
**CHEMICAL NAME:** Hydrogen **FORMULA:** H<sub>2</sub>  
**SYNONYMS:** None  
**MANUFACTURER:** Air Products and Chemicals, Inc.  
7201 Hamilton Boulevard  
Allentown, PA 18195-1501  
**PRODUCT INFORMATION:** 1-800-752-1597  
**MSDS NUMBER:** 1009 **REVISION:** 4  
**REVISION DATE:** June 1994

## SECTION 2. COMPOSITION/INFORMATION ON INGREDIENTS

Hydrogen is sold as pure product >99%

**CAS NUMBER:** 1333-74-0

**EXPOSURE LIMITS:**

**OSHA:** None

**ACGIH:** Simple asphyxiant

## SECTION 3. HAZARD IDENTIFICATION

### EMERGENCY OVERVIEW

Hydrogen is a flammable, colorless, odorless, compressed gas packaged in cylinders at high pressure. It poses an immediate fire and explosive hazard when concentrations exceed 4%. It is much lighter than air and burns with an invisible flame. High concentrations that will cause suffocation are within the flammable range and must not be entered.

### EMERGENCY TELEPHONE NUMBERS

**(800) 523-9374 Continental U.S., Canada, and Puerto Rico**

**(610) 481-7711 other locations**

### POTENTIAL HEALTH EFFECTS INFORMATION:

**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 oxygen-deficient and explosive atmosphere. Exposure to moderate concentrations may cause dizziness, headache, nausea and unconsciousness. Exposure to atmospheres containing 8-10% or less oxygen will quickly bring about unconsciousness without warning leaving individuals unable to protect themselves. Lack of sufficient oxygen may cause serious injury or death.

**EYE CONTACT:** None  
**SKIN CONTACT:** None  
**CHRONIC EFFECTS:** None  
**OTHER EFFECTS OF OVEREXPOSURE:** None

**EXPOSURE INFORMATION:**

**ROUTE OF ENTRY:** Inhalation  
**TARGET ORGANS:** None  
**EFFECT:** Asphyxiation (suffocation)  
**SYMPTOMS:** Exposure to an oxygen-deficient atmosphere (<19.5%) may cause dizziness, drowsiness, nausea, vomiting, excess salivation, diminished mental alertness, loss of consciousness, and death.

**MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE:** None

**CARCINOGENIC POTENTIAL:** Hydrogen is not listed by NTP, OSHA or IARC.

**SECTION 4. FIRST AID**

**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.

**SKIN CONTACT:** None

**EYE CONTACT:** None

**INGESTION:** None

**NOTES TO PHYSICIAN:** None

**SECTION 5. FIRE AND EXPLOSION**

<b>FLASH POINT:</b> Flammable gas	<b>AUTOIGNITION:</b> 565.5_C (1050_F)	<b>FLAMMABLE LIMITS:</b> <b>LOWER:</b> 4% <b>UPPER:</b> 74%
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**EXTINGUISHING MEDIA:** CO<sub>2</sub>, dry chemical, water spray or fog for surrounding area. Do not extinguish until hydrogen source is shut off.

**HAZARDOUS COMBUSTION PRODUCTS:** None

**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, including static electricity. Hydrogen is lighter than air and can accumulate in the upper sections of enclosed spaces. Pressure in a container can build up due to heat, and it may rupture if pressure relief devices should fail to function.

**SECTION 6. ACCIDENTAL RELEASE MEASURES**

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, call the Air Products' emergency phone number. The presence of a hydrogen flame can be detected by approaching cautiously with an outstretched straw broom to make the flame visible.

## SECTION 7. HANDLING AND STORAGE

**STORAGE:** Specific requirements are listed in NFPA 50A. 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 minimum distance of 20 ft., or by a barrier of noncombustible material at least 5 ft. high having a fire resistance rating of at least 1 hour.

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. Use a suitable hand truck for cylinder movement. 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.

**HANDLING:** Do not "open" 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 with out proper ventilation. It may leak out of a system which 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. Use only approved CGA connections. DO NOT USE ADAPTERS. 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.

