



SAFETY DATA SHEET

SECTION 1 – IDENTIFICATION

Chemical Name: Hydrogen
Chemical Formula: H₂
Hazard Classification: Hydrogen, Compressed, UN1049, Red Label
Product Use Description: For general analytical/synthetic chemical uses
Company: MESA Specialty Gases & Equipment
2427 South Anne Street
Santa Ana, California 92704 USA
Phone Number for Information: Infotrac
Emergency Contact: 800-535-5053 (Int'l: 352-323-3500)

SECTION 2 – HAZARD(S) IDENTIFICATION

SIGNAL WORD - DANGER

HAZARD STATEMENTS: Extremely flammable gas. Contains gas under pressure; may explode if heated.
May cause suffocation by displacing oxygen in the air.
May form explosive mixtures with air.
Burns with invisible flame.

PRECAUTIONARY STATEMENTS:

General: Use in accordance with Safety Data Sheets.
Do not ingest or inhale. Avoid contact with skin and clothing.

Prevention: Keep away from heat, hot surfaces, sparks, open flames, and other ignition sources. No smoking.

Response: Leaking gas fire: Do not extinguish unless leak can be stopped safely.
In case of leakage, eliminate all ignition sources.
Do not open valve until prepared to use.
Always use a back flow preventative device in piping.

Storage: Protect from sunlight. Store in a well-ventilated place.

OTHER HAZARDS: High pressure gas. May cause rapid suffocation.
May cause dizziness, nausea, drowsiness, vomiting, excess salivation, loss of mobility/consciousness.
May react explosively even in absence of air at elevated pressure and/or temperature.
May cause frostbite to any contaminated tissue.
Self-contained breathing apparatus (SCBA) may be required.



SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT	CAS NO.	CONCENTRATION
Hydrogen	1333-74-0	99.99%
Maximum Impurities		<0.01% (100 ppm)

SECTION 4 – FIRST AID MEASURES

ROUTE OF EXPOSURE:

Inhalation: Remove person to uncontaminated area. SCBA may be required to prevent asphyxiation of rescue workers. Keep warm and at rest. Lay victim face down with head and chest lower than hips to improve drainage from lungs. If breathing is labored, administer pure oxygen. If breathing has stopped, start artificial respiration. Get immediate medical attention for serious exposure.

Eye contact: Immediately flush eyes with plenty of water.

Skin contact: Immediately flush skin with plenty of water. Remove any contaminated clothing and shoes.

Ingestion: Do not induce vomiting unless instructed to do so by medical personnel. If conscious, drink plenty of water. Never give anything by mouth to an unconscious person.

Frostbite: Place the frostbitten part in warm water. **DO NOT USE HOT WATER.** If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. The skin of a victim may have a blue color. Under some circumstances, death may occur. The effects associated with various levels of oxygen are as follows:

CONCENTRATION SYMPTOMS OF EXPOSURE

12-16% Oxygen: Breathing and pulse rate increased, muscular coordination slightly disturbed.

10-14% Oxygen: Emotional upset, abnormal fatigue, disturbed respiration.

6-10% Oxygen: Nausea and vomiting, collapse or loss of consciousness.

Below 6%: Convulsive movements, possible respiratory collapse, and death.



OTHER POTENTIAL HEALTH EFFECTS: Contact with cryogenic liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after contact with liquid can quickly subside.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Overexposure to Hydrogen may cause the following health effects:

ACUTE: The most significant hazard associated with this gas is inhalation of oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, headache, dizziness and nausea. At high concentrations, unconsciousness or death may occur. Contact with cryogenic liquid or rapidly expanding gases may cause frostbite.

CHRONIC: There are currently no known adverse health effects associated with chronic exposure to Hydrogen.

TARGET ORGANS: Respiratory system.

HAZARDOUS MATERIAL INFORMATION SYSTEM			
HEALTH		(BLUE)	0
FLAMMABILITY		(RED)	4
REACTIVITY		(YELLOW)	0
PROTECTIVE EQUIPMENT			B
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8
For routine industrial applications			

SECTION 5 – FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Use appropriate media for surrounding fire such as CO2 foam extinguishers

