

Danger



SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

| | |
|----------------------|--|
| Trade name | : Hydrogen, Alphahaz™ Hydrogen, Smartop™ Hydrogen, Purified/ Compressed Hydrogen |
| SDS no | : 2010489 |
| Chemical description | : Hydrogen |
| | CAS-No. : 1333-74-0 |
| | EC-No. : 215-605-7 |
| | EC Index-No. : 001-001-00-9 |
| Registration-No. | : Listed in Annex IV / V REACH, exempted from registration. |
| Chemical formula | : H ₂ |

1.2. Relevant identified uses of the substance or mixture and uses advised against

| | |
|--------------------------|---|
| Relevant identified uses | : Industrial and professional. Perform risk assessment prior to use. Test gas/Calibration gas. Chemical reaction / Synthesis. Use as a fuel. Shield gas for welding processes. Use for manufacture of electronic/photovoltaic components. Laser gas. Laboratory use. Contact supplier for more information on uses. |
| Uses advised against | : Do not inflate in party balloons because of the risk of explosion. Consumer use. |

1.3. Details of the supplier of the safety data sheet

| | |
|------------------------|---|
| Company identification | : AIR LIQUIDE SINGAPORE PTE LTD HEAD OFFICE : 2 VENTURE DRIVE, VISION EXCHANGE, #22-28, SINGAPORE 608526 SPECIALGASES OFFICE, NO 24 JALAN BUROH SINGAPORE 619480 T +65 6 265 3788 https://industry.airliquide.sg/resources/safety-data-sheets-sds Sg-info@airliquide.com |
|------------------------|---|

1.4. Emergency telephone number

| | |
|----------------------------|--|
| Emergency telephone number | : +65 6265 3788, +65 9619 9229 (After Office Hour) |
|----------------------------|--|

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]

| | | |
|------------------|-----------------------------|------|
| Physical hazards | Flammable gases, Category 1 | H220 |
|------------------|-----------------------------|------|

Gases under pressure : Compressed gas

H280

2.2. Label elements

Labelling according to Regulation (EC) No. 1272/2008 [CLP]

Hazard pictograms (CLP) :



GHS02

GHS04

Signal word (CLP) : Danger

Hazard statements (CLP) : H220 - Extremely flammable gas.

H280 - Contains gas under pressure; may explode if heated.

Precautionary statements (CLP)

- Prevention : P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
- Response : P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381 - In case of leakage, eliminate all ignition sources.
- Storage : P403 - Store in a well-ventilated place.

2.3. Other hazards

: None.

SECTION 3: Composition/information on ingredients

3.1. Substances

| Name | Product identifier | % | Classification according to Regulation (EC) No. 1272/2008 [CLP] |
|----------|---|-----|---|
| Hydrogen | (CAS-No.) 1333-74-0 (EC-No.) 215-605-7 (EC Index-No.) 001-001-00-9 (Registration-No.) *1 | 100 | Flam. Gas 1, H220 Press. Gas (Comp.), H280 |

Contains no other components or impurities which will influence the classification of the product.

*1: Listed in Annex IV / V REACH, exempted from registration.

*2: Registration deadline not expired.

*3: Registration not required: Substance manufactured or imported < 1t/y.

3.2. Mixtures

: Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

- Inhalation : Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Perform cardiopulmonary resuscitation if breathing stopped.
- Skin contact : Adverse effects not expected from this product.
- Eye contact : Adverse effects not expected from this product.
- Ingestion : Ingestion is not considered a potential route of exposure.

4.2. Most important symptoms and effects, both acute and delayed

: Refer to section 11.

4.3. Indication of any immediate medical attention and special treatment needed

: None.

SECTION 5: Firefighting measures**5.1. Extinguishing media**

- Suitable extinguishing media : Water spray or fog.
Dry powder.
- Unsuitable extinguishing media : Carbon dioxide.
Do not use water jet to extinguish.

5.2. Special hazards arising from the substance or mixture

- Specific hazards : Exposure to fire may cause containers to rupture/explode.
- Hazardous combustion products : None.

