

Hydrogen, compressed

Safety Data Sheet P-4604

according to U.S. Code of Federal Regulations 29 CFR 1910.1200, Hazard Communication.

Date of issue: 01/01/1980 Revision date: 01/13/2015 Supersedes: 03/01/2012

SECTION 1: Product and company identification

1.1. Product identifier

Product form : Substance
 Name : Hydrogen, compressed
 CAS No : 1333-74-0
 Formula : H₂
 Other means of identification : Dihydrogen, parahydrogen, refrigerant gas R702, water gas

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Industrial use. Use as directed.

1.3. Details of the supplier of the safety data sheet

Praxair, Inc.
 39 Old Ridgebury Road
 Danbury, CT 06810-5113 - USA
 T 1-800-772-9247 (1-800-PRAXAIR) - F 1-716-879-2146
www.praxair.com

1.4. Emergency telephone number

Emergency number : Onsite Emergency: 1-800-645-4633

CHEMTREC, 24hr/day 7days/week — Within USA: 1-800-424-9300, Outside USA: 001-703-527-3887 (collect calls accepted, Contract 17729)

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

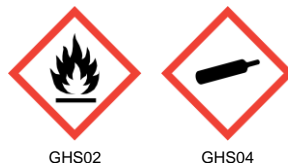
Classification (GHS-US)

Flam. Gas 1 H220
 Compressed gas H280
 Full text of H-phrases: see section 16

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :



GHS02

GHS04

Signal word (GHS-US) :

Danger

Hazard statements (GHS-US) :

H220 - EXTREMELY FLAMMABLE GAS
 H280 - CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED
 OSHA-H01 - MAY DISPLACE OXYGEN AND CAUSE RAPID SUFFOCATION.
 CGA-HG04 - MAY FORM EXPLOSIVE MIXTURES WITH AIR
 CGA-HG08 - BURNS WITH INVISIBLE FLAME.

Precautionary statements (GHS-US) :

P202 - Do not handle until all safety precautions have been read and understood
 P210 - Keep away from heat, Open flames, sparks, hot surfaces. - No smoking
 P271+P403 - Use and store only outdoors or in a well-ventilated place.
 P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely
 P381 - Eliminate all ignition sources if safe to do so
 CGA-PG05 - Use a back flow preventive device in the piping.
 CGA-PG10 - Use only with equipment rated for cylinder pressure.
 CGA-PG12 - Do not open valve until connected to equipment prepared for use.
 CGA-PG06 - Close valve after each use and when empty.
 CGA-PG02 - Protect from sunlight when ambient temperature exceeds 52°C (125°F).

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2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Name	Product identifier	%
Hydrogen, compressed (Main constituent)	(CAS No) 1333-74-0	100

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

- First-aid measures after inhalation : Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
- First-aid measures after skin contact : Adverse effects not expected from this product.
- First-aid measures after eye contact : Immediately 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. Get immediate medical attention.
- First-aid measures after ingestion : Ingestion is not considered a potential route of exposure.

4.2. Most important symptoms and effects, both acute and delayed

No additional information available

4.3. Indication of any immediate medical attention and special treatment needed

None.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Carbon dioxide, dry chemical powder, water spray, fog.

5.2. Special hazards arising from the substance or mixture

- Fire hazard : EXTREMELY FLAMMABLE GAS. The hydrogen flame is nearly invisible. Hydrogen has a low ignition energy; escaping hydrogen gas may ignite spontaneously. A fireball forms if the gas cloud ignites immediately after release. Hydrogen forms explosive mixtures with air and oxidizing agents.
- Explosion hazard : EXTREMELY FLAMMABLE GAS. Forms explosive mixtures with air and oxidizing agents.
- Reactivity : No reactivity hazard other than the effects described in sub-sections below.

5.3. Advice for firefighters

Firefighting instructions : If venting or leaking gas catches fire, do not extinguish flames. Flammable vapors may spread from leak, creating an explosive reignition 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 an area, especially a confined area, check the atmosphere with an appropriate device.

Evacuate all personnel from the danger area. Use self-contained breathing apparatus (SCBA) and protective clothing. Immediately cool containers with water from maximum distance. Stop flow of gas if safe to do so, while continuing cooling water spray. Remove ignition sources if safe to do so. Remove containers from area of fire if safe to do so. On-site fire brigades must comply with OSHA 29 CFR 1910.156 and applicable standards under 29 CFR 1910 Subpart L—Fire Protection.

- Protection during firefighting : Compressed gas: asphyxiant. Suffocation hazard by lack of oxygen.
- Special protective equipment for fire fighters : Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.