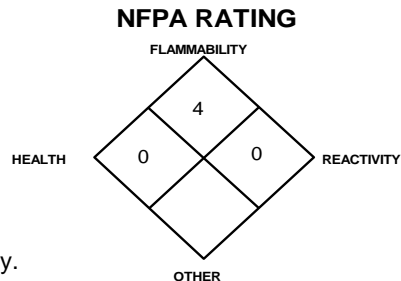
UNUSUAL FIRE AND EXPLOSION HAZARDS: Gas cylinders may rupture violently when exposed to fire. Fires impinging (direct flame) on the outside surface of unprotected pressure storage of vessels of Hydrogen can be very dangerous. Direct flame exposure on the cylinder wall can cause an explosion either by BLEVE (Boiling Liquid Expanding Vapor Explosion), or by exothermic decomposition. This is a catastrophic failure of the vessel releasing the contents into a massive fireball and explosion. The resulting fire and explosion can result in severe equipment damage and personnel injury or death over a large area around the vessel. For massive fires in large areas, use unmanned hose holder or monitor nozzles; if this is not possible, withdraw from area and allow fire to burn. Continue to cool fire exposed cylinders until flames are extinguished. Cylinder valve is equipped with a pressure relief device to safely vent the cylinder if it is exposed to elevated pressure in a fire. In presence of oxidizing materials, reducing materials, or combustible materials, or organic materials, mixture will be extremely flammable.

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area and protect people. Adequate fire protection must be provided.

Minimum Personal Protective Equipment should be Level B: fire-retardant protective clothing, mechanically-resistant gloves and Self-Contained Breathing Apparatus. Use only non-sparking tools and equipment. Locate and seal the source of the leaking gas. Protect personnel attempting the shut-off with water-spray. Allow the gas, which is lighter than air, to dissipate. Monitor the surrounding area for combustible gas levels and oxygen. Combustible gas concentration must be below 10% of the LEL (LEL = 4.0%) prior to entry of response personnel. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Attempt to close the main source valve prior to entering the area.

If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there.

THIS IS AN EXTREMELY FLAMMABLE GAS. Protection of all personnel and the area must be maintained.



SPECIAL FIRE FIGHTING PROCEDURES: RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO HYDROGEN WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and Fire-Retardant Personal Protective equipment should be worn. Adequate fire protection must be provided during rescue situations. Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment. The best fire-fighting technique may be simply to let the burning gas escape from the pipeline. Stop the leak before extinguishing fire. If the fire is extinguished before the leak is sealed, the still-leaking gas could explosively re-ignite without warning and cause extensive damage, injury, or fatality. In this case, increase ventilation to prevent flammable or explosive mixture formation. Evacuation may be necessary. Refer to the North American Emergency Response Guidebook (Guide #115) for additional information.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT, AND EMERGENCY PROCEDURES: Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment. The best fire-fighting technique may be simply to let the burning gas escape from the pipeline. Stop the leak before extinguishing fire. If the fire is extinguished before the leak is sealed, the still-leaking gas could explosively re-ignite without warning and cause extensive damage, injury, or fatality. In this case, increase ventilation to prevent flammable or explosive mixture formation. Evacuation may be necessary. Refer to the North American Emergency Response Guidebook (Guide #115) for additional information.

ENVIRONMENTAL PRECAUTIONS: Prevent spreading of vapors through sewers, ventilation systems, and confined areas. Do not discharge materials into any place where their accumulation could be dangerous.

METHODS AND MATERIALS FOR CONTAINMENT AND CLEANING UP: Stop the flow of gas or remove cylinder to outdoor location if this can be done without risk. Ventilate enclosed areas. Move leaking cylinder to fume hood or safe outdoor area. Use monitoring equipment if hazardous conditions are suspected or likely to occur.

SECTION 7 – HANDLING AND STORAGE

PRECAUTIONS FOR SAFE HANDLING: Only experienced and properly instructed persons should handle compressed gases. Person is to know and understand the properties and hazards of the product before use. Do not remove or deface labels provided by the supplier for the identification of the product.

Do not ingest. Avoid contact with eyes, skin, and clothing. May cause dizziness and fatigue without warning symptoms.

Protect cylinders from physical damage to prevent valve damage or leakage. Move cylinders properly; do not drag, slide, or drop cylinders when transporting. Use adjustable strap wrench to remove tight/rusted caps. Ensure the complete gas system has been checked for leaks before use. Never insert any object into valve cap openings; doing so may damage valve causing leakage. Store in cool, dry, well-ventilated area, away from sources of heat, ignition and direct sunlight. Do not allow area where cylinders are stored to exceed 52°C (125°F). Isolate from oxidizers such as oxygen, chlorine, or fluorine. Use a check valve or trap in the discharge line to prevent hazardous backflow. Post “No Smoking or Open Flame” signs in storage and use areas. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to situations in which cylinders are being used:

Before Use: Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap, if provided, in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap, if provided. Mark empty cylinders “EMPTY”.

Gas or liquefied gas are to be used with the appropriate pressure regulating control and high pressure equipment. Suck-back into cylinder may cause rupture. Always use a back flow preventative device in piping. Never lift cylinder by its valve protection cap. Use only in ventilated areas.

Do not attempt to repair or modify cylinders containing gas mixture. Contact supplier for any operational issues.

