

**MATERIAL SAFETY DATA SHEET**  
REV. 3 Issued: May 8, 2009

**1. Chemical Product And Company Information**

**Chemical Name:** Hydrogen (not compressed)  
**Synonyms/Trade Names:** Not applicable  
**Chemical Family:** Flammable gas  
**Formula:** H<sub>2</sub>  
**Molecular Weight:** 2.016  
**CAS No.:** 1333-74-0  
**Uses:** Fuel  
Chemical feedstock

**Manufacturer & Supplier:**  
ERCO Worldwide, a division of Superior Plus LP  
302 The East Mall, Ste. 200  
Toronto, Ontario Canada M9B 6C7  
(416) 239-7111

**Transportation Emergency Telephone Numbers :**  
Not Transported

CANADA: (613) 996-6666  
CANUTEC  
USA: 1-800-424-9300  
CHEMTREC

**Canadian WHMIS Classification(s):**

A - Compressed Gas 	B1 - Flammable Gas 
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**2. Composition / Information On Ingredients**

<b>Name:</b>	<b>Conc. % By Weight</b>	<b>CAS No.</b>
Hydrogen	45-98	1333-74-0

### 3. Hazard Identification

#### Emergency Overview:

Gas, at an absolute pressure less than 2.7 atmospheres and saturated with water vapour. None if pure. As supplied has a distinctive slight "rusty" odour. Prior to scrubbing has a chlorine

#### Routes of Entry:

##### Inhalation:

Hydrogen gas is not toxic at normal temperature and pressure, but is an extremely flammable gas, posing a very serious fire hazard. When hydrogen is present in high concentrations in air it acts as a simple asphyxiant. Simple asphyxiants displace oxygen in the air and can cause symptoms of oxygen deprivation (asphyxiation) when present in high enough concentrations to lower the oxygen concentration. The available oxygen should be a minimum of 18% or harmful effects will result.(5)

Effects of oxygen deficiency are: 12-16%: breathing and pulse rate are increased, with slight muscular incoordination; 10-14%: emotional upsets, abnormal fatigue from exertion, disturbed respiration; 6-10%: nausea and vomiting, inability to move freely, collapse, possible lack of consciousness; below 6%: convulsive movements, gasping, possible respiratory collapse and death. Since exercise increases the body's need for oxygen, symptoms will occur more quickly during exertion in an oxygen-deficient environment.(6,7) In survivors of oxygen deprivation, some or all organs, including the central nervous system and the brain, may have damage from low oxygen. These effects may or may not be reversible with time, depending on the degree and duration of the low oxygen and the amount of tissue injury.

##### Skin Contact:

Hydrogen gas is not irritating. Direct contact with compressed hydrogen escaping from its cylinder or refrigerated liquefied hydrogen can cause cold burns or frostbite (freezing of the tissue). Symptoms of mild frostbite include numbness, prickling and itching in the affected area. Symptoms of more severe frostbite include a burning sensation and stiffness of the affected area. The skin may become waxy white or yellow. Blistering, tissue death and gangrene may also develop in severe cases.

##### Eye Contact:

Hydrogen gas is not irritating. Direct contact with the compressed hydrogen escaping from its cylinder or refrigerated liquefied hydrogen can cause freezing of the eye. Permanent eye damage or blindness could result.

##### Ingestion:

Ingestion exposure is not applicable to gases.

##### Symptoms of Exposure:

See above.

### 4. First Aid Measures

#### Skin:

COMPRESSED OR REFRIGERATED LIQUEFIED GAS: Quickly remove victim from source of contamination. Immediately and briefly flush with lukewarm, gently flowing water. DO NOT attempt to rewarm. Cover both eyes with a sterile dressing. DO NOT allow victim to drink alcohol or smoke. Quickly transport victim to an emergency medical facility. GAS: Not applicable. No effects expected.

#### Eyes:

COMPRESSED OR REFRIGERATED LIQUEFIED GAS: Quickly remove victim from source of contamination. Immediately and briefly flush with lukewarm, gently flowing water. DO NOT attempt to rewarm. Cover both eyes with a sterile dressing. DO NOT allow victim to drink alcohol or smoke. Quickly transport victim to an emergency medical facility. GAS: Not applicable. No effects expected.