5.3. Advice for firefighters

- Specific methods : Use fire control measures appropriate for the surrounding fire. Exposure to fire and heat radiation may cause gas receptacles to rupture. Cool endangered receptacles with water spray jet from a protected position. Prevent water used in emergency cases from entering sewers and drainage systems.
If possible, stop flow of product.
Use water spray or fog to knock down fire fumes if possible.
Do not extinguish a leaking gas flame unless absolutely necessary. Spontaneous/explosive re-ignition may occur. Extinguish any other fire.
Move containers away from the fire area if this can be done without risk.
- Special protective equipment for fire fighters : In confined space use self-contained breathing apparatus.
Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.
Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask.
Standard EN 469 - Protective clothing for firefighters. Standard - EN 659: Protective gloves for firefighters.

SECTION 6: Accidental release measures**6.1. Personal precautions, protective equipment and emergency procedures**

: Try to stop release.
Evacuate area.
Monitor concentration of released product.
Consider the risk of potentially explosive atmospheres.
Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.
Eliminate ignition sources.
Ensure adequate air ventilation.
Act in accordance with local emergency plan.
Stay upwind.

6.2. Environmental precautions

: Try to stop release.

6.3. Methods and material for containment and cleaning up

: Ventilate area.

6.4. Reference to other sections

: See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Safe use of the product

: Do not breathe gas.
Avoid release of product into work area.
The product must be handled in accordance with good industrial hygiene and safety procedures.
Only experienced and properly instructed persons should handle gases under pressure.
Consider pressure relief device(s) in gas installations.
Ensure the complete gas system was (or is regularly) checked for leaks before use.
Do not smoke while handling product.
Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your gas supplier if in doubt.
Avoid suck back of water, acid and alkalis.
Assess the risk of potentially explosive atmospheres and the need for explosion-proof equipment.
Purge air from system before introducing gas.
Take precautionary measures against static discharge.
Keep away from ignition sources (including static discharges).
Consider the use of only non-sparking tools.
Ensure equipment is adequately earthed.

Safe handling of the gas receptacle : Refer to supplier's container handling instructions.

- Do not allow backfeed into the container.
- Protect cylinders from physical damage; do not drag, roll, slide or drop.
- When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders.
- Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use.
- If user experiences any difficulty operating cylinder valve discontinue use and contact supplier.
- Never attempt to repair or modify container valves or safety relief devices.
- Damaged valves should be reported immediately to the supplier.
- Keep container valve outlets clean and free from contaminants particularly oil and water.
- Replace valve outlet caps or plugs and container caps where supplied as soon as container is disconnected from equipment.
- Close container valve after each use and when empty, even if still connected to equipment.
- Never attempt to transfer gases from one cylinder/container to another.
- Never use direct flame or electrical heating devices to raise the pressure of a container.
- Do not remove or deface labels provided by the supplier for the identification of the cylinder contents.
- Suck back of water into the container must be prevented.
- Open valve slowly to avoid pressure shock.

7.2. Conditions for safe storage, including any incompatibilities

: Observe all regulations and local requirements regarding storage of containers.

- Containers should not be stored in conditions likely to encourage corrosion.
- Container valve guards or caps should be in place.
- Containers should be stored in the vertical position and properly secured to prevent them from falling over.
- Stored containers should be periodically checked for general condition and leakage.
- Keep container below 50°C in a well ventilated place.
- Store containers in location free from fire risk and away from sources of heat and ignition.
- Keep away from combustible materials.
- Segregate from oxidant gases and other oxidants in store.
- All electrical equipment in the storage areas should be compatible with the risk of a potentially explosive atmosphere.

7.3. Specific end use(s)

: None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

| Hydrogen, Alphahaz™ Hydrogen, Smartop™ Hydrogen, Purified/ Compressed Hydrogen (1333-74-0) | | |
|--|----------------------|------------|
| OEL : Occupational Exposure Limits | | |
| ACGIH | Regulatory reference | ACGIH 2017 |

OEL (Occupational Exposure Limits) : None available.

DNEL (Derived-No Effect Level) : None available.

PNEC (Predicted No-Effect Concentration) : None available.

8.2. Exposure controls

8.2.1. Appropriate engineering controls

- : Provide adequate general and local exhaust ventilation.
- Product to be handled in a closed system.
- Systems under pressure should be regularly checked for leakages.
- Gas detectors should be used when flammable gases/vapours may be released.
- Consider the use of a work permit system e.g. for maintenance activities.