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Specific methods : Use fire control measures appropriate for the surrounding fire. Exposure to fire and heat radiation may cause gas containers to rupture. Cool endangered containers with water spray jet from a protected position. Prevent water used in emergency cases from entering sewers and drainage systems. Stop flow of product if safe to do so. Use water spray or fog to knock down fire fumes if possible.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : EXTREMELY FLAMMABLE GAS. Forms explosive mixtures with air and oxidizing agents. See section 5. Evacuate personnel to a safe area. Appropriate self-contained breathing apparatus may be required. Approach suspected leak area with caution. Remove all sources of ignition. if safe to do so. Reduce gas with fog or fine water spray. Stop flow of product if safe to do so. Ventilate area or move container to a well-ventilated area. Flammable gas may spread from leak. Before entering the area, especially a confined area, check the atmosphere with an appropriate device.

6.1.1. For non-emergency personnel

No additional information available

6.1.2. For emergency responders

No additional information available

6.2. Environmental precautions

Try to stop release.

6.3. Methods and material for containment and cleaning up

No additional information available

6.4. Reference to other sections

See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only non-sparking tools. Use only explosion-proof equipment.

Wear leather safety gloves and safety shoes when handling cylinders. Protect cylinders from physical damage; do not drag, roll, slide or drop. While moving cylinder, always keep in place removable valve cover. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. 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. Slowly open the valve. If the valve is hard to open, discontinue use and contact your supplier. Close the container valve after each use; keep closed even when empty. Never apply flame or localized heat directly to any part of the container. High temperatures may damage the container and could cause the pressure relief device to fail prematurely, venting the container contents. For other precautions in using this product, see section 16.

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7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store only where temperature will not exceed 125°F (52°C). Post "No Smoking or Open Flames" signs in storage and use areas. There must be no sources of ignition. Separate packages and protect against potential fire and/or explosion damage following appropriate codes and requirements (e.g., NFPA 30, NFPA 55, NFPA 70, and/or NFPA 221 in the U.S.) or according to requirements determined by the Authority Having Jurisdiction (AHJ). Always secure containers upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand when the container is not in use. Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods. For other precautions in using this product, see section 16.

OTHER PRECAUTIONS FOR HANDLING, STORAGE, AND USE: When handling product under pressure, use piping and equipment adequately designed to withstand the pressures to be encountered. Never work on a pressurized system. Use a back flow preventive device in the piping. Gases can cause rapid suffocation because of oxygen deficiency; store and use with adequate ventilation. If a leak occurs, close the container valve and blow down the system in a safe and environmentally correct manner in compliance with all international, federal/national, state/provincial, and local laws; then repair the leak. Never place a container where it may become part of an electrical circuit.

7.3. Specific end use(s)

None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Hydrogen, compressed (1333-74-0)

ACGIH	Not established
USA OSHA	Not established

8.2. Exposure controls

Appropriate engineering controls : An explosion-proof local exhaust system is acceptable. Local exhaust and general ventilation must be adequate to meet exposure standards. Mechanic (general) engineering controls: Use only in a closed system. Closed system, ventilation, explosion-proof electrical equipment and lighting.

Eye protection : Wear safety glasses with side shields.

Respiratory protection : An air-supplied respirator must be used while working with this product in confined spaces. The respiratory protection used must conform with OSHA rules as specified in 29 CFR 1910.134. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

Thermal hazard protection : None necessary.

Other information : Consider the use of flame resistant anti-static safety clothing. Wear safety shoes while handling containers.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Gas

Appearance : Colorless gas.

Molecular mass : 2 g/mol

Color : Colorless.

Odor : No data available

Odor threshold : No data available

pH : Not applicable.

Relative evaporation rate (butyl acetate=1) : No data available

Relative evaporation rate (ether=1) : Not applicable.

Melting point : -259 °C

Freezing point : No data available

Boiling point : -252.9 °C

Flash point : No data available

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Critical temperature	: -239.9 °C
Auto-ignition temperature	: 566 °C
Decomposition temperature	: No data available
Flammability (solid, gas)	: 4 - 75 vol %
Vapor pressure	: Not applicable.
Critical pressure	: 1293 kPa
Relative vapor density at 20 °C	: No data available
Relative density	: 0.07
Relative gas density	: 0.07
Solubility	: Water: 1.6 mg/l
Log Pow	: Not applicable.
Log Kow	: Not applicable.
Viscosity, kinematic	: Not applicable.
Viscosity, dynamic	: Not applicable.
Explosive properties	: Not applicable.
Oxidizing properties	: None.
Explosive limits	: No data available

9.2. Other information

Gas group	: Compressed gas
Additional information	: BURNS WITH INVISIBLE FLAME.

SECTION 10: Stability and reactivity

10.1. Reactivity

No reactivity hazard other than the effects described in sub-sections below.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

Can form explosive mixture with air. May react violently with oxidants.

10.4. Conditions to avoid

Keep away from heat/sparks/open flames/hot surfaces. – No smoking.

10.5. Incompatible materials

Air, Oxidizer.