**Inhalation:**

This chemical is extremely flammable. Take proper precautions (e.g. remove any sources of ignition). In general, this gas has very low toxicity, but it can act as an asphyxiant at high concentrations. If the victim has been knocked down, wear appropriate protective equipment, and use the buddy system. Remove source of contamination or move victim to fresh air. If breathing is difficult, trained personnel should administer emergency oxygen. If breathing has stopped, trained personnel should begin artificial respiration (AR) or, if the heart has stopped, cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED) immediately. Quickly transport victim to an emergency care facility.

**Ingestion:**

Ingestion is not an applicable route of exposure for gases.

## 5. Fire-Fighting Measures

**Conditions Of Flammability:**

Highly explosive or flammable if mixed with air, oxygen or oxidizing gases such as chlorine. Hydrogen has a low ignition energy, so that escaping gas may ignite without obvious source of ignition. Flame may be virtually invisible.

**Means To Extinguish:**

Carbon dioxide, dry chemical extinguishers, water spray, fog or foam. If leaking from piping, purging by use of nitrogen or steam may be effective in extinguishing and avoiding risk of flash-back when source of hydrogen is shut off. Cool surroundings with water to minimize likelihood of reignition.

**DO NOT EXTINGUISH A FIRE UNLESS THE SOURCE OF HYDROGEN CAN BE SHUT OFF AND VESSELS AND PIPING PURGED, BECAUSE OF THE RISK OF EXPLOSIVE RE-IGNITION.**

**Hazardous Combustion Products :**

None - combustion product is water

**Flash Point & Method:** Flammable gas (burns at all ambient temperatures)

**Upper Flammability Limit:** 75%

**Lower Flammability Limit:** 4%

**Auto-Ignition Temperature:** 520°C (100% Hydrogen)

**Mechanical Impact Sensitivity:** Not Sensitive

**Static Discharge Sensitivity:** Sensitive (can accumulate static charge by flow, friction in pipes)

## 6. Accidental Release Measures

**Leak Or Spill Procedures :**

Ventilate, but keep all sources of ignition away. Conduct air monitoring for flammability. Allow access only to necessary personnel, and use a buddy system. Wear flame-resistant clothing and face shield, or SCBA when necessary. Seek to purge out lines and to work remote from the leak to stop the flow of hydrogen at the source. If already ignited do not extinguish unless equipment can be purged and hydrogen flow stopped.

**Waste Control Procedures :**

May be vented to atmosphere, where it will ultimately be oxidized to give water.

## 7. Handling Storage

### Handling Procedures And Equipment :

Establish and follow appropriate operating procedures for equipment, and controls for maintenance operations including all hot work in the vicinity.

### Storage:

As supplied, the hydrogen is used directly as generated without intermediate storage.

## 8. Exposures Controls / Personal Protection

### Protective Equipment:

No specific protective equipment required against contact with this material. Chemical safety goggles and a face shield may be necessary to prevent contact with refrigerated liquefied gas or compressed gas escaping from its cylinder.

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. Have a safety shower and eye-wash fountain readily available in the immediate work area.

In the event of a fire, use fire protective fire fighting gear (including consideration of any other hazardous materials which may be present).

### Engineering Controls:

Maintain leaktight systems. Provide means to purge with inert gas and safely vent closed systems which have potential for accidental mixing with O<sub>2</sub> gas and exceeding the UEL.

Ensure good ventilation, especially at building high points, to keep hydrogen levels below 4000 ppm by volume (10% of LEL). Use approved instruments\* to monitor concentration levels and if necessary control ventilation equipment. In areas where the LEL is exceeded under normal operating conditions, provide electrical equipment in compliance with the Hazardous Locations requirements of the CEC (Canadian Electrical code).

**(\*) WARNING:** Hot wire or catalytic bead type LEL instruments will not work in oxygen deficient atmosphere.

## 9. Physical And Chemical Properties

**State:** Gas, at an absolute pressure less than 2.7 atmospheres and saturated with water vapour.  
**Odour:** None if pure. As supplied has a distinctive slight "rusty" odour. Prior to scrubbing has a chlorine odour  
**Odour Threshold:** Not applicable  
**Boiling Point:** - 253°C @ 1 atm.  
**Melting Point:**  
**Freezing Point:** - 259°C  
**pH:** Not applicable  
**Coefficient Of Water/Oil Distribution:** Log P(oct) = 0.45 (estimated)  
**Appearance:** Not visible  
**Specific Gravity:** Not applicable  
**Vapour Pressure:** Not applicable  
**Vapour Density:** 0.069 (Air=1), 90g/m<sup>3</sup> @ 0°C and 1 atm. (14.5 times lighter than air)  
**Evaporation Rate:** Not applicable for gas  
**Solubility In Water:** 1.8% v/v @ 20°C  
**Bulk Density:** Not applicable

## 10. Stability And Reactivity

### Chemical Stability:

Stable.

