HYDROGEN (>2.9%) in ARGON, KRYPTON, NEON or XENON
Safety Data Sheet

1. IDENTIFICATION

<table>
<thead>
<tr>
<th>Product identifier</th>
<th>HYDROGEN (&gt;2.9%) in ARGON, KRYPTON, NEON or XENON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Name</td>
<td>HYDROGEN (&gt;2.9%) in ARGON, KRYPTON, NEON or XENON</td>
</tr>
</tbody>
</table>

Other means of identification

<table>
<thead>
<tr>
<th>Safety data sheet number</th>
<th>LIND-M0091</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN/ ID no.</td>
<td>UN1954</td>
</tr>
<tr>
<td>Trade name</td>
<td>VARIGON H5, VARIGON H10, VARIGON H35; SPECSHIELD 5H; PLASMASHIELD 35H</td>
</tr>
</tbody>
</table>

Recommended use of the chemical and restrictions on use

<table>
<thead>
<tr>
<th>Recommended Use</th>
<th>Industrial and professional use.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses advised against</td>
<td>Consumer use</td>
</tr>
</tbody>
</table>

Details of the supplier of the safety data sheet

Linde Gas North America LLC - Linde Merchant Production Inc. - Linde LLC
575 Mountain Ave.
Murray Hill, NJ 07974
Phone: 908-464-8100
www.lindeus.com

Linde Gas Puerto Rico, Inc.
Road 869, Km 1.8
Barrio Palmas, Catano, PR 00962
Phone: 787-641-7445
www.pr.lindegas.com

Linde Canada Limited
5860 Chedworth Way
Mississauga, Ontario L5R 0A2
Phone: 905-501-1700
www.lindecanada.com

* May include subsidiaries or affiliate companies/ divisions.

For additional product information contact your local customer service.

Emergency telephone number

<table>
<thead>
<tr>
<th>Company Phone Number</th>
<th>800-232-4726 (Linde National Operations Center, US)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>905-501-0802 (Canada)</td>
</tr>
<tr>
<td></td>
<td>CHEMTREC: 1-800-424-9300 (North America) +1-703-527-3887 (International)</td>
</tr>
</tbody>
</table>
2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

| Flammable gases                  | Category 1 |
| Gases under pressure             | Compressed gas |
| Simple asphyxiants               | Yes |

Label elements

Signal word       Danger

Hazard Statements
Extremely flammable gas
Contains gas under pressure; may explode if heated
May displace oxygen and cause rapid suffocation
May form explosive mixtures with air
Burns with invisible flame

Precautionary Statements - Prevention
Do not handle until all safety precautions have been read and understood
Keep away from heat, sparks, open flames, hot surfaces. — No smoking
Use and store only outdoors or in a well ventilated place
Use a backflow preventive device in piping
Use only with equipment rated for cylinder pressure
Do not open valve until connected to equipment prepared for use
Close valve after each use and when empty
Never put cylinders into unventilated areas of passenger vehicles

Precautionary Statements - Response
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Get medical attention/ advice.
Leaking gas fire: do not extinguish, unless leak can be stopped safely
Eliminate all ignition sources if safe to do so

Precautionary Statements - Storage
Protect from sunlight when ambient temperature exceeds 52°C/ 125°F

Hazards not otherwise classified (HNOC)
Not applicable

3. COMPOSITION/INFORMATION ON INGREDIENTS
### 4. FIRST AID MEASURES

**Description of first aid measures**

**General advice**
Show this safety data sheet to the doctor in attendance.

**Inhalation**
Remove to fresh air and keep comfortable for breathing. If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration. Get medical attention immediately.

**Skin contact**
None under normal use. Get medical attention if symptoms occur.

**Eye contact**
None under normal use. Get medical attention if symptoms occur.

**Ingestion**
Not an expected route of exposure.

**Self-protection of the first aider**
RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Remove all sources of ignition.

**Most important symptoms and effects, both acute and delayed**

**Symptoms**
Simple asphyxiant. May cause suffocation by displacing the oxygen in the air. Exposure to oxygen-deficient atmosphere (<19.5%) may cause dizziness, drowsiness, nausea, vomiting, excess salivation, diminished mental alertness, loss of consciousness and death. Exposure to atmospheres containing 8-10% or less oxygen will bring about unconsciousness without warning and so quickly that the individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death.

**Indication of any immediate medical attention and special treatment needed**

**Note to physicians**
Treat symptomatically.

### 5. FIRE-FIGHTING MEASURES

**Suitable extinguishing media**
Dry chemical or CO2. Water spray (fog). DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.

