

# Hydrogen, refrigerated liquid

## Safety Data Sheet P-4603

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

Date of issue: 01/01/1981    Revision date: 01/15/2015    Supersedes: 03/01/2014

### SECTION 1: Product and company identification

#### 1.1. Product identifier

Product form : Substance  
Name : Hydrogen, refrigerated liquid  
CAS No : 1333-74-0  
Formula : H<sub>2</sub>  
Other means of identification : Hydrogen (cryogenic liquid)

#### 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](http://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

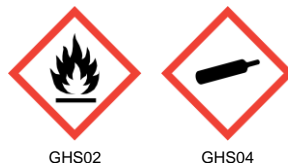
##### Classification (GHS-US)

Flam. Gas 1                    H220  
Refrigerated liquefied gas   H281  
Full text of H-phrases: see section 16

#### 2.2. Label elements

##### GHS-US labeling

Hazard pictograms (GHS-US) :



Signal word (GHS-US) :

DANGER

Hazard statements (GHS-US) :

H220 - EXTREMELY FLAMMABLE GAS  
H281 - CONTAINS REFRIGERATED GAS; MAY CAUSE CRYOGENIC BURNS OR INJURY  
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. - No smoking  
P271+P403 - Use and store only outdoors or in a well-ventilated place.  
P282 - Wear cold insulating gloves, protective clothing, face shield, eye protection  
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-PG24 - DO NOT change or force fit connections.  
CGA-PG06 - Close valve after each use and when empty.  
CGA-PG26 - Use insulated hoses and piping to avoid condensation of oxygen-rich liquid air.

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CGA-PG23 - Always keep container in upright position.

### 2.3. Other hazards

Other hazards not contributing to the classification : Contact with liquid may cause cold burns/frostbite.

Asphyxiant in high concentrations.

### 2.4. Unknown acute toxicity (GHS-US)

No data available

## SECTION 3: Composition/information on ingredients

### 3.1. Substance

Name	Product identifier	%
Hydrogen, refrigerated liquid (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. If not breathing, give artificial respiration, with supplemental oxygen given by qualified personnel. If breathing is difficult, qualified personnel should give oxygen. Call a physician.
- First-aid measures after skin contact : For exposure to liquid, immediately warm frostbite area with warm water not to exceed 105°F (41°C). Water temperature should be tolerable to normal skin. Maintain skin warming for at least 15 minutes or until normal coloring and sensation have returned to the affected area. In case of massive exposure, remove clothing while showering with warm water. Seek medical evaluation and treatment as soon as possible.
- 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, Water spray or fog.

### 5.2. Special hazards arising from the substance or mixture

- Fire hazard : EXTREMELY FLAMMABLE, EXTREMELY COLD CRYOGENIC LIQUID AND 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.

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### 5.3. Advice for firefighters

Firefighting instructions	<p>: DANGER! Extremely cold, flammable liquid and gas under pressure. Take care not to direct spray onto vents on top of container. Do not discharge sprays into liquid hydrogen. Liquid hydrogen can freeze water rapidly. If flames are accidentally extinguished, explosive re-ignition may occur. All personnel, including fire and rescue workers, should leave the area immediately. Re-approach with extreme caution. When containers have cooled, move them away from fire area if safe to do so.</p> <p>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.</p> <p>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.</p>
Special protective equipment for fire fighters	: Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.
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.
Other information	: Cryogenic liquid causes severe frostbite, a burn-like injury. Heat of fire can build pressure in a closed container and cause it to rupture. Venting vapors may obscure visibility. Air will condense on surfaces such as vaporizers or piping exposed to liquid or cold gas. Nitrogen, which has a lower boiling point than oxygen, evaporates first, leaving an oxygen-enriched condensate.

## SECTION 6: Accidental release measures

### 6.1. Personal precautions, protective equipment and emergency procedures

General measures	: EXTREMELY COLD, FLAMMABLE LIQUID AND GAS UNDER PRESSURE. FORMS EXPLOSIVE MIXTURES WITH AIR. (See section 5.) 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. (See section 2.) Flammable gas may spread from leak. Approach suspected leak area with caution. Before entering area, especially confined areas, check atmosphere with an appropriate device. Self-contained breathing apparatus and protective clothing may be required by rescue workers. 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.
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

Prevent waste from contaminating the surrounding environment. Prevent soil and water pollution. Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.

### 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.

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### SECTION 7: Handling and storage

#### 7.1. Precautions for safe handling

Precautions for safe handling : PRECAUTIONS TO BE TAKEN IN HANDLING: Do not get liquid in eyes, on skin, or on clothing. Keep away from heat, flame, and sparks. 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. For liquid withdrawal, wear face shield and cryogenic gloves (see section 8). Air will condense on exposed liquid or cold-gas surfaces such as vaporizers and piping. Nitrogen, which has a lower boiling point than oxygen, will evaporate first, leaving oxygen-enriched condensation on the surface. To prevent possible ignition of grease, oil, or other combustibles, keep all areas of potential condensation free of these substances. Use only spark-proof tools and explosion-proof equipment. Use a suitable hand truck for container movement. 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. For other precautions in using hydrogen, see section 16.

