

# Material Safety Data Sheet

## Liquid Oxygen

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### SECTION I - IDENTIFICATION

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<b>Manufacturer's Name:</b>	Island Equipment Company
<b>Address:</b>	388 S. Marine Drive Tamuning, Guam 96911
<b>Emergency Phone No:</b>	CHEMTREC: 1-800-424-9300 GUAM: 1-671-565-2485/888-2450
<b>Chemical Name and Synonyms:</b>	Liquid Oxygen
<b>Trade Name and Synonyms:</b>	Liquid Oxygen; LOX; Oxygen, Refrigerated Liquid; Oxygen, Cryogenic Liquid
<b>Chemical Family:</b>	Oxidizer
<b>Formula:</b>	Liquid O <sub>2</sub>
<b>CAS No:</b>	7782-44-7
<b>Molecular Weight:</b>	31.999

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### SECTION II - HEALTH HAZARD DATA

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#### Time Weighted Average Exposure Limit (TWA):

Oxygen is the "vital element" in the atmosphere in which we live and breath (approximately 21 molar [volume] percent of the atmosphere). The minimum oxygen content in workplace air is 18% by volume under normal atmospheric pressure, equivalent to a partial pressure, pO<sub>2</sub> of 135 torr.

#### Symptoms of Exposure:

The primary route of entry is inhalation. **Acute health effects:** Adults can satisfactorily breathe pure oxygen for extended periods at 0.33 ATM, or at 1 ATM for several days at less than 5 hours a day. However, irritation to mucous membranes may occur when 100% oxygen is inhaled continuously for several hours. Chest pains and cough can result from breathing O<sub>2</sub> at 1 ATM for 8 to 24 hours or 2 ATM for 2 to 3 hours or from an atmosphere of 60 % oxygen for several days. Breathing high concentrations greater than 75 (molar) percent by volume at atmospheric pressure for more than a few hours causes symptoms of hyperoxia (high oxygen exposure) with a variety of central nervous system effects. These symptoms includes cramps, nausea, dizziness, hypothermia (low body temperature), ambyopia (diminished vision), nasal stuffiness, cough, sore throat, chest pain, respiratory difficulties, bradycardia (slow heart rate), fainting spells, and convulsions capable of leading to death.

Breathing oxygen at higher pressures increases the likelihood of adverse effects within a shorter time period. Prolonged breathing of very cold atmospheres can cause lung damage and hypothermia (low body temperature). Chronic health effects: None established. Medical conditions generally aggravated by exposure: See NOTES TO PHYSICIAN, below.

NOTES TO PHYSICIAN: For gaseous exposure, supportive treatment should include immediate sedation, anti-convulsive therapy if needed, and rest. Animal studies suggest that the administration of certain drugs, including phenothiazine drugs and chloroquine, increases the susceptibility to toxicity from oxygen at high concentrations or pressures. Animal studies also indicate that Vitamin E deficiency may increase susceptibility to oxygen toxicity.

Airway obstruction during high oxygen tension may cause alveolar collapse following absorption of the oxygen. Similarly, occlusion of the eustachian tubes may cause retraction of the ear drum and obstruction of the paranasal sinuses may produce "vacuum-type" headache.

Newborn premature infants exposed to high concentrations may suffer delayed retinal damage which can progress to retinal detachment and blindness (retrolental fibroplasia). Retinal damage can also occur in adults exposed to 100% oxygen under greater than atmospheric pressure, particularly in individuals whose retinal circulation has been previously compromised.

All individuals exposed for long periods to oxygen at high pressure and all who exhibit overt oxygen toxicity should have ophthalmological examinations.

Contact with the cryogenic liquid or cold piping containing the liquid can cause tissue freezing or frostbite on dermal contact or if splashed in the eyes.

### **Toxicological Properties:**

At normal concentration and pressure, oxygen poses no toxicity hazards. However, at elevated concentrations and pressures, oxygen may cause adverse effects of hyperoxia (high oxygen exposure) which leads to pneumonia. Concentrations between 25 and 75 molar percent present a risk of inflammation of organic matter in the body. Frostbite effects are a change in color of the skin to gray or white possibly followed by blistering.