**Specific extinguishing methods**
If possible, stop the flow of gas. Do not extinguish the fire until supply is shut off as otherwise an explosive-ignition may occur. If the fire is extinguished and the flow of gas continues, use increased ventilation to prevent build-up of explosive atmosphere. Ventilation fans must be explosion proof. Use non-sparking tools to close container valves.

Use water spray to cool surrounding containers. Be cautious of a Boiling Liquid Evaporating Vapor Explosion, BLEVE, if flame is impinging on surrounding containers. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible withdraw from area and let fire burn. Damaged cylinders should be handled only by specialists.

**Specific hazards arising from the chemical**
Extremely flammable gas. May form explosive mixtures with air. Hydrogen is very light and may collect in the upper portions of storage areas.
Hydrogen burns with an almost invisible flame. High pressure releases may ignite with no apparent ignition source possibly via static electricity. Will be easily ignited by heat, sparks or flames. Vapors may travel to source of ignition and flash back. Vapors may accumulate in confined areas (basement, tanks, hopper/ tank cars, etc.). Cylinders may rupture under extreme heat.

**Protective equipment and precautions for firefighters**

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/ NIOSH (approved or equivalent) and full protective gear. As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions.

### 6. ACCIDENTAL RELEASE MEASURES

**Personal precautions, protective equipment and emergency procedures**

**Personal precautions**

ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Evacuate personnel to safe areas. Ensure adequate ventilation, especially in confined areas. Monitor oxygen level. Consider the risk of potentially explosive atmospheres. All equipment used when handling the product must be grounded. Use non-sparking tools and equipment. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.

**Environmental precautions**

Beware of vapors accumulating to form explosive concentrations. Prevent spreading of vapors through sewers, ventilation systems and confined areas.

**Methods and material for containment and cleaning up**

**Methods for containment**

Stop the flow of gas or remove cylinder to outdoor location if this can be done without risk. If leak is in container or container valve, contact the appropriate emergency telephone number in Section 1 or call your closest Linde location.

**Methods for cleaning up**

Return cylinder to Linde or an authorized distributor.

### 7. HANDLING AND STORAGE

**Precautions for safe handling**

Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Ground and bond all lines and equipment associated with product system. All equipment should be non-sparking and explosion proof. Separate flammable gas cylinders from oxygen and other oxidizers by a minimum distance of 20 ft. or by a 5 ft. high barrier with a minimum fire resistance rating of a half an hour. "NO SMOKING" signs should be posted in storage and use areas. Hydrogen is non-corrosive. However hydrogen can interact with metals (hardened steels) to cause embrittlement.

Protect cylinders from physical damage; do not drag, roll, slide or drop. When moving cylinders, even for short distance, use a cart designed to transport cylinders. Never attempt to lift a cylinder by its valve protection cap. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Use only with adequate ventilation. Use a backflow preventive device in piping. Use only with equipment rated for cylinder pressure. Close valve after each use and when empty. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Ensure the complete gas system has been checked for leaks before use.

Never put cylinders into trunks of cars or unventilated areas of passenger vehicles. Never attempt to refill a compressed gas cylinder without the owner's written consent. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit.
Only experienced and properly instructed persons should handle gases under pressure. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, pamphlet CGA-P1, Safe Handling of Compressed Gases in Containers.

**Conditions for safe storage, including any incompatibilities**

**Storage Conditions**
Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Keep at temperatures below 52°C / 125°F. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Stored containers should be periodically checked for general condition and leakage. Outside or detached storage is preferred.

**Incompatible materials**
Oxidizing agents.

### 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

**Control parameters**

**Exposure Guidelines**
This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

**Appropriate engineering controls**
Engineering Controls
Explosion proof ventilation systems. Local exhaust ventilation to prevent accumulation of high concentrations and maintain air-oxygen levels at or above 19.5%. Oxygen detectors should be used when asphyxiating gases may be released. Consider installation of leak detection systems in areas of use and storage. Systems under pressure should be regularly checked for leakages.

**Individual protection measures, such as personal protective equipment**

**Eye/ face protection**
Wear safety glasses with side shields (or goggles).

**Skin and body protection**
Work gloves and safety shoes are recommended when handling cylinders. Wear fire/ flame resistant/ retardant clothing. Take precautionary measures against static discharge.

**Respiratory protection**
Use positive pressure airline respirator with escape cylinder or self contained breathing apparatus for oxygen-deficient atmospheres (<19.5%).

