PRODUCT NAME: OXYGEN GAS

MATERIAL SAFETY DATA SHEET

Identification

Product Name: Oxygen
CAS Number: 7782-44-7
Chemical Family: Oxidizing gas
Chemical Formula: O₂
Common Names/Synonyms: None
MSDS Identification Number: 1072
Prepared By: Quality Dept.

Revision Date: 07/17/06
Last Review Date: 07/11/12

Composition/Information on Ingredients

Exposure Limits¹:

<table>
<thead>
<tr>
<th>INGREDIENT</th>
<th>% VOLUME</th>
<th>PEL-OSHA²</th>
<th>TLV-ACGIH³</th>
<th>LD₅₀ or LC₅₀ Route/Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>99.6% to 100%</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

¹ Refer to individual state or provincial regulations, as applicable, for limits which may be more stringent than those listed here.
² As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993).
³ As stated in the ACGIH 2007 Threshold Limit Values for Chemical Substances and Physical Agents

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

Hazards Identification

Emergency Overview:
Odorless, colorless, non-flammable gas. Oxidizer. Will accelerate combustion and increase the risk of fire and explosion in combustible or flammable materials. Non-toxic. Prolonged inhalation of high concentrations may cause coughing and lung effects. Contents under pressure. Use and store below 125°F (52°C).

Route of Entry:

<table>
<thead>
<tr>
<th>Skin Contact</th>
<th>Skin Absorption</th>
<th>Eye contact</th>
<th>Inhalation</th>
<th>Ingestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Health Effects:

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>Irritant</th>
<th>Sensitization</th>
<th>Teratogen</th>
<th>Reproductive Hazard</th>
<th>Mutagen</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Synergistic Effects:
None Reported

Carcinogenicity: NTP: No  IARC: No  OSHA: No
Hazards Identification Continued

Eye Effects:
None anticipated. Contact with rapidly expanding gas near the point of release may cause frostbite.

Skin Effects:
Contact with rapidly expanding gas near the point of release may cause frostbite with redness, skin color change to gray or white and blistering.

Ingestion Effects:
Ingestion is unlikely. Product is a gas.

Inhalation Effects:
Oxygen is not acutely toxic under normal pressure. Prolonged inhalation of high oxygen concentrations (>75%) may affect coordination, attention, and cause tiredness or respiratory irritation. Inhalation for several hours may cause cough, sore throat, chest pain and difficulty breathing.

Oxygen is more toxic when inhaled at elevated pressures. Depending upon pressure and duration of exposure, pure oxygen at elevated pressures (i.e.: divers) may cause cramps, dizziness, difficulty breathing, convulsions, edema, and death.

Elevated oxygen concentrations in incubators have caused visual impairment and blindness in premature infants. High oxygen concentrations primarily affect eyes which are not fully developed (see section on Toxicological Information).

Medical Conditions Aggravated by Exposure:
May aggravate chronic obstructive pulmonary (lung) disease.

Potential Environmental Effects:
Not expected to be toxic to fish and wildlife.

NFPA Hazard Codes | HMIS Hazard Codes | Ratings System
---|---|---
Health: 0 | Health: 0 | 0 = No Hazard
Flammability: 0 | Flammability: 0 | 1 = Slight Hazard
Instability: 0 | Physical Hazard: 3 | 2 = Moderate Hazard
OXIDIZER | | 3 = Severe Hazard

Hazard codes based on recommendations contained in CGA P-19 2009, CGA Recommended Hazard Ratings for Compressed Gases.

First Aid Measures

Eyes:
None required for gas. If frostbite is suspected, flush eyes with cool water for 15 minutes and obtain immediate medical attention.

Skin:
None required for gas. For frostbite, immerse skin in lukewarm water. DO NOT USE HOT WATER. Obtain medical attention.

Ingestion:
Ingestion is unlikely as product is a gas at room temperature.

Inhalation:
Overexposure to oxygen is not anticipated under normal working conditions. High oxygen concentrations in the air may present a fire and explosion hazard. PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES WHEN OXYGEN IS INHALED UNDER PRESSURE (i.e.: as in scuba diving). Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Further treatment should be symptomatic and supportive. Inform the treating physician that the patient could be experiencing hyperoxia.
Conditions of Flammability: Nonflammable, Oxidizer

<table>
<thead>
<tr>
<th>Flash point:</th>
<th>Method:</th>
<th>Autoignition Temperature:</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Not Applicable</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LEL (%)</th>
<th>UEL (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Hazardous combustion products: None
Sensitivity to mechanical shock: None
Sensitivity to static discharge: None

**Fire and Explosion Hazards:**
High oxygen concentrations vigorously accelerate combustion. Will support or initiate combustion/explosion of organic matter and other oxidizable material. Cylinders may rupture violently or vent rapidly from pressure when involved in a fire situation.

**Extinguishing Media:**
Water spray to keep cylinders cool. Extinguishing agent appropriate for the combustible material.

**Fire Fighting Instructions:**
If possible, stop the flow of oxygen which is supporting the fire. Firefighters should wear respiratory protection (SCBA) and full turnout or Bunker gear. Continue to cool fire-exposed cylinders until well after flames are extinguished.

**Accidental Release Measures**
Evacuate all personnel from affected area. A leak near combustible or flammable materials may represent a severe fire or explosion hazard. Eliminate all ignition sources. Ventilate enclosed areas. If it can be done without risk, stop the flow of gas or remove cylinder to outside. Use appropriate protective equipment. If leak is in user’s equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve contact the appropriate emergency telephone number listed in Section 1 or call your closest Norco/NorLab location.

