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 Singapore Pte Ltd
50 Jurong Island Highway, Singapore 627877

Phone: +65 68678998
www.linde.com.sg

For additional product information contact your local customer service.

Emergency telephone number
Company Phone Number +65 68670860

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 physican 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 MEASURES

Suitable 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 MEASURES

Personal 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 conatin 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 ot 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 segregrated. 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 INFORMATION

Ecotoxicity
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 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.	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)

IATA Forbidden

IMDG

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)

ADR

UN / ID no.	UN1073
Proper shipping name	Oxygen, refrigerated liquid
Hazard Class	2.2
Classification code	3O
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

16. OTHER INFORMATION

NFPA 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.

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Revision Note	Initial Release.

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End of Safety Data Sheet