

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Oxygen, refrigerated liquid (P-4637-H)	Trade Names: Liquid Oxygen, Medipure [®] Liquid Oxygen
Chemical Name: Chemical Name	Synonyms: Oxygen (cryogenic liquid)
Chemical Family: Cryogenic liquid	Product Grades: Industrial, aviator's breathing, USP
Telephone:	Company Name: Praxair, Inc.
Emergencies: 1-800-645-4633*	39 Old Ridgebury Road
CHEMTREC: 1-800-424-9300*	Danbury, CT 06810-5113
Routine: 1-800-PRAXAIR	

*Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).

2. Hazards Identification

EMERGENCY OVERVIEW

**WARNING! 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.
May cause dizziness and drowsiness.
Self-contained breathing apparatus and protective clothing
may be required by rescue workers.
This material is a pale blue, odorless cryogenic liquid.**

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

POTENTIAL HEALTH EFFECTS:

Effects of a Single (Acute) Overexposure

Inhalation. Breathing 80% or more oxygen at atmospheric pressure for more than a few hours may cause nasal stuffiness, cough, sore throat, chest pain, and breathing difficulty. At higher pressures, adverse effects from breathing pure oxygen are more likely and may occur sooner. Breathing pure oxygen under pressure may damage the lungs and affect the Central Nervous System (CNS), producing dizziness, poor coordination, a tingling sensation, visual and hearing disturbances, muscular twitching, unconsciousness, and convulsions. Persons who breathe oxygen under pressure may adapt more slowly to darkness and may suffer reduced peripheral vision.

Skin Contact. No harm expected from vapor. Cold gas or liquid may cause severe frostbite.

Swallowing. An unlikely route of exposure, but severe frostbite of the lips and mouth may result from contact with the liquid.

Eye Contact. No harm expected from vapor. Cold gas or liquid may cause severe frostbite.

Effects of Repeated (Chronic) Overexposure. No harm expected.

Other Effects of Overexposure. See section 11, Toxicological Information.

Medical Conditions Aggravated by Overexposure. See section 11, Toxicological Information.

CARCINOGENICITY: Oxygen is not listed by NTP, OSHA, or IARC.

POTENTIAL ENVIRONMENTAL EFFECTS: None known. For further information, see section 12, Ecological Information.

3. Composition/Information on Ingredients

See section 16 for important information about mixtures.

COMPONENT	CAS NUMBER	CONCENTRATION
Oxygen <i>*The symbol > means "greater than."</i>	7782-44-7	>99%*

4. First Aid Measures

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration. Keep victim warm and at rest. Call a physician. Advise the physician that the victim has been exposed to a high concentration of oxygen.

SKIN CONTACT: For exposure to liquid, immediately warm frostbite area with warm water not to exceed 105°F (41°C). In case of massive exposure, remove clothing while showering with warm water. Call a physician. In case of frostbite, obtain immediate medical attention.

SWALLOWING: An unlikely route of exposure. This product is a gas at normal temperature and pressure.

EYE CONTACT: Immediately flush eyes thoroughly with warm water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. See a physician, preferably an ophthalmologist, immediately.

NOTES TO PHYSICIAN: Supportive treatment should include immediate sedation, anti-convulsive therapy if needed, and rest. See section 11, Toxicological Information.

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Oxidizing agent; vigorously accelerates combustion. Contact with flammable materials may cause fire or explosion. Do not walk on or roll equipment over spill; any impact could cause an explosion. Smoking, flames, and electric sparks are potential explosion hazards in oxygen-enriched atmospheres. Heat of fire can build pressure in a closed container and cause it to rupture. No part of a container should be subjected to a temperature higher than 125°F (52°C). Liquid oxygen containers are equipped with pressure relief devices. Venting vapors may obscure visibility. Liquid causes severe frostbite, a burn-like injury. Air will condense on surfaces such as vaporizers and piping exposed to liquid or cold gas. Nitrogen, which has a lower boiling point than oxygen, will evaporate first, leaving an oxygen-

enriched condensate. Keep all areas of possible condensation free of oil, grease, and other combustible materials to prevent possible ignition or explosion.

