

Hydrogen

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SAFETY DATA SHEET**SECTION 1. IDENTIFICATION****Product identifier used on the label**: **Hydrogen****Other means of identification** : Not available.**Recommended use of the chemical and restrictions on use**: Metal treatment, cooling, welding, etc.
professional use /Consumer use
Recommended restrictions: None Known.**Chemical family**

: gas :H

**Name, address, and telephone number
of the supplier:****Charbone Hydrogen Corporation**5005 Boul. Lapinière, suite 1080
Brossard, QC, Canada
J4Z 0N5

Supplier's Telephone # : (450) 678 7171

24 Hr. Emergency Tel # : No information available.**Name, address, and telephone number of
the manufacturer:**

Refer to supplier

SECTION 2. HAZARDS IDENTIFICATION**Classification of the chemical**

Most important hazards: Extremely flammable gas.Gas Under Pressure.

This material is classified as hazardous under U.S. OSHA regulations (29CFR 1910.1200) (Hazcom 2012) and Canadian WHMIS regulations (Hazardous Products Regulations) (WHMIS 2015).

Hazard classification:

Flammable gas -Category 1

Gases under pressure - Compressed gas

Simple asphyxiant

Physical Hazards Not Otherwise Classified (PHNOC):Not applicable

Health Hazards Not Otherwise Classified (HHNOC):Direct contact with eyes or skin may cause frostbite.

Label elements*Hazard pictogram(s)**Signal Word***DANGER!***Hazard statement(s)*

Extremely flammable gas

Contains gas under pressure; may explode if heated.

May displace oxygen and cause rapid suffocation.

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Precautionary statement(s)

Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No Smoking
Use only with equipment rated for cylinder pressure.
Close valve after each use.

Leaking gas fire: do not extinguish, unless leak can be stopped safely.
Eliminate ignition sources if safe to do so.

Protect from sunlight and store in well-ventilated place.

Other hazards

Other hazards which do not result in classification:
Contact with liquid may cause frostbite.

Ecological information:

Not expected to be harmful to aquatic organisms. See Section 12 for more environmental information.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Pure substance

<u>Chemical name</u>	<u>Common name and synonyms</u>	<u>CAS #</u>	<u>Concentration (% by weight)</u>
Hydrogen	H	1333-74-0	100.00

SECTION 4. FIRST-AID MEASURES

Description of first aid measures

- Ingestion* : Not an expected route of entry.
- Inhalation* : Wear personal protective equipment. A self contained breathing apparatus should be used in emergency situations or instances where exposure levels are not known. Immediately remove person to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen by qualified medical personnel only. Get medical attention if irritation develops and persists.
- Skin contact* : Treat for frostbite if necessary by gently warming affected area. When symptoms persist or in all cases of doubt, seek medical advice.
- Eye contact* : Treat for frostbite if necessary by gently warming affected area. When symptoms persist or in all cases of doubt, seek medical advice.

Most important symptoms and effects, both acute and delayed

- : Simple asphyxiant - this product does not contain oxygen and may cause asphyxia in confined spaces. Oxygen content in the area must not fall below 19.5% or harmful effects will result. In extremely high concentrations, product may act as an asphyxiant and cause increased breathing and pulse rates, fatigue and unconsciousness. As asphyxiation progresses, nausea, vomiting, prostration and loss of consciousness may result, eventually leading to convulsions, coma and death.

Indication of any immediate medical attention and special treatment needed

- : Provide general supportive measures and treat symptomatically.

SECTION 5. FIRE-FIGHTING MEASURES

Extinguishing media

Suitable extinguishing media

- : Use media suitable to the surrounding fire such as water fog or fine spray, alcohol foams, carbon dioxide and dry chemical.

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SAFETY DATA SHEET*Unsuitable extinguishing media*

- : None known.

Special hazards arising from the substance or mixture / Conditions of flammability

- : Extremely flammable gas. Closed containers are contained under pressure and may explode if exposed to excess heat for a prolonged period of time. Product is a simple asphyxiant. Asphyxiant, can replace oxygen in confined area. May displace oxygen in breathing air and lead to suffocation and death, particularly in confined spaces.

