



# DEUTERIUM

## Safety Data Sheet

### 1. IDENTIFICATION

Product identifier

Product Name DEUTERIUM

Other means of identification

Safety data sheet number LIND-P037  
UN/ID no. UN1957  
Synonyms Normal Deuterium; Heavy Hydrogen

Recommended use of the chemical and restrictions on use

Recommended Use Industrial and professional use.  
Uses advised against Consumer use

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.lindecana.com

\* May include subsidiaries or affiliate companies/divisions.

For additional product information contact your local customer service.

Emergency telephone number

Company Phone Number 800-232-4726 (Linde National Operations Center, US)  
905-501-0802 (Canada)

CHEMTREC: 1-800-424-9300 (North America) +1-703-527-3887 (International)

### 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 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

## 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

Chemical Name	CAS No.	Volume %	Chemical Formula
Deuterium	7782-39-0	100	D <sub>2</sub>

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

Note to physicians	Treat symptomatically.
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## 5. FIRE-FIGHTING MEASURES

### Suitable extinguishing media

Dry chemical or CO<sub>2</sub>. 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. Deuterium is very light and may collect in the upper portions of storage areas. Deuterium burns with an almost invisible flame. High pressure releases may ignite with no apparent ignition source possibly via static electricity. Easily ignited over a wide range of concentrations in air. 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

Environmental precautions 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

Advice on 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 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.

For additional recommendations, consult Compressed Gas Association's pamphlets P-1, G-5, G-5.3, G-5.5, P-6 and Safety Bulletin SB-2. NFPA 50A covers gaseous hydrogen at consumer sites.

#### 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. Outside or detached storage is preferred. Stored containers should be periodically checked for general condition and leakage.

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. Systems under pressure should be regularly checked for leakages. Consider installation of leak detection systems in areas of use and storage.

### 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

Physical state	Compressed gas
Appearance	Colorless.
Odor	Odorless.
Odor threshold	No information available
pH	No data available
Melting point	-254 °C / -426 °F
Evaporation rate	Not applicable
Fire Hazard	Yes
Lower flammability limit:	5%
Upper flammability limit:	75%
Flash point	No information available
Autoignition temperature	570 °C / 1058 °F
Decomposition temperature	No data available
Water solubility	Slightly soluble
Partition coefficient	No data available
Kinematic viscosity	Not applicable

Chemical Name	Molecular weight	Boiling point	Vapor Pressure	Vapor density (air =1)	Gas Density Kg/m <sup>3</sup> @20°C	Critical Temperature
Deuterium	4.032	-249.5 °C	Above critical temperature	0.171	0.08342	-235 °C

## 10. STABILITY AND REACTIVITY

### Reactivity

Not reactive under normal conditions.

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.
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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

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

DOT

UN/ID no.	UN1957
Proper shipping name	Deuterium, compressed
Hazard Class	2.1
Special Provisions	N89
Description	UN1957, Deuterium, compressed, 2.1
Emergency Response Guide Number	115

TDG

UN/ID no.	UN1957
Proper shipping name	Deuterium, compressed
Hazard Class	2.1
Description	UN1957, Deuterium, compressed, 2.1

MEX

UN/ID no.	UN1957
Proper shipping name	Deuterium, compressed
Hazard Class	2.1
Description	UN1957, Deuterium, compressed, 2.1

IATA

UN/ID no.	UN1957
Proper shipping name	Deuterium, compressed
Hazard Class	2.1
ERG Code	10L
Special Provisions	A1
Description	UN1957, Deuterium, compressed, 2.1

IMDG

UN/ID no.	UN1957
Proper shipping name	Deuterium, compressed
Hazard Class	2.1
EmS-No.	F-D, S-U
Description	UN1957, Deuterium, compressed, 2.1

ADR

UN/ID no.	UN1957
Proper shipping name	Deuterium, compressed
Hazard Class	2.1
Classification code	1F
Tunnel restriction code	(B/D)
Description	UN1957, Deuterium, compressed, 2.1, (B/D)

## 15. REGULATORY INFORMATION

### International Inventories

TSCA	Complies
DSL	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

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	Yes
Sudden release of pressure hazard	Yes
Reactive Hazard	No

#### 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, does not contain any regulated substances with specified thresholds under 40 CFR Part 68. This product does not contain any substances regulated as Highly Hazardous Chemicals pursuant to the 29 CFR Part 1910.110.

### US State Regulations

#### California Proposition 65

This product does not contain any Proposition 65 chemicals

#### U.S. State Right-to-Know Regulations



Chemical Name	New Jersey	Massachusetts	Pennsylvania
Deuterium 7782-39-0	X	X	X

International Regulations**16. OTHER INFORMATION**

<u>NFPA</u>	Health hazards 0	Flammability 4	Instability 0	Physical and Chemical Properties -
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.				
Issue Date	24-Feb-2015			
Revision Date	24-Feb-2015			
Revision Note	Initial Release.			

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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End of Safety Data Sheet