SUITABLE EXTINGUISHING MEDIA: Vigorously accelerates combustion. Use media appropriate for surrounding fire. Water (e.g., safety shower) is the preferred extinguishing media for clothing fires.

PRODUCTS OF COMBUSTION: Not applicable.

PROTECTION OF FIREFIGHTERS: WARNING! Extremely cold, oxidizing liquid and gas under pressure. Evacuate all personnel from danger area. Immediately spray containers with water from maximum distance until cool, taking care not to direct spray onto vents on top of container. Do not discharge sprays into liquid oxygen. Liquid oxygen will freeze water rapidly. When containers have cooled, move them away from fire area if without risk. Self-contained breathing apparatus may be required by rescue workers. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

Specific Physical and Chemical Hazards. Air will condense on surfaces such as vaporizers and piping exposed to liquid or cold gas. Nitrogen, which has a lower boiling point than oxygen, will evaporate first, leaving an oxygen-enriched condensate. Keep all areas of possible condensation free of oil, grease, and other combustible materials to prevent possible ignition or explosion.

Protective Equipment and Precautions for Firefighters. Firefighters should wear self-contained breathing apparatus and full fire-fighting turnout gear.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

WARNING! Extremely cold, oxidizing liquid and gas under pressure.

Personal Precautions. Immediately evacuate all personnel from danger area. Avoid contact with spilled liquid and allow it to evaporate. Extremely cold oxidizing liquid and gas. Liquid causes severe frostbite, a burn-like injury. Do not walk on or roll equipment over spill; any impact could cause an explosion. Contact with flammable materials may cause fire or explosion. Smoking, flames, and electric sparks are potential explosion hazards in enriched oxygen atmospheres. Shut off leak if without risk. Ventilate area or move leaking container to ventilated area. Remove all flammable materials from vicinity. Oxygen must never be permitted to strike an oily surface, greasy clothes, or other combustible material.

Environmental Precautions. Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN HANDLING: Never allow any unprotected part of your body to touch uninsulated pipes or vessels containing cryogenic fluids. Flesh will stick to the extremely cold metal and will tear when you try to pull free. **Never use oxygen as a substitute for compressed air.** Never use an oxygen jet for cleaning of any sort, especially for cleaning clothing. Oxygen-saturated clothing may burst into flame at the slightest spark and be quickly consumed in an engulfing fire. **Do not get liquid in eyes, on skin, or on clothing.** Persons exposed to high concentrations of liquid oxygen should stay in a well-ventilated or open

area for 30 minutes before entering a confined space or going near any source of ignition. Immediately remove clothing exposed to oxygen and air it out to reduce the likelihood of an engulfing fire. Prevent ignition sources such as static electricity generated in clothing while walking. **Protect container against physical damage.** Isolate it from combustible gas installations and combustible materials by an adequate distance or by gas-tight, fire resistant barriers. *Use a suitable hand truck to move containers.* Cryogenic containers must be handled and stored in an upright position. Do not drop or tip containers, or roll them on their sides. **Close valve after each use; keep closed even when empty.** If valve is hard to open, discontinue use and contact your supplier. For other precautions in using oxygen, see section 16.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation, away from oil, grease, and other hydrocarbons. Protect against overheating. Store only where temperature will not exceed 125°F (52°C). **Do not store in a confined space.** Cryogenic containers are equipped with a pressure relief device and a pressure controlling valve. Under normal conditions, these containers will periodically vent product. **Separate oxygen containers from flammables** by at least 20 ft (6.1 m) or use a barricade of noncombustible material. This barricade should be at least 5 ft (1.53 m) and have a fire resistance rating of at least ½ hour. **Use adequate pressure relief devices in systems and piping to prevent pressure buildup;** entrapped liquid can generate extremely high pressures when vaporized by warming.

RECOMMENDED PUBLICATIONS: For further information on storage, handling, and use, see Praxair publication P-14-153, *Guidelines for Handling Gas Cylinders and Containers.* Obtain from your local supplier.

8. Exposure Controls/Personal Protection

COMPONENT	OSHA PEL	ACGIH TLV-TWA (2007)
Oxygen	Not established.	Not established.

IDLH = Not available.

ENGINEERING CONTROLS:

Local Exhaust. Use a local exhaust system, if necessary, to prevent increased oxygen concentration.