**General Hygiene Considerations**
Handle in accordance with good industrial hygiene and safety practice.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

**Information on basic physical and chemical properties**

**Product Information**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical state</td>
<td>Compressed gas</td>
</tr>
<tr>
<td>Appearance</td>
<td>Colorless.</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless.</td>
</tr>
<tr>
<td>Odor threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>No data available</td>
</tr>
<tr>
<td>Melting point</td>
<td>No data available</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Fire Hazard</td>
<td>Yes</td>
</tr>
<tr>
<td>Flammability Limit in Air</td>
<td>(For Hydrogen)</td>
</tr>
<tr>
<td>Lower flammability limit:</td>
<td>4%</td>
</tr>
<tr>
<td>Upper flammability limit:</td>
<td>75%</td>
</tr>
<tr>
<td>Flash point</td>
<td>No information available</td>
</tr>
<tr>
<td>Autoignition temperature</td>
<td>570 °C / 1058 °F; (Hydrogen)</td>
</tr>
</tbody>
</table>
Decomposition temperature
Partition coefficient
Kinematic viscosity
No data available
No data available
Not applicable

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Molecular weight</th>
<th>Boiling point</th>
<th>Vapor Pressure</th>
<th>Vapor density (air =1)</th>
<th>Gas Density kg/ m³@ 20°C</th>
<th>Critical Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xenon</td>
<td>131.29</td>
<td>-108.1 °C</td>
<td>Above critical temperature</td>
<td>4.55</td>
<td>5.472</td>
<td>16.6 °C</td>
</tr>
<tr>
<td>Neon</td>
<td>20.17</td>
<td>-246.1 °C</td>
<td>Above critical temperature</td>
<td>0.694</td>
<td>0.922</td>
<td>-228.8 °C</td>
</tr>
<tr>
<td>Krypton</td>
<td>83.79</td>
<td>-153.4 °C</td>
<td>Above critical temperature</td>
<td>2.89</td>
<td>3.479</td>
<td>-228.8 °C</td>
</tr>
<tr>
<td>Argon</td>
<td>39.95</td>
<td>-185.9 °C</td>
<td>Above critical temperature</td>
<td>1.38</td>
<td>1.65</td>
<td>-122.3 °C</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>1.00</td>
<td>-252.8 °C</td>
<td>Above critical temperature</td>
<td>0.07</td>
<td>0.083</td>
<td>-240 °C</td>
</tr>
</tbody>
</table>

10. STABILITY AND REACTIVITY

Reactivity
No data available

Chemical stability
Stable under normal conditions.

Explosion data
- Sensitivity to Mechanical Impact: None.
- Sensitivity to Static Discharge: Yes.

Possibility of Hazardous Reactions
May form explosive mixtures with air.

Conditions to avoid
Heat, flames and sparks. Flammable or explosive when mixed with chlorine or other oxidizing materials. Fluorine and hydrogen react at -418°F (-250°C) when impurities are present. Chlorine/ hydrogen mixtures explode if exposed to light. Lithium metal will burn in a hydrogen atmosphere.

Incompatible materials
Oxidizing agents.

Hazardous Decomposition Products
None known.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Inhalation
Product is a simple asphyxiant.

Skin contact
No data available.

Eye contact
No data available.

Ingestion
Not an expected route of exposure.

Information on toxicological effects
Symptoms
No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation
Not classified.

Sensitization
Not classified.

Germ cell mutagenicity
Not classified.

Carcinogenicity
This product does not contain any carcinogens or potential carcinogens listed by OSHA, IARC or NTP.

Reproductive toxicity
Not classified.

STOT - single exposure
Not classified.

STOT - repeated exposure
Not classified.

Chronic toxicity
None known.

Aspiration hazard
Not applicable.

Numerical measures of toxicity

Component Level Information:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Oral LD50</th>
<th>Dermal LD50</th>
<th>Inhalation LC50</th>
<th>Inhalation LC50 (CGA P-20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen 1333-74-0</td>
<td>-</td>
<td>-</td>
<td>&gt;15000 ppm (Rat) 1 h</td>
<td>-</td>
</tr>
</tbody>
</table>

Product Information

Oral LD50
No information available

Dermal LD50
No information available

Inhalation LC50
No information available

12. ECOLOGICAL INFORMATION

Ecotoxicity
No known acute aquatic toxicity.

Persistence and degradability
Not applicable.

Bioaccumulation
No information available.

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal of wastes
Do not attempt to dispose of residual 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 Linde for proper disposal.

14. TRANSPORT INFORMATION

Note: The technical names of components listed as part of shipping description will depend on specific mixture composition and/or balance gas.

