



OXYGEN, REFRIGERATED LIQUID

Safety Data Sheet

1. IDENTIFICATION

Product identifier

Product Name OXYGEN, REFRIGERATED LIQUID

Other means of identification

Safety data sheet number LIND-P098
 UN/ID no. UN1073
 Synonyms Liquid Oxygen; LOX

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).

| | |
|----------------------|----------------------------|
| Oxidizing gases | Category 1 |
| Gases under pressure | Refrigerated liquefied gas |

Label elements

Signal word

Danger

Hazard Statements

May cause or intensify fire; oxidizer
 Contains refrigerated gas; may cause cryogenic burns or injury
 Combustibles in contact with liquid oxygen may explode on ignition or impact

Precautionary Statements - Prevention

Do not handle until all safety precautions have been read and understood
 Keep and store away from clothing and other combustible materials
 Keep valves and fittings free from oil and grease
 Use and store only outdoors or in a well ventilated place
 Wear cold insulating gloves/face shield/eye protection
 Use backflow preventive device in piping
 Use only with equipment of compatible materials of construction and rated for cylinder pressure
 Use only with equipment cleaned for oxygen service
 Do NOT change or force fit connections
 Avoid spills. Do not walk on or roll equipment over spills
 Close valve after each use and when empty
 Always keep container in upright position

Precautionary Statements - Response

IF ON SKIN: Thaw frosted parts with lukewarm water. Do not rub affected area. Get immediate medical advice/attention.
 In case of fire: Stop leak if safe to do so

Hazards not otherwise classified (HNOC)

Not applicable

3. COMPOSITION/INFORMATION ON INGREDIENTS

| Chemical Name | CAS No. | Volume % | Chemical Formula |
|---------------|-----------|----------|------------------|
| Oxygen | 7782-44-7 | 100 | O ₂ |

4. FIRST AID MEASURES

Description of first aid measures

| | |
|----------------|--|
| General advice | Show this safety data sheet to the doctor in attendance. |
| Inhalation | Move victim to fresh air. Seek immediate medical attention/advice. |
| Skin contact | For dermal contact or suspected frostbite, remove contaminated clothing and flush affected areas with lukewarm water. DO NOT USE HOT WATER. A physician should see the patient promptly if contact with the product has resulted in blistering of the dermal surface or in deep tissue freezing. |
| Eye contact | If frostbite is suspected, flush eyes with cool water for 15 minutes and obtain immediate medical attention. |
| Ingestion | Not an expected route of exposure. |

Most important symptoms and effects, both acute and delayed

| | |
|----------|--|
| Symptoms | Oxygen is not acutely toxic under normal pressure. Oxygen is more toxic when inhaled at elevated pressures. Depending upon pressure and duration of exposure, pure oxygen at elevated pressures may cause cramps, dizziness, difficulty breathing, convulsions, edema and death. Contact with liquid may cause cold burns/frostbite. |
|----------|--|

Indication of any immediate medical attention and special treatment needed

| | |
|--------------------|------------------------|
| Note to physicians | Treat symptomatically. |
|--------------------|------------------------|

5. FIRE-FIGHTING MEASURESSuitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Specific extinguishing methods

Continue to cool fire exposed cylinders until flames are extinguished. Damaged cylinders should be handled only by specialists.

Specific hazards arising from the chemical

May cause or intensify fire; oxidizer. Combustibles in contact with liquid oxygen may explode on ignition or impact. Will support and accelerate combustion of combustible materials (wood, paper, oil, debris, 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.

6. ACCIDENTAL RELEASE MEASURESPersonal precautions, protective equipment and emergency procedures

| | |
|----------------------|---|
| Personal precautions | Evacuate personnel to safe areas. Ensure adequate ventilation, especially in confined areas. Avoid spills. Do not walk on or roll equipment over spills. Monitor oxygen level. Eliminate all ignition sources if safe to do so. Use personal protection recommended in Section 8. |
| Other Information | When in contact with refrigerated/cryogenic liquids, many materials become brittle and are likely to break without warning. |

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 Portable Cryogenic Container to Linde or an authorized distributor. |

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling

Liquid oxygen cannot be handled in carbon or low alloy steel, 18-8 and 18-10 stainless steel are acceptable as are copper and its alloys, brass bronze, silicon alloys, Monel®, Inconel®, and beryllium. Teflon®, Teflon® composites, or Kel-F® are preferred non-metallic gasket materials. Oxygen should not be used as a substitute for compressed air in pneumatic equipment since they generally contain flammable lubricants. Equipment able to use oxygen must be "cleaned for oxygen service". Check with the equipment supplier to verify oxygen compatibility for the service conditions. Keep valves and fittings free from oil and grease. Use only equipment of compatible materials and construction. Do NOT change or force fit connections. Open valve slowly. NO SMOKING" signs should be posted in storage and use areas. 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. Never allow any unprotected part of the body to touch uninsulated pipes or vessels that contain cold fluids. The extremely cold metal will cause moist flesh to stick fast and tear when one attempts to withdraw from it. Stationary customer site vessels should be operated in accordance with the manufacturer's and Linde's instruction. Do not attempt to repair, adjust or in any other way modify the operation of these vessels. If there is a malfunction or other type of operations problem with the vessel, contact the closest Linde location immediately for assistance.

Protect cylinders from physical damage; do not drag, roll, slide or drop. Never attempt to lift a cylinder by its valve protection cap. When moving cylinders, even for short distance, use a cart designed to transport cylinders. 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. 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 SB-7, G-4.3, G-4.1, G-4.4, P-2.5, G-4.9, P-14, and SB-2.