CONDITIONS FOR SAFE STORAGE: Cylinders should be secured with mounting brackets away from heavily traveled areas. Use oldest cylinders in stock first to prevent full cylinders from being stored for excessive periods of time. Full and empty cylinders should be segregated. Keep cylinder in dry, cool, well ventilated area away from heat, flame, sparks or corrosive chemicals. Cylinders should be moved by suitable hand trucks. Close valve after each use and when empty. Cylinder valve guards or caps should be in place. Keep cylinder at room temperature (21°C/ 70°F). Store containers in location free from fire risk and away from any sources of heat and ignition. Keep cylinder at least 20 feet away from combustible material, oxidizers, and Oxygen. Use equipment rated for cylinder pressure.

SECTION 8 – EXPOSURE CONTROLS/PERSONAL PROTECTION

COMPONENT	OSHA PEL	ACGIH TLV
Hydrogen	None	None

APPROPRIATE ENGINEERING CONTROLS: Use with adequate ventilation to maintain oxygen levels above 19.5% in the workplace. Local exhaust ventilation is preferred, because it prevents Hydrogen dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the level of oxygen and the presence of potentially explosive air-gas mixtures. Monitoring devices should be installed near the ceiling.

INDIVIDUAL PROTECTIVE MEASURES: Safety glasses, work gloves, and safety shoes should be worn when handling high pressure cylinders or hazardous materials. Avoid skin contact with leaking liquid (danger of frostbite). Wear suitable protective equipment. Ensure adequate ventilation, especially in confined areas. Do not eat, drink, or smoke when using. Respiratory Protection (Specify Type): Maintain oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if oxygen levels are below 19.5% or during emergency response to a release of Hydrogen. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Colorless	Upper/lower flammability/explosive limits: No data available
Odor: Odorless	Vapor Pressure: N/A
Odor threshold: No data available	Vapor Density (Air=1): 0.08432 kg/m ³ (0.0052 lb/ft ³)
pH: N/A	Relative Density (Water=1): Varies
Melting point/range: N/A	Solubility (in water): Very slightly soluble.
Boiling point/range: -253.0°C (-423.0°F)	Partition coefficient (n-octanol/water): N/A
Flash Point: N/A	Auto-ignition temperature: No data available
Evaporation Rate (Butyl Acetate=1): N/A	Decomposition temperature: No data available
Flammability (solid, gas): No data available	Viscosity: N/A

SECTION 10 – STABILITY AND REACTIVITY DATA

Reactivity: Highly reactive	Conditions to avoid: Contact with incompatible materials and exposure to heat, sparks and other sources of ignition. Cylinders exposed to high temperatures or direct flame can rupture or burst.
Chemical Stability: Stable	Incompatible materials: Strong oxidizers (e.g., chlorine, bromine, pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride). Oxygen/Hydrogen mixtures can explode on contact with a catalyst such as platinum.
Possibility of hazardous reactions: No data available	Hazardous Decomposition or Byproducts: Hydrogen. When ignited in the presence of oxygen, water will be produced.

SECTION 11 – TOXICOLOGICAL INFORMATION

LIKELY ROUTES OF EXPOSURE:

There are no specific toxicology data for Hydrogen. Hydrogen is a simple asphyxiant, which acts to displace oxygen in the environment.

Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. The skin of a victim may have a blue color. Under some circumstances, death may occur. The effects associated with various levels of oxygen are as follows:

CONCENTRATION SYMPTOMS OF EXPOSURE

12-16% Oxygen: Breathing and pulse rate increased, muscular coordination slightly disturbed.

10-14% Oxygen: Emotional upset, abnormal fatigue, disturbed respiration.

6-10% Oxygen: Nausea and vomiting, collapse or loss of consciousness.

Below 6%: Convulsive movements, possible respiratory collapse, and death.

OTHER POTENTIAL HEALTH EFFECTS: Contact with cryogenic liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow.

The pain after contact with liquid can quickly subside.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Overexposure to Hydrogen may cause the following health effects:

ACUTE: The most significant hazard associated with this gas is inhalation of oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, headache, dizziness and nausea. At high concentrations, unconsciousness or death may occur. Contact with cryogenic liquid or rapidly expanding gases may cause frostbite.

CHRONIC: There are currently no known adverse health effects associated with chronic exposure to Hydrogen.

TARGET ORGANS: Respiratory system.

ACUTE/CHRONIC TOXICITY:

SUSPECTED CANCER AGENT: Hydrogen is not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC, and therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Contact with rapidly expanding gases can be irritating to exposed skin and eyes.

SENSITIZATION OF PRODUCT: Hydrogen is not a sensitizer after prolonged or repeated exposure.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Hydrogen on the human reproductive system.

Mutagenicity: Hydrogen is not expected to cause mutagenic effects in humans.

Embryotoxicity: No embryotoxic effects have been described for Hydrogen.