Flammability classification (OSHA 29 CFR 1910.106)

- : Flammable gas

Hazardous combustion products

- : Not available.

Special protective equipment and precautions for firefighters*Protective equipment for fire-fighters*

- : Firefighters should wear proper protective equipment and self-contained breathing apparatus (SCBA) with full face piece operated in positive pressure mode. Do not enter without wearing specialized protective equipment suitable for the situation. Firefighter's normal protective clothing (Bunker Gear) will not provide adequate protection. A full-body encapsulating chemical protective suit with positive pressure self-contained breathing apparatus (NIOSH approved or equivalent) may be necessary.

Special fire-fighting procedures

- : Use extreme caution. Evacuate personnel to safe areas. If feasible, stop the flow of gas. Move containers from fire area if safe to do so. Shield personnel to protect from venting or rupturing containers. DO NOT direct water at open or leaking containers or cylinders and take precautions not to get water inside a container or cylinder or on or into vent openings. Stay away from ends of cylinders and withdraw immediately in case of rising sounds or discolouration of containers.

SECTION 6. ACCIDENTAL RELEASE MEASURES**Personal precautions, protective equipment and emergency procedures**

- : Restrict access to area until completion of clean-up. Keep all other personnel upwind and away from the spill/release. Ensure clean-up is conducted by trained personnel only. All persons dealing with clean-up should wear the appropriate protective equipment including self-contained breathing apparatus. Refer to Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION, for additional information on acceptable personal protective equipment.

Environmental precautions : Ensure spilled product does not enter confined areas.**Methods and material for containment and cleaning up**

- : Ventilate area of release. Do not enter confined spaces unless adequately ventilated. Eliminate all ignition sources. Leaks in lines to equipment set-ups can be identified by painting suspected sites with soapy water. Leaks can be located by bubble formation. Stop spill or leak at source if safely possible. If leak cannot be stopped, move cylinders to an open space. Isolate the area until all gas has dispersed. Notify the appropriate authorities as required. Conduct air monitoring for flammability and oxygen deficiency before anyone is allowed back into area .

Special spill response procedures

- : If a spill/release in excess of the EPA reportable quantity is made into the environment, immediately notify the National Response Center in the United States (phone: 1-800-424-8802). In case of a transportation accident, in the United States contact CHEMTREC at 1-800-424-9300 or International at 1-703-527-3887. US CERCLA Reportable quantity (RQ): See section 15.

SECTION 7. HANDLING AND STORAGE**Precautions for safe handling**

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- Conditions for safe storage** :
- : Do not handle until all safety precautions have been read and understood. Before handling, it is very important that engineering controls are operating, and that protective equipment requirements and personal hygiene measures are being followed. People working with this chemical should be properly trained regarding its hazards and its safe use. Simple asphyxiant - this product does not contain oxygen and may cause asphyxia in confined spaces. Oxygen content in the area must not fall below 19.5% or harmful effects will result.
 - : Use only in well-ventilated areas. Avoid inhaling gas. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources - No smoking. Keep away from incompatibles. Protect cylinders from damage. Never attempt to lift cylinder by its cap. Open valves slowly to prevent rapid decompression. Shut flow off at cylinder valve and not just at the regulator after use. Use only with equipment rated for cylinder pressure. Do not puncture or incinerate containers.
 - : Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Store in a cool, dry, well ventilated area, away from heat and ignition sources. Avoid storage of cylinders for more than six months. Protect from sunlight. Storage area should be clearly identified, clear of obstruction and accessible only to trained and authorized personnel. Inspect periodically for damage or leaks. No smoking in the area.
- Incompatible materials** :
- : Oxidizing agents. Halogens. Metals. Sodium. Potassium.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

<u>Exposure Limits:</u>			
<u>Chemical Name</u>	<u>ACGIH TLV</u>		<u>OSHA PEL</u>
	<u>TWA</u>	<u>STEL</u>	<u>PEL</u> <u>STEL</u>
Hydrogen	Simple Asphyxiant	N/Av	N/Av N/Av

Exposure controls

Ventilation and engineering measures

- : Provide exhaust ventilation or other engineering controls to keep the airborne concentration of vapours below their respective threshold limit value. Recommended monitoring procedures: Provide sufficient air exchange and/or exhaust in work rooms. Oxygen content in the area must not fall below 19.5% or harmful effects will result. Use explosion-proof electrical and ventilating equipment.