### Reactivity Conditions:

May form explosive gas mixture with air, oxygen, halogens, nitrogen trifluoride or oxygen difluoride, and other oxidizing gases or vapours.

### Incompatible Substances:

Will react explosively or burn with air, oxygen, chlorine, bromine, fluorine, nitrogen trifluoride or oxygen difluoride, with minimal or no ignition source. Platinum and some other metals will catalyse reaction with oxygen or air in absence of an ignition source.

Hydrogen embrittlement can occur at high temperatures and pressures and can seriously weaken or embrittle the metal. This can lead to hydrogen leaks. Alloys and metals that resist hydrogen embrittlement at room temperature include aluminum (types 3003, 6061-T6 and 7075-T73), stainless steel (e.g. types 304, 316, 321, 347, 410, 440 series), oxygen-free copper and its alloys, brass, bronze, naval brass, and silicon bronze, nickel and nickel-base alloys, Monel, Hastelloy and Inconel, and titanium. Decarburization happens in ferritic steels and alloys that contain carbon on contact with hydrogen, at temperatures greater than 200 deg C and causes these metals to weaken. Decarburization can be prevented by alloying metals such as chromium, molybdenum, tungsten, vanadium, titanium, and niobium.

### Hazardous Decomposition Products:

None

## 11. Toxicological Information

**Skin Contact:** No effect.  
**Skin Absorption:** No effect.  
**Eye Contact:** No effect.  
**Inhalation:** No toxic effect. A simple asphyxiant, hydrogen may suffocate by replacing air and so depriving a person of oxygen. Remember that hydrogen is very light, and so tends to rise in air to fill high spots (most common asphyxiants are heavier than air and tend to fill low places).  
**Ingestion:** Not applicable (Material is a gas - see "inhalation" above)  
**LD<sub>50</sub>:** Not Applicable  
**LC<sub>50</sub>:** Not Applicable  
**Exposure Limits:** Simple asphyxiant.  
**Irritancy:** Not irritant.  
**Sensitization:** Not a sensitizer.  
**Carcinogenicity:** Does not meet criteria.  
**Teratogenicity & Mutagenicity:** Does not meet criteria.  
**Reproductive Toxicology:** Does not meet criteria.  
**Toxicological Synergism:** None

## 12. Ecological Information

**Ecological Information:**  
No information available

**Biodegradability:**  
Not applicable

**Aquatic Toxicity:**  
Not applicable

## 13. Disposal Considerations

**Disposal Considerations:**  
May be vented to atmosphere or used as fuel.

## 14. Transportation Information

Shipping Name (TDGR)	UN Number	Hazard Class	Packing Group
Hydrogen	UN 1049	2.1	Not applicable

## 15. Regulatory Information

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all of the information required by the CPR .

### Safety:

#### U.S.

##### OSHA Hazard Communication Evaluation :

Meets criteria for hazardous material, as defined by 29 CFR 1910.1200.

##### 29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS

CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Hydrogen is not listed in Appendix A as a highly hazardous chemical. However, any process that involves a flammable gas on site in one location in quantities of 10,000 lb (4536 kg) or greater is covered under this regulation unless the gas is used as a fuel.

#### Canada

##### WHMIS Ingredient Disclosure List :

Not included. Meets criteria for disclosure at 1% or greater.

##### Detailed WHMIS Classification According to Criteria :

###### Class A - Compressed Gas:

Meets criteria.

Critical temperature: -240°C (-400°F).

###### Class B - Flammable and Combustible Material :

Meets criteria for "Flammable gas".

LFL/LEL: 4% (less than 13%) and Flammable range: 71% (4-75%) (greater than 12%).

### Environmental:

All components of this product are either on the Canadian Domestic Substances List (DSL) or the Non-Domestic Substances List (NDSL) or exempt.

All components of this product are either on the U.S. Toxic Substances Control Act (TSCA) Inventory List or exempt.

### Transportation:

Refer to Section 14.

## 16. Other Information

### Prepared By:

ERCO Worldwide, A division of Superior Plus LP  
Toronto, ON  
416-239-7111

### Summary of Changes Made in this Revision :

This MSDS is for non-compressed hydrogen gas, supplied by low pressure pipeline. Metal embrittlement information was added in section 10. Also, reactivity conditions were spelled out to replace reference to other section of this document..

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