Not listed in National Toxicology Program(NTP) or IARC; not regulated as a carcinogen by OSHA.

WARNING FOR MEDICAL U.S.P. -- For oxygen deficiency in breathing persons or emergency resuscitation when used by personnel instructed in oxygen administration. For other medical applications, use only as directed by a licensed practitioner. Uninterrupted use of high concentrations of oxygen over long duration, without monitoring its effect on oxygen content of arterial blood, maybe harmful. Use only with pressure reducing equipment and apparatus designed for oxygen.

### **Recommended First Aid Treatment:**

**Prompt medical attention is mandatory in all cases of overexposure to oxygen. Rescue personnel should be aware of extreme fire hazard associated with oxygen-rich atmospheres. Reduce oxygen pressures to 1 atmosphere and /or move victim into fresh air.**

Conscious persons should be assisted to an uncontaminated area and inhale fresh air. They should be kept warm and quiet. The physician should be informed that the victim is experiencing (has experienced) hyperoxia (high oxygen exposure). Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given assisted respiration. When breathing is restored, treatment should be as above. Continued treatment should be symptomatic and supportive.

For skin contact or frostbite, immerse affected areas in lukewarm water. *DO NOT USE HOT WATER.* Do not rub frozen area. For eye contact, flush with lots of warm (tepid) water. For hypothermia (low body temperature), remove the victim to a warm (not hot) area. Remove contaminated clothing, if possible. Wrap him/her in blankets. Slowly restore body temperatures. A physician should see the patient promptly in all cases.

### **Hazardous Mixtures of Other Liquids, Solids or Gases:**

Although not flammable itself, oxygen vigorously accelerates fire and combustion (burning). Contact with ALL flammable materials should be avoided. Some materials which are not flammable in air will burn in pure oxygen or oxygen-enriched atmospheres. Materials that burn in air can burn with explosive violence in a pure oxygen or oxygen enriched atmospheres.

Do not allow liquid oxygen to leak, drip or spill onto hydrocarbon based paving or onto plastic base or other flammable flooring. Combustibles in contact with liquid oxygen may explode on ignition or impact.

*Note: Except where specified, the health hazard data and most of the other data in this material safety data sheet are for gaseous oxygen. One volume of liquid oxygen at its boiling point and atmospheric pressure will vaporize into approximately 860 volumes of gaseous oxygen at 70 F (21.1 C) and 1 atmosphere.*

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### SECTION III - PHYSICAL DATA

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<b>Boiling Point:</b>	-297.35 F (-182.97 C)
<b>Liquid Density @ B.P.</b>	71.23 lb/cu. ft. (1141 kg/cu. meter) specific gravity = 1.14
<b>Vapor Pressure:</b>	@ 70 F (21.1 C) above the critical temp. of -181.433 F (-118.574 C)
<b>Gas Density @ 70 F, 1 atm:</b>	0.0828 lb./cu. ft. ( 1.326 kg/cu. meter)
<b>Solubility in water:</b>	Bunsen Coefficient = .0310 @ 68 F (20 C); 3.16 cu. meter / 100 g @ 25 C.
<b>Freezing Point:</b>	- 361.838 F (-218.799 C)
<b>Appearance and Odor:</b>	Clear, pale blue, odorless liquid

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### SECTION IV - FIRE AND EXPLOSION HAZARD DATA

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<b>Flammable Limit:</b>	Not Applicable
<b>Electrical Classification:</b>	Non-Hazardous
<b>Special Fire Fighting Procedure:</b>	

Copious quantities of water for fires with oxygen as the oxidizer. If possible, stop the flow of oxygen which is supporting the fire if you can do so without risk. Use media that are appropriate to the surrounding fire. Immediately cool fire-exposed container, standing at a safe distance as far away as possible and using a water spray. If feasible, remove oxygen containers from the fire area. Containers may explode in the heat or fire. Though not flammable itself, oxygen vigorously supports combustion. Materials that do not burn in air may burn in oxygen enriched air (> 23% oxygen). Some materials can even become spontaneously flammable in oxygen or oxygen-enriched air. Oxygen released in a fire situation greatly increases fire and explosion hazards. (Oxygen containers are equipped with safety devices to release oxygen at excessive temperature or pressure). Liquid oxygen can explode on contact with flammables. Do not direct water spray into liquid oxygen.