**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.

## SECTION 8. PERSONAL PROTECTION/EXPOSURE CONTROLS

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

### RESPIRATORY PROTECTION:

**General Use:** None

**Emergency Use:** Air supplied respirators are required in oxygen-deficient atmospheres. 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 are recommended when handling cylinders.

## SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

**APPEARANCE AND STATE:** Colorless gas at normal temperature and pressure.

**ODOR:** Odorless

**MOLECULAR WEIGHT:** 2.016

**BOILING POINT (1 atm):** -423.0 °F (-252.8 °C)

**SPECIFIC GRAVITY (Air =1):** 0.06960

**FREEZING POINT/MELTING POINT:** -434.5 °F (-259.2 °C)

**VAPOR PRESSURE (at 70 °F):** Not applicable

**GAS DENSITY (At 70 °F (21.1 °C) and 1 atm):** 0.00521 lb/ft<sup>3</sup> (0.08342 kg/m<sup>3</sup>)

**SOLUBILITY IN WATER (Vol/Vol at 60 °F (15.6 °C)):** 0.019

**SPECIFIC VOLUME (At 70 °F (21.1 °C) and 1 atm):** 192 ft<sup>3</sup>/lb (11.99m<sup>3</sup>/kg)

## SECTION 10. REACTIVITY/STABILITY

**CHEMICAL 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.

## SECTION 11. TOXICOLOGICAL INFORMATION

Hydrogen is a simple asphyxiant.

## SECTION 12. ECOLOGICAL INFORMATION

No adverse ecological effects are expected. Hydrogen does not contain any Class I or Class II ozone depleting chemicals (40 CFR Part 82). Hydrogen is not listed as a marine pollutant by DOT (49 CFR Part 171).

## SECTION 13. DISPOSAL

**WASTE DISPOSAL METHOD:** Do not attempt to dispose of residual or unused product in the cylinder. Return 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 stack should be in an isolated area away from ignition sources.

## SECTION 14. TRANSPORTATION

**DOT/IMO SHIPPING NAME:** Hydrogen, compressed

**HAZARD CLASS:** 2.1 (Flammable Gas)

**IDENTIFICATION NUMBER:** UN1049

**PRODUCT RQ:** None

**SHIPPING LABEL(s):** Flammable gas.

**PLACARD (When required):** Flammable gas.

**SPECIAL SHIPPING INFORMATION:** Cylinder should be transported in a secure upright position in a well ventilated truck. NEVER TRANSPORT IN PASSENGER COMPARTMENT OF A VEHICLE.

Shipment of compressed gas cylinders which have not been filled with the owner's consent is a violation of Federal law (49 CFR Part 173.301 (b)).

## SECTION 15. REGULATORY INFORMATION

**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

**SECTION 302/304:** Requires emergency planning on threshold planning quantities (TPQ) and release reporting based on reportable quantities (RQ) of EPA's extremely hazardous substances (40 CFR Part 355).

Extremely Hazardous Substances: None

Threshold Planning Quantity (TPQ): None

**SECTIONS 311/312:** Require submission of material safety data sheets (MSDSs) and chemical inventory reporting with identification of EPA defined hazard classes (40 CFR Part 370). The hazard classes for this product are:

IMMEDIATE:	No	PRESSURE:	Yes
DELAYED:	No	REACTIVITY:	No
		FLAMMABLE:	Yes

**SECTION 313:** Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Hydrogen does not require reporting under Section 313

**40 CFR PART 68:** Risk Management for Chemical Accidental Release. Requires the 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 not listed as a regulated substance. However, any process that involves a flammable gas on site in one location, in quantities of 10,000 pounds (4,553 kg) or greater, is covered under this regulation.

**TSCA:** Toxic Substance 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 pounds (4,553 kg) or greater is covered under this regulation unless it is used as fuel.

<b>SECTION 16. OTHER INFORMATION</b>
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**OTHER INFORMATION:**

**NFPA RATINGS:**

HEALTH:	= 0
FLAMMABILITY:	= 4
REACTIVITY:	= 0
SPECIAL:	= SA (CGA recommends this to designate simple asphyxiant)

**HMIS RATINGS:**

HEALTH:	= 0
FLAMMABILITY:	= 4
REACTIVITY:	= 0