Respiratory protection

- : If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable approved respiratory protection. Confirmation of which type of respirator is most suitable for the intended application should be obtained from respiratory protection suppliers.

Skin protection

- : Wear protective gloves/clothing. Advice should be sought from glove suppliers. Appropriate protective gloves, coveralls, boots, and/or other protective clothing are required to prevent contact with refrigerated liquefied gas or compressed gas escaping from its cylinder (e.g. loose-fitting gloves, cuffless pants that are not tucked into shoes or boots, apron). Wear appropriate foot protection when handling cylinders.

Eye / face protection

- : Wear safety glasses with side shields (or goggles).

Other protective equipment

- : An eyewash station and safety shower should be made available in the immediate working area. Wear chemical-resistant gloves, footwear, and protective clothing appropriate for the risk of exposure.

General hygiene considerations

- : Avoid inhaling gas. Do not eat, drink or smoke when using this product. Handle in accordance with good industrial hygiene and safety practice.

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SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	: Gas
Colour	: Clear, colorless.
Odour	: Odourless.
Odour threshold	: Poor warning properties at low concentrations.
pH	: Not applicable.
Melting Point/Freezing point	: -259.2°C
Initial boiling point and boiling range	: -252.8 °C
Flash point	: Flammable gas, burns at ambient temperatures.
Flashpoint (Method)	: Not applicable.
Evaporation rate (BuAe = 1)	: Not available.
Flammability	: Flammable gas
Lower explosion or flammability limit (% by vol.)	: 4%
Upper explosion or flammability limit (% by vol.)	: 75%
Oxidizing properties	: None known.
Explosive properties	: Can form explosive mixtures with air.
Vapour pressure	: >7000 kPa
Relative vapour density	: (Air = 1) 0.0695
Relative density / Specific gravity	: Not applicable.
Solubility in water	: Slightly soluble.
Other solubility(ies)	: Not available.
Partition coefficient: n-octanol/water or Coefficient of water/oil distribution	: 0.45
Auto-ignition temperature	: 400-585 °C
Decomposition temperature	: Not available.
Viscosity	: Not available.
Particle characteristics	: Not applicable.
Volatiles (% by weight)	: Not available.
Volatile organic Compounds (VOC's)	: Not applicable.
Absolute pressure of container	: Not applicable.
Flame projection length	: Not applicable.
Other physical/chemical comments	: Critical temperature:-240°C

SECTION 10. STABILITY AND REACTIVITY

Reactivity	: Not normally reactive.
Chemical stability	: Stable under normal conditions.
Possibility of hazardous reactions	: No dangerous reaction known under conditions of normal use. Hazardous polymerization does not occur.
Conditions to avoid	: Avoid heat, sparks, open flames and other ignition sources. Ensure adequate ventilation, especially in confined areas.
Incompatible materials	: Strong oxidizers. Halogens. Metals.Sodium. Potassium.

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Hazardous decomposition products

: Not available.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure:

Routes of entry inhalation : YES

Routes of entry skin & eye : NO

Routes of entry Ingestion : NO

Routes of exposure skin absorption

: NO

Potential Health Effects:

Signs and symptoms of short-term (acute) exposure

Sign and symptoms Inhalation

: Simple asphyxiant - this product does not contain oxygen and may cause asphyxia in confined spaces. Oxygen content in the area must not fall below 19.5% or harmful effects will result.

In extremely high concentrations, product may act as an asphyxiant and cause increased breathing and pulse rates, fatigue and unconsciousness. As asphyxiation progresses, nausea, vomiting, prostration and loss of consciousness may result, eventually leading to convulsions, coma and death.

Sign and symptoms ingestion

: Not an expected route of entry under normal conditions of use. (gas)

Sign and symptoms skin

: May cause frostbite. Symptoms of frostbite may include numbness, prickling and itching.