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. Do not store near combustible materials

Incompatible materials

Combustible materials. Organic material. Reducing 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 Showers. Eyewash stations. Use local exhaust in combination with general ventilation as necessary to keep oxygen concentrations below 23.5%. 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). If splashes are likely to occur, wear: Goggles. Face-shield.

Skin and body protection Work gloves and safety shoes are recommended when handling cylinders. Gloves must be clean and free from grease or oil. Wear cold insulating gloves when handling liquid.

Respiratory protection No special protective equipment required.

General Hygiene Considerations Handle in accordance with good industrial hygiene and safety practice. Do not get in eyes, on skin, or on clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

| | |
|---------------------------|--------------------------|
| Physical state | Cryogenic Liquid |
| Appearance | Pale blue. |
| Odor | Odorless. |
| Odor threshold | No information available |
| pH | No data available |
| Melting point | -218.8 °C / -361.8 °F |
| Evaporation rate | Not applicable |
| Fire Hazard | Yes |
| Lower flammability limit: | Not applicable |
| Upper flammability limit: | Not applicable |
| Flash point | Not applicable |
| Autoignition temperature | No data available |
| Decomposition temperature | No data available |
| Oxidizing properties | Oxidizer |
| 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 ³ @20°C | Critical Temperature |
|---------------|------------------|---------------|----------------------------|------------------------|-------------------------------------|----------------------|
| Oxygen | 31.99 | -182.9 °C | Above critical temperature | 1.11 | 1.331 | -118.6 °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 | None. |

Possibility of Hazardous Reactions

None under normal processing.

Conditions to avoid

Heat, flames and sparks.

Incompatible materials

Combustible materials. Organic material. Reducing agents.

Hazardous Decomposition Products

None known.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Inhalation

Symptoms of overexposure are dizziness, headache, tiredness, nausea, unconsciousness, cessation of breathing. Poisoning began in dogs 36 hours after inhalation of pure oxygen at atmospheric pressure. Distress was seen within 48 hours and death within 60 hours.

Skin contact

Contact with liquid may cause cold burns/frostbite.

Eye contact

The incompletely developed retinal circulation is more susceptible to toxic levels of oxygen. In premature infants, arterial oxygen tension above 150 mm Hg may cause retrolental fibroplasia. Permanent blindness may occur several months later. One case of severe retinal damage in an adult was reported. An individual suffering from myasthenia gravis developed irreversible retinal atrophy after breathing 80% oxygen for 150 days. Contact with liquid may cause cold burns/frostbite.

Ingestion

Not an expected route of exposure.

Information on toxicological effects

Symptoms

Oxygen is not acutely toxic under normal pressure. Oxygen is more toxic when inhaled at elevated pressures. Depending upon pressure and duration of exposure, pure oxygen at elevated pressures may cause cramps, dizziness, difficulty breathing, convulsions, edema and death.

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 | Prolonged inhalation of high oxygen concentrations (>75%) may affect coordination, attention, and cause tiredness of respiratory irritation. |
| Target Organ Effects | 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 INFORMATIONEcotoxicity

No known acute aquatic toxicity.

Persistence and degradability

Not applicable.

Bioaccumulation

Will not bioconcentrate.

Other adverse effects

Can cause frost damage to vegetation.

13. DISPOSAL CONSIDERATIONSWaste 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 INFORMATIONDOT

| | |
|---------------------------------|--|
| UN/ID no. | UN1073 |
| Proper shipping name | Oxygen, refrigerated liquid |
| Hazard Class | 2.2 |
| Subsidiary class | 5.1 |
| Special Provisions | T75, TP5, TP22 |
| Description | UN1073, Oxygen, refrigerated liquid, 2.2 (5.1) |
| Emergency Response Guide Number | 122 |

TDG

| | |
|----------------------|--|
| UN/ID no. | UN1073 |
| Proper shipping name | Oxygen, refrigerated liquid |
| Hazard Class | 2.2 |
| Subsidiary class | 5.1 |
| Description | UN1073, Oxygen, refrigerated liquid, 2.2 (5.1) |

MEX

| | |
|----------------------|--|
| UN/ID no. | UN1073 |
| Proper shipping name | Oxygen, refrigerated liquid |
| Hazard Class | 2.2 |
| Subsidiary class | 5.1 |
| Description | UN1073, Oxygen, refrigerated liquid, 2.2 (5.1) |

| | |
|-------------------------|---|
| <u>IATA</u> | Forbidden |
| | |
| <u>IMDG</u> | |
| UN/ID no. | UN1073 |
| Proper shipping name | Oxygen, refrigerated liquid |
| Hazard Class | 2.2 |
| Subsidiary hazard class | 5.1 |
| EmS-No. | F-C, S-W |
| Description | UN1073, Oxygen, refrigerated liquid, 2.2 (5.1) |
| | |
| <u>ADR</u> | |
| UN/ID no. | UN1073 |
| Proper shipping name | Oxygen, refrigerated liquid |
| Hazard Class | 2.2 |
| Classification code | 30 |
| Tunnel restriction code | (C/E) |
| Description | UN1073, Oxygen, refrigerated liquid, 2.2 (5.1), (C/E) |
| Labels | 5.1 |

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 RegulationsCalifornia Proposition 65

This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

| Chemical Name | New Jersey | Massachusetts | Pennsylvania |
|---------------------|------------|---------------|--------------|
| Oxygen 7782-44-7 | X | X | X |

International Regulations

| |
|------------------------------|
| 16. OTHER INFORMATION |
|------------------------------|

| | | | | |
|-------------|------------------|----------------|---------------|--|
| <u>NFPA</u> | Health hazards 3 | Flammability 0 | Instability 0 | Physical and Chemical Properties OX |
|-------------|------------------|----------------|---------------|--|

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.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

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