Mechanical (General). Adequate

Special. None

Other. None

PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Wear loose-fitting, cryogenic gloves, metatarsal shoes for container handling, and protective clothing where needed. Cuffless trousers should be worn outside the shoes. Gloves must be free of oil and grease. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

Eye/Face Protection. Safety glasses and a full face shield are recommended. Select in accordance with OSHA 29 CFR 1910.133.

Respiratory Protection. None required under normal use. However, an air-supplied respirator must be used while working in confined spaces with this product. The respiratory protection

used must conform with OSHA rules as specified in 29 CFR 1910.134. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

9. Physical and Chemical Properties

APPEARANCE:	Pale blue cryogenic liquid
ODOR:	Odorless
ODOR THRESHOLD:	Not applicable.
PHYSICAL STATE:	Cryogenic liquid
pH:	Not applicable.
FREEZING POINT at 1 atm:	-361.1°F (-218.4°C)
BOILING POINT at 1 atm:	-297.4°F (-183°C)
FLASH POINT (test method):	Not applicable.
EVAPORATION RATE (Butyl Acetate = 1):	High
FLAMMABILITY:	Nonflammable
FLAMMABLE LIMITS IN AIR , % by volume:	LOWER: Not applicable. UPPER: Not applicable.
EXPANSION RATIO:	1 to 860.5
VAPOR PRESSURE:	Not available.
VAPOR DENSITY at 70°F (21.1°C) and 1 atm:	0.0827 lb/ft ³ (1.325 kg/m ³)
SPECIFIC GRAVITY (H ₂ O = 1) at boiling point:	1.141
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm:	1.105
SOLUBILITY IN WATER vol/vol at 32°F (0°C):	0.0489 (gas)
PARTITION COEFFICIENT: n-octanol/water:	Not available.
AUTOIGNITION TEMPERATURE:	Not applicable.
DECOMPOSITION TEMPERATURE:	None
PERCENT VOLATILES BY VOLUME:	100
MOLECULAR WEIGHT:	31.9988
MOLECULAR FORMULA:	O ₂

10. Stability and Reactivity

CHEMICAL STABILITY: Unstable Stable

CONDITIONS TO AVOID: Contact with incompatible materials.

INCOMPATIBLE MATERIALS: Flammable materials, hydrocarbons such as oils and grease, asphalt, ethers, alcohols, acids, and aldehydes. Oxygen reacts with many materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Per input or existing MSDS.

POSSIBILITY OF HAZARDOUS REACTIONS: May Occur Will Not Occur

Contact with incompatible materials may result in explosion or fire.

11. Toxicological Information

ACUTE DOSE EFFECTS: Not available.

STUDY RESULTS: At atmospheric concentration and pressure, oxygen poses no toxicity hazards. At high concentrations, newborn premature infants may suffer delayed retinal damage (retrolental fibroplasia) that can progress to retinal detachment and blindness. Retinal damage may also occur in adults exposed to 100% oxygen for extended periods (24 to 48 hours) or at pressures exceeding 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 ophthalmologic examinations.

At two or more atmospheres, toxicity to the CNS occurs. Symptoms include nausea, vomiting, dizziness or vertigo, muscle twitching, vision changes, and loss of consciousness and generalized seizures. At three atmospheres, CNS toxicity occurs in less than two hours; at six atmospheres, in only a few minutes.

Patients with chronic obstructive pulmonary disease retain carbon dioxide abnormally. If oxygen is administered, raising their blood-oxygen concentration, their breathing becomes depressed, and retained carbon dioxide rises to a dangerous level.

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 eardrum and obstruction of the paranasal sinuses may produce vacuum-type headache.

12. Ecological Information

ECOTOXICITY: The atmosphere contains approximately 21% oxygen. No adverse ecological effects expected.

OTHER ADVERSE EFFECTS: Oxygen does not contain any Class I or Class II ozone-depleting chemicals.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Contact your supplier.

Emergency Disposal.

CAUTION: Any disposal must be conducted in accordance with federal, state, and local regulations.

Discharge slowly to the atmosphere in a well-ventilated area or outdoors. Also see section 6 for disposal following spills.