**Handling and Storage**

**Electrical Classification:**
Non-hazardous

Dry product is noncorrosive and may be used with all materials of construction. Equipment to contain oxygen must be “Cleaned for Oxygen Service”. Check with the supplier to verify oxygen compatibility for the service conditions. Moisture causes metal oxides which are formed with air to be hydrated so that they include volume and lose their protective role (rust formation). Concentrations of SO₂, Cl₂, salt, etc. in the moisture enhances the rusting of metals in air. Carbon steels and low alloy steels are acceptable for use at lower pressures.

For high pressure applications stainless steels are acceptable, as are copper and its alloys, nickel and its alloys, brass, bronze, silicon alloys, Monel®, Inconel®, and beryllium. Lead and silver or lead tin alloys are good gasket materials. 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 this type generally contains flammable lubricants.

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure regulator when connecting cylinder to lower pressure piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavy traffic areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125°F (52°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. 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.
Handling and Storage Continued


Never carry a compressed gas cylinder or a container of a gas in cryogenic liquid form in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

Exposure Controls, Personal Protection

Engineering Controls:
Use general ventilation and/or local exhaust as necessary to keep oxygen concentrations below 23.5%.

Eye/Face Protection:
Safety goggles or glasses.

Skin Protection:
Protective gloves of suitable material. Gloves must be clean and free from oil and grease.

Other/General Protection:
Safety shoes, emergency eyewash station.

Physical and Chemical Properties

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>VALUE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical state (gas, liquid, solid)</td>
<td>Gas</td>
<td></td>
</tr>
<tr>
<td>Vapor pressure at 70°F</td>
<td>Above critical temp.</td>
<td>psia</td>
</tr>
<tr>
<td>Vapor density at STP (Air=1)</td>
<td>1.11 (Gas)</td>
<td></td>
</tr>
<tr>
<td>Evaporation point</td>
<td>Not Available</td>
<td></td>
</tr>
<tr>
<td>Boiling Point</td>
<td>-297.3</td>
<td>°F</td>
</tr>
<tr>
<td></td>
<td>-182.9</td>
<td>°C</td>
</tr>
<tr>
<td>Freezing point</td>
<td>-361.8</td>
<td>°F</td>
</tr>
<tr>
<td></td>
<td>-218.8</td>
<td>°C</td>
</tr>
<tr>
<td>pH</td>
<td>Not Applicable</td>
<td></td>
</tr>
<tr>
<td>Specific gravity (H₂O = 1at 77°F and 1 atm.)</td>
<td>Not Available</td>
<td></td>
</tr>
<tr>
<td>Oil/water partition coefficient</td>
<td>Not Available</td>
<td></td>
</tr>
<tr>
<td>Solubility (H₂O)</td>
<td>Slight 0.0491</td>
<td>(vol. /vol.)</td>
</tr>
<tr>
<td>Odor threshold</td>
<td>Not Applicable</td>
<td></td>
</tr>
<tr>
<td>Odor and appearance</td>
<td>Colorless odorless gas</td>
<td></td>
</tr>
</tbody>
</table>

Stability and Reactivity

Stability:
Stable.

Incompatible Materials:
All flammable, organic, and combustible materials. Avoid heat, sparks, flames, and other ignition sources.

Hazardous Decomposition Products:
None

Hazardous Polymerization:
Will not occur.
**Toxicological Information**

**Skin & Eye:**
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 myasthenia gravis developed irreversible retinal atrophy after breathing 80% oxygen for 150 days.

**Inhalation:**
Human volunteers which inhaled 90-95% oxygen through a face mask for 6 hours showed signs of tracheal irritation and fatigue. Other symptoms (which might have been caused by placing a tube into the trachea during the experiment) included: sinusitis, conjunctivitis, fever, and symptoms of acute bronchitis.

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.

**Ecological Information**
No adverse ecological effects expected. Product does not contain any Class I or Class II ozone-depleting chemicals. Not toxic. Will not bioconcentrate.

**Disposal Considerations**
Do not attempt to dispose of residual waste or unused quantities in returnable containers. Return in shipping container, *properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place* to Norco for proper disposal. Non-refillable containers should be vented in a well-ventilated area then disposed of in compliance with local regulations, or returned to Norco/NorLab.

**Transport Information**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>United States DOT</th>
<th>Canada TDG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proper Shipping Name:</td>
<td>Oxygen, compressed</td>
<td>Oxygen, compressed</td>
</tr>
<tr>
<td>Hazard Class:</td>
<td>2.2 (5.1)</td>
<td>2.2 (5.1)</td>
</tr>
<tr>
<td>Identification Number:</td>
<td>UN 1072</td>
<td>UN 1072</td>
</tr>
<tr>
<td>Shipping Label:</td>
<td>Nonflammable Gas, Oxidizer</td>
<td>Nonflammable Gas, Oxidizer</td>
</tr>
</tbody>
</table>

**Regulatory Information**

**SARA Title III Notifications and Information:**
This product does not contain toxic chemicals subject to reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372.

**SARA Title III – Hazard Classes:**
Fire Hazard
Sudden Release of Pressure Hazard

**California Proposition 65:**
This product does not contain ingredient(s) known to the State of California to cause cancer or reproductive toxicity.

**Other Information**
Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.
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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).