**Unusual Fire and Explosion Hazard:**

Vigorously accelerates combustion (burning). No smoking in container area or while oxygen is in use. Keep oil and grease away. Keep oxygen containers away from flammables and combustibles.

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### SECTION V - REACTIVITY DATA

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<b>Stability:</b>	Stable
<b>Conditions to avoid:</b>	

Liquid oxygen is stable when kept isolated as a cryogenic liquid in specially designed storage tanks, tankers and DOT 4L liquid containers. This material is an oxidizing agent that vigorously accelerates combustion (burning, fire). Oxygen will undergo highly exothermic reactions or explosions with many materials. The greater the concentration of oxygen in contact with a fuel or reducing agent, the greater the violence of the reaction. Air contains 21 percent oxygen; reactivity with environmental materials is substantially increased at above 23 percent oxygen by volume.

Oxygen reacts explosively with phosphine, hydrazine, hydrogen sulfide, ethers, alcohols, hydrocarbons, etc. Red-hot steel burns in an oxygen atmosphere. This material is incompatible with oils, grease, lubricants, and flammable materials. Keep oxygen containers free of oil and/or grease.

<b>Incompatibility:</b>	All Flammable Materials
<b>Hazardous Decomposition Products:</b>	None
<b>Hazardous Polymerization:</b>	Will Not Occur

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## SECTION VI - SPILL OR LEAK PROCEDURE

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### Steps to be taken in case material is released or spilled:

Evacuate all personnel from affected area. Use appropriate equipment (refer to "SPECIAL PROTECTION INFORMATION" section). Provide optimum exhaust ventilation. If at all possible, shut off the source of the oxygen leak if you can do so without risk. Remove sources of heat, ignition and, if feasible, separate combustibles from the leak. Shut off all internal combustion engines within 50 feet of affected area. Avoid contact with liquid oxygen or its cold boil-off gas. Small leaks in an oxygen system in an enclosed, unventilated area can build up a hazardous oxygen level. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs.

Liquid Oxygen, when spilled, will evaporate rapidly causing a vapor cloud that will be highly oxygen-enriched, which can cause materials in this cloud to ignite easily. Evacuate the cloud area and remove any ignition sources. Visibility may be obscured in this vapor cloud.

To increase the rate of controlled evaporation of spilled liquid oxygen (when desired), spray the spill with large amount of water. This may generate a fog and generate visibility.

Liquid oxygen is delivered to customer into stationary vacuum-jacketed vessels at the customer's location or in portable vacuum-jacketed "liquid" cylinders (DOT 4L).

Stationary customer-site vessels should be operated in accordance with the manufacturer's and Island Equipment Company's instructions. 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 operational problem with the vessel, contact Island Equipment Company immediately. No Smoking or open flames should be allowed near these vessels. Bulk liquid oxygen storage must meet exposure separation requirements in National Fire Protection Association Pamphlet 50, "Bulk Oxygen Systems at Consumer Sites".

Liquid oxygen containers should be used only in well ventilated areas and in accordance with the manufacturer's and Island Equipment Company's instructions. These containers must always be kept in an upright position. Specialized hand trucks are needed for their movement. Full and empty containers should be used with these containers.

### Waste Disposal Method:

Do not attempt to dispose of residual or unused quantities. Return in the shipping container tagged to indicate a defect, and properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to Island Equipment Company for proper disposal.