8.2.2. Individual protection measures, e.g. personal protective equipment

- : A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select the PPE that matches the relevant risk. The following recommendations should be considered:
PPE compliant to the recommended EN/ISO standards should be selected.

- Eye/face protection : Wear safety glasses with side shields.
Standard EN 166 - Personal eye-protection - specifications.
- Skin protection :
 - Hand protection : Wear working gloves when handling gas containers.
Standard EN 388 - Protective gloves against mechanical risk.
 - Other : Consider the use of flame resistant anti-static safety clothing.
Standard EN ISO 14116 - Limited flame spread materials.
Standard EN 1149-5 - Protective clothing: Electrostatic properties.
Wear safety shoes while handling containers.
Standard EN ISO 20345 - Personal protective equipment - Safety footwear.
- Respiratory protection : None necessary.
- Thermal hazards : None in addition to the above sections.

8.2.3. Environmental exposure controls

- : Refer to local regulations for restriction of emissions to the atmosphere. See section 13 for specific methods for waste gas treatment.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance

- Physical state at 20°C / 101.3kPa : Gas
- Colour : Colourless.
- Odour : Odourless.
- Odour threshold : Odour threshold is subjective and inadequate to warn of overexposure.
- pH : Not applicable for gases and gas mixtures.
- Melting point / Freezing point : -259 °C
- Boiling point : -253 °C
- Flash point : Not applicable for gases and gas mixtures.
- Evaporation rate : Not applicable for gases and gas mixtures.
- Flammability (solid, gas) : Extremely flammable gas.
- Explosive limits : 4 - 77 vol %
- Vapour pressure [20°C] : Not applicable.

| | |
|---|--|
| Vapour pressure [50 °C] | : Not applicable. |
| Vapour density | : Not applicable. |
| Relative density, liquid (water=1) | : 0.07 |
| Relative density, gas (air=1) | : 0.07 |
| Water solubility | : 1.6 mg/l |
| Partition coefficient n-octanol/water (Log Kow) | : Not applicable for inorganic products. |
| Auto-ignition temperature | : 560 °C |
| Decomposition temperature | : Not applicable. |
| Viscosity, kinematic | : No reliable data available. |
| Explosive properties | : Not applicable. |
| Oxidising properties | : Not applicable. |

9.2. Other information

| | |
|---------------------------|----------------------------------|
| Molar mass | : 2 g/mol |
| Critical temperature [°C] | : -240 °C |
| Other data | : Burns with an 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.
Avoid moisture in installation systems.

10.5. Incompatible materials

: Air, Oxidisers.
For additional information on compatibility refer to ISO 11114.

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 | : No known toxicological effects from this product. |
| Skin corrosion/irritation | : No known effects from this product. |
| Serious eye damage/irritation | : No known effects from this product. |
| Respiratory or skin sensitisation | : No known effects from this product. |
| Germ cell mutagenicity | : No known effects from this product. |
| Carcinogenicity | : No known effects from this product. |
| Toxic for reproduction : Fertility | : No known effects from this product. |

| | |
|--|--|
| Toxic for reproduction : unborn child | : No known effects from this product. |
| STOT-single exposure | : No known effects from this product. |
| STOT-repeated exposure | : No known effects from this product. |
| Aspiration hazard | : Not applicable for gases and gas mixtures. |

SECTION 12: Ecological information

12.1. Toxicity

| | |
|---------------------------------|--|
| Assessment | : No ecological damage caused by this product. |
| EC50 48h - Daphnia magna [mg/l] | : No data available. |
| EC50 72h - Algae [mg/l] | : No data available. |
| LC50 96 h - Fish [mg/l] | : No data available. |

12.2. Persistence and degradability

| | |
|------------|--|
| Assessment | : No ecological damage caused by this product. |
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12.3. Bioaccumulative potential

| | |
|------------|----------------------|
| Assessment | : No data available. |
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12.4. Mobility in soil

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|------------|---|
| Assessment | : Because of its high volatility, the product is unlikely to cause ground or water pollution. Partition into soil is unlikely. |
|------------|---|

12.5. Results of PBT and vPvB assessment

| | |
|------------|----------------------|
| Assessment | : No data available. |
|------------|----------------------|

12.6. Other adverse effects

| | |
|---|--|
| Other adverse effects | : No known effects from this product. |
| Effect on the ozone layer | : None. |
| Global warming potential [CO ₂ =1] | : 6 |
| Effect on global warming | : Contains greenhouse gas(es). When discharged in large quantities may contribute to the greenhouse effect. |

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Contact supplier if guidance is required.