DOT

<table>
<thead>
<tr>
<th>UN/ID no.</th>
<th>Proper shipping name</th>
<th>Hazard Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN1954</td>
<td>Compressed gas, flammable, n.o.s.</td>
<td>2.1</td>
</tr>
</tbody>
</table>
Description
UN1954, Compressed gas, flammable, n.o.s. (Hydrogen, XXXXX), 2.1
Emergency Response Guide Number 115

TDG
UN/ID no. UN1954
Proper shipping name Compressed gas, flammable, n.o.s.
Hazard Class 2.1
Description UN1954, Compressed gas, flammable, n.o.s. (Hydrogen, XXXXX), 2.1

MEX
UN/ID no. UN1954
Proper shipping name Compressed gas, flammable, n.o.s.
Hazard Class 2.1
Description UN1954, Compressed gas, flammable, n.o.s. (Hydrogen, XXXXX), 2.1

IATA
UN/ID no. UN1954
Proper shipping name Compressed gas, flammable, n.o.s.
Hazard Class 2.1
ERG Code 10L
Special Provisions A1
Description UN1954, Compressed gas, flammable, n.o.s. (Hydrogen, XXXXX), 2.1

IMDG
UN/ID no. UN1954
Proper shipping name Compressed gas, flammable, n.o.s.
Hazard Class 2.1
EmS-No. F-D, S-U
Special Provisions 274
Description UN1954, Compressed gas, flammable, n.o.s. (Hydrogen, XXXXX), 2.1

ADR
UN/ID no. UN1954
Proper shipping name Compressed gas, flammable, n.o.s.
Hazard Class 2.1
Classification code 1F
Tunnel restriction code (B/ D)
Special Provisions 274
Description UN1954, Compressed gas, flammable, n.o.s. (Hydrogen, XXXXX), 2.1, (B/ D)
Labels 2.1

15. REGULATORY INFORMATION

International Inventories
TSCA Complies
DSL/ NDSL Complies
EINECS/ ELINCS Complies

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/ NDSL - Canadian Domestic Substances List/ Non-Domestic Substances List
EINECS/ ELINCS - European Inventory of Existing Chemical Substances/ European List of Notified Chemical Substances

US Federal Regulations
SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.
SARA 311/ 312 Hazard Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Health Hazard</td>
<td>No</td>
</tr>
<tr>
<td>Chronic Health Hazard</td>
<td>No</td>
</tr>
<tr>
<td>Fire Hazard</td>
<td>Yes</td>
</tr>
<tr>
<td>Sudden release of pressure hazard</td>
<td>Yes</td>
</tr>
<tr>
<td>Reactive Hazard</td>
<td>No</td>
</tr>
</tbody>
</table>

CERCLA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)
This product does not contain any substances regulated as hazardous air pollutants (HAPS) under Section 112 of the Clean Air Act Amendments of 1990.

CWA (Clean Water Act)
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

Risk and Process Safety Management Programs
This material, as supplied, contains one or more regulated substances with specified thresholds under 40 CFR Part 68 or regulated as a highly hazardous chemical pursuant to the 29 CFR Part 1910.110 with specified thresholds:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>U.S. - CAA (Clean Air Act) - Accidental Release Prevention - Toxic Substances</th>
<th>U.S. - CAA (Clean Air Act) - Accidental Release Prevention - Flammable Substances</th>
<th>U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td></td>
<td>10000 lbs</td>
<td></td>
</tr>
</tbody>
</table>

US State Regulations

California Proposition 65
This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>New Jersey</th>
<th>Massachusetts</th>
<th>Pennsylvania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argon 7440-37-1</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hydrogen 1333-74-0</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tbody>
</table>

International Regulations

16. OTHER INFORMATION

<table>
<thead>
<tr>
<th>NFPA</th>
<th>Health hazards</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical and Chemical Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>Simple asphyxiants</td>
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</table>

Note: Ratings were assigned in accordance with Compressed Gas Association (CGA) guidelines as published in CGA Pamphlet P-19-2009, CGA Recommended Hazard Ratings for Compressed Gases, 3rd Edition.
LIND-M0091 HYDROGEN (>2.9%) in ARGON, KRYPTON, NEON or XENON

General Disclaimer
For terms and conditions, including limitation of liability, please refer to the purchase agreement in effect between Linde LLC, Linde Merchant Production, Inc. or Linde Gas North America LLC (or any of their affiliates and subsidiaries) and the purchaser.

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Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user’s intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

End of Safety Data Sheet