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## SECTION VII - SPECIAL PROTECTION INFORMATION

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### Respiratory Protection:

Not Applicable

### Ventilation:

Local Exhaust recommended to prevent accumulation above 23 molar percent

### Protective Gloves:

Loose fitting and insulated

### Eye Protection:

Safety goggles or glasses plus face shield

### Special/ Mechanical:

Where oxygen may be released, provide adequate ventilation to prevent excessive oxygen enrichment of the workplace atmosphere (holding at less than 23 % O<sub>2</sub> by volume is recommended for fire safety). Personnel who have been exposed to high concentrations of oxygen should stay in a well ventilated area or open area for 30 minutes before going into a confined space or near an ignition source. Workers handling or transferring liquid oxygen should wear safety glasses and face shield, clean approved insulated gloves and other protective clothing as required to prevent skin contact. Gloves and protective clothing must be of materials that are resistant to ignition on contact with liquid oxygen. Leather gloves and safety shoes are recommended.

Safety shoes and safety glasses are recommended when handling containers of liquid oxygen. Clothing that

has been overexposed or contaminated with oxygen should be removed and considered unsafe (highly flammable) to wear for at least 30 minutes. If oxygen enriched clothing catches fire, extinguish the flame under a safety shower; a fire blanket might not be effective in this situation. Use a continuous water spray to soak the clothing of a rescuer who must operate in an oxygen-rich fire area. Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them.

**Other protective equipment:** Safety Shoes, safety shower

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**SECTION VIII - SPECIAL PRECAUTION\***

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**Special Labeling Information:** DOT Shipping Name -- Oxygen, Refrigerated liquid  
ID Number ----- UN 1073  
DOT Shipping Label --- Oxidizer or Oxygen  
DOT Hazard Class ---- 2.2

**Special Handling Recommendations:**

Always keep liquid oxygen container (DOT 4L) in upright position. Extremely cold, oxidizing liquid and gas under pressure. Vigorously accelerates combustion. Combustibles in contact with liquid oxygen may explode on ignition or impact. Can cause severe frostbite.  
Keep oil, grease and combustibles away. Use only with equipment cleaned for oxygen service. Store and use with adequate ventilation. Do not get liquid in eyes, on skin, or clothing. For liquid withdrawal, wear face shield and gloves. Do not drop or handle container roughly. Use hand-truck for container movement. Avoid spills. Do not walk on or roll equipment over spills. Close valve after each use and when empty. Use in accordance with CGA pamphlets: G-4, G-4.1, G-4.4, P-1, P-2, P-12 and P-14, and with MSDS.

**Special Storage Recommendations:**

Protect cylinders from physical damage. Store in cool, dry, well ventilated area, away from heavily trafficked area and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125 F (52 C). Containers should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty containers should be segregated. Use a "first in-first out" inventory system to prevent full containers being stored for excessive periods of time. Refer in particular to the Compressed Gas Association pamphlets: G-4 "Oxygen"; P-12 "Safe Handling of Cryogenic Liquids"; P-14 "Accident Prevention in Oxygen-Rich and Oxygen-Deficient Atmospheres.

**Special Packaging Recommendation:**

Liquid Oxygen cannot be handled in carbon or low alloy steels. Eighteen-eight (18-8) and 18-10 stainless steels are acceptable as are copper and its alloys, nickel and its alloys brass, silicon alloys, Monel, Inconel, and beryllium. Teflon and Kel-F are preferred gaskets.  
Valve connection: CGA 440 for liquid, CGA 540 for gas (to 3,000 psig); CGA 870 for medical gas pin-indexed yoke connection.

**Other Recommendation or Precaution:**

Equipment to contain liquid oxygen must be "cleaned for oxygen service." See CGA Pamphlet G-4.1, "Cleaning Equipment for Oxygen Service". Liquefied gas containers should not be refilled except by qualified suppliers of these products. Shipment of a compressed gas container which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).  
100 % cotton clothing (underwear and overalls) is highly recommended to wear when handling or transferring liquid oxygen.

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