

MATERIAL
SAFETY
DATA SHEET

PRODUCT NAME Hydrogen	CAS # 1333-74-0
TRADE NAME AND SYNONYMS Hydrogen, compressed (D.O.T.); Water Gas	DOT I.D. No.: UN 1049
CHEMICAL NAME AND SYNONYMS Hydrogen; Normal Hydrogen	DOT Hazard Class: Division 2.1
ISSUE DATES AND REVISIONS Revised January 1995	Formula H ₂
	Chemical Family: Inorganic Flammable Gas

HEALTH HAZARD DATA

<p>TIME WEIGHTED AVERAGE EXPOSURE LIMIT Hydrogen is defined as a simple asphyxiant (ACGIH 1994-1995); OSHA 1993 PEL (8 Hr. TWA)=No Listing. (Continued on Page 4)</p>
<p>SYMPTOMS OF EXPOSURE <u>Inhalation:</u> High concentrations of hydrogen so as to exclude an adequate supply of oxygen to the lungs causes dizziness, deeper breathing due to air hunger, possible nausea and eventual unconsciousness.</p>
<p>TOXICOLOGICAL PROPERTIES Hydrogen is inactive biologically and essentially nontoxic; therefore, the major property is the exclusion of an adequate supply of oxygen to the lungs. Hydrogen is not listed in the IARC, NTP or by OSHA as a carcinogen or potential carcinogen. Persons in ill health where such illness would be aggravated by exposure to hydrogen should not be allowed to work with or handle this product.</p>
<p>RECOMMENDED FIRST AID TREATMENT PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO HYDROGEN. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF- CONTAINED BREATHING APPARATUS AND BE COGNIZANT OF EXTREME FIRE AND EXPLOSION HAZARD. <u>Inhalation:</u> Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given assisted respiration and supplemental oxygen. Further treatment should be symptomatic and supportive.</p>

Information contained in this material safety 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 or completeness thereof is not guaranteed and no warranty of any kind is made with respect thereto. This information is not intended as a license to operate under or a recommendation to practice or infringe any patent of this Company or others covering any process, composition of matter or use.
Since the Company shall have no control of the use of the product described herein, the Company assumes no liability for loss or damage incurred from the proper or improper use of such product.

HYDROGEN

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Hydrogen is flammable over a very wide range in air.

PHYSICAL DATA

BOILING POINT -423°F (-252.8°C)	LIQUID DENSITY AT BOILING POINT 4.43 lb/ft ³ (70.96 kg/m ³)
VAPOR PRESSURE @ 70°F (21.1°C) = Above the critical temperature of 399.8°F(-239.9°C)	GAS DENSITY AT 70°F, 1 atm .0052
SOLUBILITY IN WATER Very slightly	FREEZING POINT -434.6°F (-259.2°C)
EVAPORATION RATE N/A (Gas)	SPECIFIC GRAVITY (AIR=1) @ 70°F (21.1°C) =.069
APPEARANCE AND ODOR Colorless, odorless gas	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) N/A Gas	AUTO IGNITION TEMPERATURE 1058°F(570°C)	FLAMMABLE LIMITS % BY VOLUME (See Page 4) LEL 4 UEL 74.5
EXTINGUISHING MEDIA Water, carbon dioxide, dry chemical	ELECTRICAL CLASSIFICATION Class 1, Group B	
SPECIAL FIRE FIGHTING PROCEDURES If possible, stop the flow of hydrogen. Cool surrounding containers with water spray. Hydrogen burns with an almost invisible flame of relatively low thermal radiation.		
UNUSUAL FIRE AND EXPLOSION HAZARDS Hydrogen is very light and rises very rapidly in air. Should a hydrogen fire be extinguished and the flow of gas continue, increase ventilation to prevent an explosion hazard, particularly in the upper portions (Continued on Page 4)		

REACTIVITY DATA

STABILITY Unstable		CONDITIONS TO AVOID None
Stable	X	
INCOMPATIBILITY (Materials to avoid) Oxidizers		
HAZARDOUS DECOMPOSITION PRODUCTS None		
HAZARDOUS POLYMERIZATION May Occur		CONDITIONS TO AVOID
Will Not Occur	X	None

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact your closest supplier location or call the emergency telephone number listed herein.
WASTE DISPOSAL METHOD Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to your supplier. For emergency disposal assistance, contact your closest supplier location or call the emergency telephone number listed herein.

HYDROGEN

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)		Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.	
VENTILATION Hood with forced ventilation	LOCAL EXHAUST To prevent accumulation above the LEL	SPECIAL	N/A
	MECHANICAL (Gen.) In accordance with electrical codes	OTHER	N/A
PROTECTIVE GLOVES Plastic or rubber			
EYE PROTECTION Safety goggles or glasses			
OTHER PROTECTIVE EQUIPMENT Safety shoes, safety shower			

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION	
DOT Shipping Name: Hydrogen, compressed	DOT Hazard Class: Division 2.1
DOT Shipping Label: Flammable Gas	I.D. No.: UN 1049
SPECIAL HANDLING RECOMMENDATIONS	
<p>Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.</p> <p>For additional handling recommendations, consult Compressed Gas Association's Pamphlets G-5, P-1, P-14, and Safety Bulletin SB-2.</p>	
SPECIAL STORAGE RECOMMENDATIONS	
<p>Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of I noncombustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125F (52C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in - first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area.</p> <p>For additional storage recommendations, consult Compressed Gas Association's Pamphlets G-5, P-1, P-14, and Safety Bulletin SB-2.</p>	
SPECIAL PACKAGING RECOMMENDATIONS	
Hydrogen is noncorrosive and may be used with any common structural material.	
OTHER RECOMMENDATIONS OR PRECAUTIONS	
<p>Earth-ground and bond all lines and equipment associated with the hydrogen system. Electrical equipment should be non-sparking or explosion proof. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR). (Continued on Page 4)</p>	

*Various Government Agencies (i.e. Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that he is in full compliance.

HYDROGEN

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT: (Continued)

Oxygen levels should be maintained at greater than 18 Molar percent at normal atmospheric pressure (pO₂>135 torr).

FIRE AND EXPLOSION HAZARD DATA

UNUSUAL FIRE AND EXPLOSION HAZARDS: (Continued)

of buildings or sheds where the gas might "collect."

SPECIAL PRECAUTIONS

OTHER RECOMMENDATIONS OR PRECAUTIONS: (Continued)

Always secure cylinders in an upright position before transporting them. NEVER transport cylinders in trunks of vehicles, enclosed vans, truck cabs or in passenger compartments. Transport cylinders secured in open flatbed or in open pick-up type vehicles.

Reporting under SARA, Title III, Section 313 not required.

NFPA 704 NO. for hydrogen = 1 4 0 None