# Material Safety Data Sheet

## 1. Chemical Product and Company Identification

| | |
|---|---|
| **Product Name:** Hydrogen, compressed (MSDS No. P-4604-E) | **Trade Name:** Hydrogen |
| **Chemical Name:** Hydrogen | **Synonyms:** None |
| **Formula:** $H_2$ | **Chemical Family:** Permanent Gas |
| **Telephone:** **Emergencies:** 1-800-633-8253* **PERS:** 1-800-633-8253* | **Company Name:** Alliance Gas Products 2001-F Peralta Street Oakland, CA 94607 |

** Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier.*

## 2. Composition/Information on Ingredients

**This section covers materials of manufacture only. For custom mixtures of this product, request an MSDS for each component. See section 16 for important information about mixtures.**

| INGREDIENT | CAS NUMBER | CONCEN-TRATION | OSHA PEL | ACGIH TLV-TWA |
|---|---|---|---|---|
| Hydrogen | 1333-74-0 | >99% | None currently established | Simple asphyxiant |

** The symbol > means "greater than"; the symbol <, "less than."*

## 3. 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.**
**Odor: None**

**THRESHOLD LIMIT VALUE:** TLV-TWA, simple asphyxiant (ACGIH, 1999). TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.





*Revised*

**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.

**SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION:** None known.

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

## 4. First Aid Measures

**INHALATION:** Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

**SKIN CONTACT:** Wash with soap and water. If irritation persists, seek medical attention.

**SWALLOWING:** An unlikely route of exposure. This product is a gas at normal temperature and pressure.

**EYE CONTACT:** Flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. See a physician, preferably an ophthalmologist, immediately.

***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

| | | |
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| **FLASH POINT** (test method)**:** | Flammable gas | |
| **AUTOIGNITION TEMPERATURE:** | 932°F (500°C) | |
| **FLAMMABLE LIMITS IN AIR,** % by volume**:** | **LOWER:** 4% | **UPPER:** 75% |

**EXTINGUISHING MEDIA:** $CO_2$, dry chemical, water spray, or fog

**SPECIAL FIRE FIGHTING PROCEDURES: 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.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** 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. 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.

**HAZARDOUS COMBUSTION PRODUCTS:** None known.

## 6. Accidental Release Measures

**STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: DANGER! Flammable high-pressure gas.** Forms explosive mixtures with air. (See section 5.) Immediately evacuate all personnel from danger area. 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 cylinder to a well-ventilated area. Flammable gas may spread from leak. Before entering area, especially confined areas, check atmosphere with an appropriate device.

**WASTE DISPOSAL METHOD:** 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 STORAGE:** Store and use with adequate ventilation. 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. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. 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 only where temperature will not exceed 125°F (52°C). Store full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods. For full details and requirements, see NFPA 50A, published by the National Fire Protection Association.

**PRECAUTIONS TO BE TAKEN IN HANDLING:** 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. 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. Do not crack or open disconnected hydrogen cylinder valves; escaping gas may ignite spontaneously. 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. Open valve slowly. If valve is hard to open, discontinue use and contact your supplier. For other precautions in using hydrogen, see section 16.

## 8. Exposure Controls/Personal Protection

**VENTILATION/ENGINEERING CONTROLS:**

**LOCAL EXHAUST–**An explosion-proof local exhaust system is acceptable. See SPECIAL.

**MECHANICAL (general)–**Inadequate; see SPECIAL.

**SPECIAL–**Use only in a closed system.

**OTHER–**See SPECIAL.

**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.

**SKIN PROTECTION:** Wear work gloves for cylinder handling.

**EYE PROTECTION:** Select in accordance with OSHA 29 CFR 1910.133.

**OTHER PROTECTIVE EQUIPMENT:** Metatarsal shoes for cylinder handling. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

## 9. Physical and Chemical Properties

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|---|---|
| **MOLECULAR WEIGHT:** | 2.016 |
| **SPECIFIC GRAVITY** (Air = 1) at 32°F (0°C) and 1 atm**:** | 0.06960 |
| **GAS DENSITY** at 70°F (21.1°C) and 1 atm**:** | 0.00521 lb/ft$^3$ (0.08342 kg/m$^3$) |
| **SOLUBILITY IN WATER,** vol/vol at 60°F (15.6°C) and 1 atm**:** | 0.019 |
| **PERCENT VOLATILES BY VOLUME:** | 100 |
| **BOILING POINT** at 1 atm**:** | -423.0°F (-252.8°C) |
| **MELTING POINT** at 1 atm**:** | -434.55°F (-259.2°C) |

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

## 10. Stability and Reactivity

**STABILITY:** ☐ **Unstable** ☒ **Stable**

**INCOMPATIBILITY (materials to avoid):** Oxidizing agents, lithium, halogens

**HAZARDOUS DECOMPOSITION PRODUCTS:** None

**HAZARDOUS POLYMERIZATION:** ☐ **May Occur** ☒ **Will Not Occur**

**CONDITIONS TO AVOID:** None known.

## 11. Toxicological Information

Hydrogen is a simple asphyxiant.

## 12. Ecological Information

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

## 13. Disposal Considerations

**WASTE DISPOSAL METHOD:** Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

## 14. Transport Information

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

| | | |
|---|---|---|
| **HAZARD CLASS:** 2.1 | **IDENTIFICATION NUMBER:** UN 1049 | **PRODUCT RQ:** Not applicable |
| **SHIPPING LABEL(s):** | FLAMMABLE GAS | |
| **PLACARD (when required):** | FLAMMABLE GAS | |

**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 [49 CFR 173.301(b)].

## 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 (40 CFR Part 355):

**Threshold Planning Quantity (TPQ):** None
**Extremely Hazardous Substances (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 does not require reporting under Section 313.

**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 only spark-proof tools and explosion-proof equipment. Keep away from heat, sparks, and open flame. ***Gas can cause rapid suffocation due to oxygen deficiency.*** Store and use with adequate ventilation. Close cylinder valve after each use; keep closed even when empty. ***Prevent reverse flow.*** Reverse flow into cylinder may cause rupture. Use a check valve or other protective device in any line or piping from the cylinder. ***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:** | | **HMIS RATINGS:** | |
|---|---|---|---|
| HEALTH | = 0 | HEALTH | = 0 |
| FLAMMABILITY | = 4 | FLAMMABILITY | = 4 |
| REACTIVITY | = 0 | REACTIVITY | = 0 |
| SPECIAL | = None | | |

**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 Praxair safety literature as referred to in this MSDS and on the label for this product. Further information about this product can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 1725 Jefferson Davis Highway, Arlington, VA 22202-4102, Telephone (703) 412-0900.

| | |
|---|---|
| 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* |
| P-14 | *Accident Prevention in Oxygen-Rich, Oxygen-Deficient Atmospheres* |
| SB-2 | *Oxygen-Deficient Atmospheres* |
| V-1 | *Compressed Gas Cylinder Valve Inlet and Outlet Connections* |
| — | *Handbook of Compressed Gases, Third Edition* |

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. 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 Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

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Praxair, Inc.
39 Old Ridgebury Road
Danbury, CT 06810-5113

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