10.6. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Hydrogen, compressed (1f)1333-74-0

LC50 inhalation rat (ppm)	> 15000 ppm/1h
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Skin corrosion/irritation	: Not classified
	pH: Not applicable.
Serious eye damage/irritation	: Not classified
	pH: Not applicable.
Respiratory or skin sensitization	: Not classified
Germ cell mutagenicity	: Not classified

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Carcinogenicity	: Not classified
Reproductive toxicity	: Not classified
Specific target organ toxicity (single exposure)	: Not classified
Specific target organ toxicity (repeated exposure)	: Not classified No known effects from this product.
Aspiration hazard	: Not classified Not applicable.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : No ecological damage caused by this product.

12.2. Persistence and degradability

Hydrogen, compressed (1333-74-0)

Persistence and degradability	No ecological damage caused by this product.
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12.3. Bioaccumulative potential

Hydrogen, compressed (1333-74-0)

BCF fish 1	(no bioaccumulation expected)
Log Pow	Not applicable.
Log Kow	Not applicable.
Bioaccumulative potential	No ecological damage caused by this product.

12.4. Mobility in soil

Hydrogen, compressed (1333-74-0)

Mobility in soil	No data available.
Ecology - soil	No ecological damage caused by this product.

12.5. Other adverse effects

Effect on ozone layer : None.

Effect on the global warming : No known effects from this product.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.

SECTION 14: Transport information

In accordance with DOT

Transport document description	: UN1049 Hydrogen, compressed, 2.1
UN-No.(DOT)	: UN1049
Proper Shipping Name (DOT)	: Hydrogen, compressed
Department of Transportation (DOT) Hazard Classes	: 2.1 - Class 2.1 - Flammable gas 49 CFR 173.115
Hazard labels (DOT)	: 2.1 - Flammable gas



DOT Special Provisions (49 CFR 172.102) : N89 - When steel UN pressure receptacles are used, only those bearing the "H" mark are authorized.

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Additional information

Emergency Response Guide (ERG) Number	: 115 (UN1049)
Other information	: No supplementary information available.
Special transport precautions	: Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers: - Ensure there is adequate ventilation. - Ensure that containers are firmly secured. - Ensure cylinder valve is closed and not leaking. - Ensure valve outlet cap nut or plug (where provided) is correctly fitted. - Ensure valve protection device (where provided) is correctly fitted.

Transport by sea

UN-No. (IMDG)	: 1049
Proper Shipping Name (IMDG)	: HYDROGEN, COMPRESSED
Class (IMDG)	: 2 - Gases
MFAG-No	: 115

Air transport

UN-No.(IATA)	: 1049
Proper Shipping Name (IATA)	: Hydrogen, compressed
Class (IATA)	: 2
Civil Aeronautics Law	: Gases under pressure/Gases flammable under pressure

SECTION 15: Regulatory information

15.1. US Federal regulations

Hydrogen, compressed (1333-74-0)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

SARA Section 311/312 Hazard Classes	Sudden release of pressure hazard Fire hazard
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15.2. International regulations

CANADA

Hydrogen, compressed (1333-74-0)

Listed on the Canadian DSL (Domestic Substances List)

WHMIS Classification	Class A - Compressed Gas Class B Division 1 - Flammable Gas
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EU-Regulations

Hydrogen, compressed (1333-74-0)

Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Flam. Gas 1 H220
Compressed gas H280

Full text of H-phrases: see section 16

15.2.2. National regulations

Hydrogen, compressed (1333-74-0)

Listed on the AICS (Australian Inventory of Chemical Substances)
Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China)
Listed on the Korean ECL (Existing Chemicals List)
Listed on NZIoC (New Zealand Inventory of Chemicals)
Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances)

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15.3. US State regulations

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U.S. - California - Proposition 65 - Carcinogens List	No
U.S. - California - Proposition 65 - Developmental Toxicity	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No
State or local regulations	U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List

SECTION 16: Other information

Revision date : 1/13/2015 12:00:00 AM

Other information : When you mix two or more chemicals, 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. Before using any plastics, confirm their compatibility with this product.

Praxair asks users of this product to study this SDS and become aware of the 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 SDS 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 Safety Data Sheet. Since the use of this information and the conditions of use 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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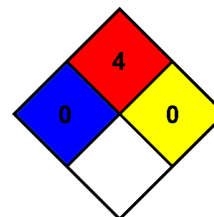
Full text of H-phrases:

Compressed gas	Gases under pressure Compressed gas
Flam. Gas 1	Flammable gases Category 1
H220	EXTREMELY FLAMMABLE GAS
H280	CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED

NFPA health hazard : 0 - Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.

NFPA fire hazard : 4 - Will rapidly or completely vaporize at normal pressure and temperature, or is readily dispersed in air and will burn readily.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.





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HMIS III Rating

Health : 0 Minimal Hazard - No significant risk to health
Flammability : 4 Severe Hazard
Physical : 3 Serious Hazard

SDS US (GHS HazCom 2012) - Praxair

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.