Do not discharge into areas where there is a risk of forming an explosive mixture with air.
Waste gas should be flared through a suitable burner with flash back arrestor.

Do not discharge into any place where its accumulation could be dangerous.

Ensure that the emission levels from local regulations or operating permits are not exceeded.

Refer to the EIGA code of practice Doc.30 "Disposal of Gases", downloadable at <http://www.eiga.eu> for more guidance on suitable disposal methods.

Return unused product in original cylinder to supplier.

List of hazardous waste codes (from Commission Decision 2000/532/EC as amended)

: 16 05 04 *: Gases in pressure containers (including halons) containing hazardous substances.

13.2. Additional information

: External treatment and disposal of waste should comply with applicable local and/or national regulations.

SECTION 14: Transport information

14.1. UN number

UN-No. : 1049

14.2. UN proper shipping name

Transport by road/rail (ADR/RID) : HYDROGEN, COMPRESSED

Transport by air (ICAO-TI / IATA-DGR) : Hydrogen, compressed

Transport by sea (IMDG) : HYDROGEN, COMPRESSED

14.3. Transport hazard class(es)

Labelling



2.1 : Flammable gases.

Transport by road/rail (ADR/RID)

Class : 2

Classification code : 1F

Hazard identification number : 23

Tunnel Restriction : B/D - Tank carriage : Passage forbidden through tunnels of category B, C, D and E. Other carriage : Passage forbidden through tunnels of category D and E

Transport by air (ICAO-TI / IATA-DGR)

Class / Div. (Sub. risk(s)) : 2.1

Transport by sea (IMDG)

Class / Div. (Sub. risk(s)) : 2.1

Emergency Schedule (EmS) - Fire : F-D

Emergency Schedule (EmS) - Spillage : S-U

14.4. Packing group

Transport by road/rail (ADR/RID) : Not applicable

Transport by air (ICAO-TI / IATA-DGR) : Not applicable

Transport by sea (IMDG) : Not applicable

14.5. Environmental hazards

Transport by road/rail (ADR/RID) : None.

Transport by air (ICAO-TI / IATA-DGR) : None.

Transport by sea (IMDG) : None.

14.6. Special precautions for user

Packing Instruction(s)

Transport by road/rail (ADR/RID) : P200

Transport by air (ICAO-TI / IATA-DGR)

Passenger and Cargo Aircraft : Forbidden.

Cargo Aircraft only : 200.

Transport by sea (IMDG) : P200

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.

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

: Not applicable.

SECTION 15: Regulatory information**15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture****EU-Regulations**

Restrictions on use : None.

Seveso Directive : 2012/18/EU (Seveso III) : Listed.

National regulations

National legislation : Ensure all national/local regulations are observed.

15.2. Chemical safety assessment

: A CSA does not need to be carried out for this product.

SECTION 16: Other information

Indication of changes : Revised safety data sheet in accordance with commission regulation (EU) No 2015/830.

| | |
|----------------------------|--|
| Abbreviations and acronyms | : ATE - Acute Toxicity Estimate CLP - Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008 REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (EC) No 1907/2006 EINECS - European Inventory of Existing Commercial Chemical Substances CAS# - Chemical Abstract Service number PPE - Personal Protection Equipment LC50 - Lethal Concentration to 50 % of a test population RMM - Risk Management Measures PBT - Persistent, Bioaccumulative and Toxic vPvB - Very Persistent and Very Bioaccumulative STOT- SE : Specific Target Organ Toxicity - Single Exposure CSA - Chemical Safety Assessment EN - European Standard UN - United Nations ADR - European Agreement concerning the International Carriage of Dangerous Goods by Road IATA - International Air Transport Association IMDG code - International Maritime Dangerous Goods RID - Regulations concerning the International Carriage of Dangerous Goods by Rail WGK - Water Hazard Class STOT - RE : Specific Target Organ Toxicity - Repeated Exposure |
| Training advice | : Ensure operators understand the flammability hazard. |
| DISCLAIMER OF LIABILITY | : Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out. Details given in this document are believed to be correct at the time of going to press. Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted. |