Teratogenicity: Hydrogen is not expected to cause teratogenic effects in humans.

Reproductive Toxicity: Hydrogen is not expected to cause adverse reproductive effects in humans.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions may be aggravated by overexposure to Hydrogen.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate overexposure.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Hydrogen.

CARCINOGENICITY: May cause cancer depending on duration and level of exposure.

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity (aquatic and terrestrial): No known effects. Any adverse effect on animals would be related to oxygen deficient environments, as well as respiratory system damage. Additionally, frost produced in the presence of rapidly expanding gases may adversely affect plant life.

Persistence and degradability: No data available

Bioaccumulative potential: No data available

Mobility in soil: No data available

Other Effects: The mixture does not contain any class I or Class II ozone depleting chemicals.

SECTION 13 – DISPOSAL CONSIDERATIONS

Disposal: Waste disposal must be in accordance with appropriate National, Federal, State, and local regulations. Do not dispose or discharge into the environment. Do not discharge into enclosed environment. Contact supplier if additional guidance is required.

SECTION 14 – TRANSPORTATION INFORMATION**DOT Classification:**

Proper Shipping Name: Hydrogen, compressed

Class: 2.1

UN/ID No.: UN1049

Label: Flammable Gas, Red Label

IATA Classification:

Proper Shipping Name: Hydrogen, compressed

Class: 2.1

UN/ID No.: UN1049

Label: Flammable Gas, Red Label

Environment hazard: No

Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code: N/A)

SPECIAL PRECAUTIONS FOR USER: Avoid transport on vehicles where the load space is not separated from driver's compartment. Ensure that transporter is aware of the potential hazards of the load and knows what to do in event of an emergency. Contact supplier for complete transportation information.

SECTION 15 – REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Hydrogen is not subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, and are listed as follows:

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

CANADIAN DSL/NDL INVENTORY STATUS: Hydrogen is on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Hydrogen is on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Hydrogen is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 lb. Depending on specific operations involving the use of Hydrogen, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation Hydrogen is not listed in Appendix A, however, any process that involves a flammable gas on-site, in one location, in quantities of 10,000 lb (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

U.S. STATE REGULATORY INFORMATION: Hydrogen is covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Hydrogen. California - Permissible Exposure Limits for Chemical Contaminants: Hydrogen. Florida - Substance List: Hydrogen. Illinois - Toxic Substance List: Hydrogen. Kansas - Section 302/313 List: None. Massachusetts - Substance List: Hydrogen. Michigan - Critical Materials Register: No. Minnesota - List of Hazardous Substances: Hydrogen. Missouri - Employer Information/Toxic Substance List: Hydrogen. New Jersey - Right to Know Hazardous Substance List: Hydrogen. North Dakota - List of Hazardous Chemicals, Reportable Quantities: None. Pennsylvania - Hazardous Substance List: Hydrogen. Rhode Island - Hazardous Substance List: Hydrogen. Texas - Hazardous Substance List: None. West Virginia - Hazardous Substance List: None. Wisconsin - Toxic and Hazardous Substances: None.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Hydrogen is not on the California Proposition 65 lists.

LABELING (For Compressed Gas):

DANGER: EXTREMELY FLAMMABLE GAS. CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED. MAY CAUSE RAPID SUFFOCATION BY DISPLACING OXYGEN IN THE AIR. MAY FORM EXPLOSIVE MIXTURES WITH AIR. BURNS WITH INVISIBLE FLAMES. May cause dizziness, nausea, drowsiness, vomiting, excess salivation, and loss of mobility/consciousness. May react explosively even in absence of air at elevated pressure and/or temperature. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources—No smoking. Use and store in well-ventilated areas. Leaking gas fire: Do not extinguish unless leak can be stopped safely. In case of leakage, eliminate all ignition sources. Do not open valve until prepared to use. Always use a backflow preventative device in piping. Use only with equipment rated for cylinder pressure. Close valve after each use and when empty. Cylinder temperature should not exceed 52°C (125°F). Use in accordance with Safety Data Sheet. **FIRST AID: IF INHALED,** remove to fresh air. If breathing is difficult, give Oxygen. Call a physician. **IN CASE OF FROSTBITE,** obtain immediate medical attention. **DO NOT REMOVE THIS LABEL.**

SECTION 16 – OTHER INFORMATION

Information contained in this data sheet is offered without charge for use by technically qualified personnel at their discretion and risk. All statements, technical information and recommendations contained herein are based on tests and data which we believe to be reliable. But the accuracy and completeness thereof, is not guaranteed and no warranty of any kind, either expressed or implied, is made with respect thereto. Since MESA Specialty Gases and Equipment Division of MESA International Technologies, Inc. shall have no control over the use of the product described herein, we assume no liability for loss or damage incurred from the proper or improper use of such product.

HISTORY:

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