Sign and symptoms eyes

: Spraying the product directly into the eyes may cause freezing, and could cause eye damage.

Potential Chronic Health Effects

: Not available.

Mutagenicity

: Not expected to be mutagenic in humans.

Carcinogenicity

: No components are listed as carcinogens by ACGIH, IARC, OSHA or NTP.

Reproductive effects & Teratogenicity

: Not expected to have other reproductive effects.

Sensitization to material

: Not expected to be a skin or respiratory sensitizer.

Specific target organ effects

: The substance or mixture is not classified as specific target organ toxicant, single exposure.

The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Medical conditions aggravated by overexposure

: Not available.

Synergistic materials

: Not available.

Toxicological data

: Not classified for acute toxicity based on available data. See below for toxicological data on the substance.

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<u>Chemical name</u>	LC₅₀(4hr)	LD₅₀	
	<u>inh, rat</u>	<u>(Oral, rat)</u>	<u>(Rabbit, dermal)</u>
Hydrogen	>15000 ppm 1 h	N/Av	N/Av

Other important toxicological hazards

: Not applicable

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity : No information available. Measured ecotoxicity data are not available for the aquatic toxicity endpoints for these gases. These chemicals are gases at standard temperature and pressure and are expected to partition primarily to air, therefore aquatic toxicity tests may not be relevant.

Ecotoxicity data:

<u>Ingredients</u>	CAS #	Toxicity to Fish		
		LC50 / 96h	NOEC / 21 day	M Factor
Hydrogen	1333-74-0	N/Av	N/Av	None.

<u>Ingredients</u>	CAS #	Toxicity to Daphnia		
		EC50 / 48h	NOEC / 21 day	M Factor
Hydrogen	1333-74-0	N/Av	N/Av	None.

<u>Ingredients</u>	CAS #	Toxicity to Algae		
		EC50 / 96h or 72h	NOEC / 96h or 72h	M Factor
Hydrogen	1333-74-0	N/Av	N/Av	None.

Persistence and degradability

: No information available. The methods for determining biodegradability are not applicable to inorganic substances.

Bioaccumulation potential

: No information available.

<u>Components</u>	<u>Partition coefficient n-octanol/water (log Kow)</u>	<u>Bioconcentration factor (BCF)</u>
Hydrogen (CAS 1333-74-0)		no bioaccumulation expected

Mobility in soil : No information available.

Other Adverse Environmental effects

: No information available.

SECTION 13. DISPOSAL CONSIDERATIONS

Handling for Disposal : Handle in accordance with good industrial hygiene and safety practice. See Section 7 (Handling and Storage) for further details. Allow to safely dissipate into atmosphere. Do not puncture or incinerate containers.

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- Methods of Disposal** : Return to vendor with cylinder valve tightly closed and valve cap in place. Dispose in accordance with all applicable federal, state, provincial and local regulations.
- RCRA** : If this product, as supplied, becomes a waste in the United States, it may meet the criteria of a hazardous waste as defined under RCRA, Title 40 CFR 261. It is the responsibility of the waste generator to determine the proper waste identification and disposal method. For disposal of unused or waste material, check with local, state and federal environmental agencies.

SECTION 14. TRANSPORT INFORMATION

Regulatory Information	UN Number	UN proper shipping name	Transport hazard class(es)	Packing Group	Label
49CFR/DOT	UN1049	Hydrogen, compressed	2.1	none	
49CFR/DOT Additional information	Exceptions 173.306				
TDG	UN1049	HYDROGEN, COMPRESSED	2.1	none	
TDG Additional information	Limited Quantity exemption may be used if shipped in containers of 0.125 Litres or less, per Schedule 1. ERAP Index 3000				
ICAO/IATA	UN1049	Hydrogen, compressed	2.1	none	
ICAO/IATA Additional information	Refer to ICAO/IATA Packing Instruction 200. ICAO / IATA cargo aircraft only				
IMDG	UN1049	HYDROGEN, COMPRESSED	2.1	none	
IMDG Additional information	EmS No. F-D, S-U				

Special precautions for user : Keep away from heat and open flames. - No smoking. Appropriate advice on safety must accompany the package.