#### 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.

#### 7.3. Specific end use(s)

None.

### SECTION 8: Exposure controls/personal protection

#### 8.1. Control parameters

Hydrogen, refrigerated liquid (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.

Hand protection : Cold-insulating gloves.

Eye protection : Wear safety glasses with side shields.

Skin and body protection : Wear loose-fitting, cryogenic gloves, metatarsal shoes for container handling, and protective clothing where needed. Cuffless trousers should be worn outside the shoes. Gloves must be free of oil and grease. Select in accordance with OSHA 29 CFR 1910.132, 1910.136, and 1910.138.

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 : Wear cold insulating gloves. Wear cold insulating gloves when transfilling or breaking transfer connections.

Environmental exposure controls : The substance is not classified for human health hazards or for environment effects and it is not PBT or vPvB so that no exposure assessment or risk characterization is required. For tasks where the intervention of workers is required, the substance must be handled in accordance with good industrial hygiene and safety procedures.

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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	: Not available
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
Specific gravity / density	: 70.96 kg/m <sup>3</sup>
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	: Not applicable.

#### 9.2. Other information

Gas group	: Refrigerated liquefied 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.

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### 10.5. Incompatible materials

Oxidizing agent. Lithium. Halogens.

### 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, refrigerated liquid ( 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

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, refrigerated liquid (1333-74-0)

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

#### Hydrogen, refrigerated liquid (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, refrigerated liquid (1333-74-0)

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

### 12.5. Other adverse effects

Other adverse effects : Can cause frost damage to vegetation.

Effect on ozone layer : None.

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

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### SECTION 13: Disposal considerations

#### 13.1. Waste treatment methods

Waste disposal recommendations : Do not attempt to dispose of residual or unused quantities. Return container to supplier.

### SECTION 14: Transport information

In accordance with DOT

Transport document description : UN1966 Hydrogen, refrigerated liquid, 2.1  
 UN-No.(DOT) : UN1966  
 Proper Shipping Name (DOT) : Hydrogen, refrigerated liquid  
 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) : T75 - When portable tank instruction T75 is referenced in Column (7) of the 172.101 Table, the applicable refrigerated liquefied gases are authorized to be transported in portable tanks in accordance with the requirements of 178.277 of this subchapter.  
 TP5 - For a portable tank used for the transport of flammable refrigerated liquefied gases or refrigerated liquefied oxygen, the maximum rate at which the portable tank may be filled must not exceed the liquid flow capacity of the primary pressure relief system rated at a pressure not exceeding 120 percent of the portable tank's design pressure. For portable tanks used for the transport of refrigerated liquefied helium and refrigerated liquefied atmospheric gas (except oxygen), the maximum rate at which the tank is filled must not exceed the liquid flow capacity of the pressure relief device rated at 130 percent of the portable tank's design pressure. Except for a portable tank containing refrigerated liquefied helium, a portable tank shall have an outage of at least two percent below the inlet of the pressure relief device or pressure control valve, under conditions of incipient opening, with the portable tank in a level attitude. No outage is required for helium.

#### Additional information

Emergency Response Guide (ERG) Number : 115 (UN1966)  
 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) : 1966  
 Proper Shipping Name (IMDG) : HYDROGEN, REFRIGERATED LIQUID  
 Class (IMDG) : 2 - Gases  
 MFAG-No : 115

#### Air transport

UN-No.(IATA) : 1966  
 Proper Shipping Name (IATA) : Hydrogen, refrigerated liquid  
 Class (IATA) : 2  
 Civil Aeronautics Law : Gases under pressure/Gases flammable under pressure

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### SECTION 15: Regulatory information

#### 15.1. US Federal regulations

##### Hydrogen, refrigerated liquid (1333-74-0)

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

SARA Section 311/312 Hazard Classes	Fire hazard Sudden release of pressure hazard Immediate (acute) health hazard
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#### 15.2. International regulations

##### CANADA

##### Hydrogen, refrigerated liquid (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, refrigerated liquid (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  
Refrigerated liquefied gas   H281

Full text of H-phrases: see section 16

#### 15.2.2. National regulations

##### Hydrogen, refrigerated liquid (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)

#### 15.3. US State regulations

##### Hydrogen, refrigerated liquid(1333-74-0)

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 : 1/15/2015 12:00:00 AM



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**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:**

Flam. Gas 1	Flammable gases Category 1
Refrigerated liquefied gas	Gases under pressure Refrigerated liquefied gas
H220	EXTREMELY FLAMMABLE GAS
H281	CONTAINS REFRIGERATED GAS; MAY CAUSE CRYOGENIC BURNS OR INJURY

**NFPA health hazard**

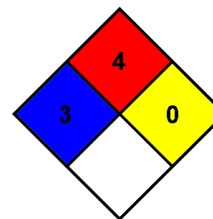
: 3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.

**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.



**HMIS III Rating**

**Health** : 3 Serious Hazard - Major injury likely unless prompt action is taken and medical treatment is given

**Flammability** : 4 Severe Hazard

**Physical** : 1 Slight 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.*