14. Transport Information

DOT/IMO SHIPPING NAME: Oxygen, refrigerated liquid

HAZARD CLASS:	PACKING GROUP/Zone:	IDENTIFICATION NUMBER:	PRODUCT RQ:
2.2	NA/NA*	UN1073	None

SHIPPING LABEL(s): NONFLAMMABLE GAS, OXIDIZER

PLACARD (when required): NONFLAMMABLE GAS, OXIDIZER

*NA = Not applicable.

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

MARINE POLLUTANTS: Oxygen is not listed as a marine pollutant by DOT.

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (ENVIRONMENTAL PROTECTION AGENCY)

CERCLA: COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): None

SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

SECTIONS 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of Extremely Hazardous Substances (EHS) (40 CFR Part 355):

TPQ: None

EHS RQ (40 CFR 355): None

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: Yes

DELAYED: No

PRESSURE: Yes

REACTIVITY: No

FIRE: Yes

SECTION 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Oxygen is not subject to reporting under Section 313.

40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Oxygen is not listed as a regulated substance.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Oxygen is listed on the TSCA inventory.

OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Oxygen is not listed in Appendix A as a highly hazardous chemical.

STATE REGULATIONS:

CALIFORNIA: Oxygen is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: Oxygen is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Be sure to read and understand all labels and instructions supplied with all containers of this product.

WARNING: Medical grades of oxygen are subject to strict federal regulation and are for use only under the control of a licensed physician or clinician familiar with the product and its hazards.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: *Extremely cold, oxidizing liquid and gas under pressure.* All gauges, valves, regulators, piping, and equipment to be used in oxygen service must be cleaned for oxygen service in accordance with CGA pamphlet G-4.1. Keep containers and their valves free of oil and grease. **Use piping and equipment adequately designed to withstand the pressures to be encountered.** Use a backflow prevention device in any piping. Avoid materials incompatible with cryogenic use; some metals such as carbon steel may fracture easily at low temperature. To prevent cryogenic liquid or cold gas from being trapped in piping between valves, equip the piping with pressure relief devices; entrapped liquid can generate extremely high pressures when vaporized by warming. Use only transfer lines designed for cryogenic liquids. Praxair recommends piping all vents to the exterior of the building. **Never work on a pressurized system.** If a leak occurs, close the cylinder valve. Blow the system down in a safe and environmentally sound manner in compliance with all federal, state, and local laws; then repair the leak. **Never place a compressed gas cylinder where it may become part of an electrical circuit.**

Use of this product in manufacturing may generate toxic fumes and gases or create additional toxicity hazards. Consult an industrial hygienist or other appropriately trained person to evaluate end-use operations or processes for hazards and to establish measures to protect employees.

Mixtures. When you mix two or more gases or liquefied gases, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Remember, gases and liquids have properties that can cause serious injury or death.

HAZARD RATING SYSTEMS:**NFPA RATINGS:**

HEALTH = 3
FLAMMABILITY = 0
INSTABILITY = 0
SPECIAL = OX

HMIS RATINGS:

HEALTH = 3
FLAMMABILITY = 0
PHYSICAL HAZARD = 2

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED: CGA-440 (cryogenic liquid withdrawal)
PIN-INDEXED YOKE: Not applicable.
ULTRA-HIGH-INTEGRITY CONNECTION: Not applicable.

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlet V-1 listed below.

Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this product. Further information can be found in the following materials published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700, <http://www.cganet.com/Publication.asp>.

AV-1 *Safe Handling and Storage of Compressed Gases*
AV-8 *Characteristics and Safe Handling of Cryogenic Liquid and Gaseous Oxygen*
G-4 *Oxygen*
G-4.1 *Cleaning Equipment for Oxygen Service*
P-1 *Safe Handling of Compressed Gases in Containers*
P-2 *Characteristics and Safe Handling of Medical Gases*
P-12 *Safe Handling of Cryogenic Liquids*
P-39 *Oxygen-Rich Atmospheres*
V-1 *Compressed Gas Cylinder Valve Inlet and Outlet Connections*
V-7.1 *Standard Method Of Determining Cylinder Valve Outlet Connections For Medical Gases*
— *Handbook of Compressed Gases, Fourth Edition*

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

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Praxair, Inc.
39 Old Ridgebury Road
Danbury, CT 06810-5113