Environmental hazards : This substance does not meet the criteria for an environmentally hazardous substance according to the IMDG Code. See ECOLOGICAL INFORMATION, Section 12.

SECTION 15 - REGULATORY INFORMATION

US Federal Information:

Components listed below are present on the following U.S. Federal chemical lists:

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<u>Ingredients</u>	CAS #	TSCA Inventory	CERCLA Reportable Quantity(RQ) (40 CFR 117.302):	SARA TITLE III: Sec. 302, Extremely Hazardous Substance, 40 CFR 355:	SARA TITLE III: Sec. 313, 40 CFR 372, Specific Toxic Chemical	
					Toxic Chemical	de Minimis Concentration
Hydrogen	1333-74-0	Yes	N/Ap	N/Av	No	No

SARA TITLE III: Sec. 311 and 312, SDS Requirements, 40 CFR 370 Hazard Classes: Flammable gas; Gas Under Pressure ;Simple Asphyxiant.

US State Right to Know Laws:

The following chemicals are specifically listed by individual States:

<u>Ingredients</u>	CAS #	California Proposition 65		State "Right to Know" Lists					
		Listed	Type of Toxicity	CA	MA	MN	NJ	PA	RI
Hydrogen	1333-74-0	No	N/Ap	Yes	Yes	Yes	Yes	Yes	Yes

Canadian Information:

Canadian Environmental Protection Act (CEPA) information: All ingredients listed appear on the Domestic Substances List (DSL).

International Information:

Components listed below are present on the following International Inventory list:

<u>Ingredients</u>	CAS #	European EINECS	Australia AICS	Philippines PICCS	Japan ENCS	Korea KECI/KECL	China IECSC	NewZealand IOC
Hydrogen	1333-74-0	215-605-7	Present	Present	N/Av	KE-20137	Present	HSR001002

SECTION 16. OTHER INFORMATION
Legend

: ACGIH: American Conference of Governmental Industrial Hygienists
AICS: Australian Inventory of Chemical Substances
CAS: Chemical Abstract Services
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act of 1980
EC50: Effective Concentration 50%
EINECS: European Inventory of Existing Commercial chemical Substances
ENCS: Existing and New Chemical Substances
EPA: Environmental Protection Agency
IARC: International Agency for Research on Cancer
IECSC: Inventory of Existing Chemical Substances
IOC: Inventory of Chemicals
KECI: Korean Existing Chemicals Inventory
KECL: Korean Existing Chemicals List
LC: Lethal Concentration
LD: Lethal Dose
N/Ap: Not Applicable
N/Av: Not Available
NIOSH: National Institute of Occupational Safety and Health
NOEC: No observable effect concentration

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NTP: National Toxicology Program
OECD: Organisation for Economic Co-operation and Development
OSHA: Occupational Safety and Health Administration
PEL: Permissible exposure limit
PICCS: Philippine Inventory of Chemicals and Chemical Substances
SARA: Superfund Amendments and Reauthorization Act
SCBA: Self-Contained Breathing Apparatus
STEL: Short Term Exposure Limit
TDG: Canadian Transportation of Dangerous Goods Act & Regulations
TLV: Threshold Limit Values
TSCA: Toxic Substance Control Act
TWA: Time Weighted Average

References

- : 1. ACGIH, Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices
- 2. ECHA - European Chemical Agency
- 3. Canadian Centre for Occupational Health and Safety, CCInfoWeb databases
- 4. Safety Data Sheets from manufacturer.
- 5. US EPA Title III List of Lists
- 6. California Proposition 65 List
- 7. OECD - The Global Portal to Information on Chemical Substances - eChemPortal

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Other special considerations for handling

: Provide adequate information, instruction and training for operators.

<u>Prepared for:</u> Charbone Hydrogen Corporation 5005 Boul. Lapinière, suite 1080 Brossard, QC J4Z 0N5 Telephone: (450) 678 7171	
<u>Prepared by:</u> ICC The Compliance Center Inc. Telephone: (888) 442-9628 (U.S.): (888) 977-4834 (Canada) http://www.thecompliancecenter.com	

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