MACURCO

GAS DETECTION

MANUFACTURED BY AERIONICS

Macurco Gas Detection Products

Macurco Oxygen Training

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Oxygen History

Oxygen was discovered about 1772 by a Swedish chemist, Carl Wilhelm Scheele, who obtained it by heating potassium nitrate, mercuric oxide, and many other substances.

- An English chemist, Joseph Priestley, independently discovered oxygen in 1774 by the thermal decomposition of mercuric oxide and published his findings the same year, three years before Scheele published.
- In 1775–80, French chemist Antoine-Laurent Lavoisier interpreted the role of oxygen in respiration as well as combustion, discarding the phlogiston theory, which had been accepted up to that time; he noted its tendency to form acids by combining with many different substances and accordingly named the element oxygen (oxygène) from the Greek words for “acid former.”

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Oxygen Properties and Occurrence

Oxygen is a colorless, odorless, tasteless gas essential to living organisms, being taken up by animals, which convert it to carbon dioxide; plants, in turn, utilize carbon dioxide as a source of carbon and return the oxygen to the atmosphere.

- The proportion of oxygen by volume in the atmosphere is 20.9 percent.
- Seawater is 89 percent oxygen by weight. Dissolved oxygen is essential for the respiration of fish and other marine life.
- During respiration, animals and some bacteria take oxygen from the atmosphere and return to it carbon dioxide, whereas by photosynthesis, green plants assimilate carbon dioxide in the presence of sunlight and evolve free oxygen.
- Almost all the free oxygen in the atmosphere is due to photosynthesis.

Oxygen Enrichment

Potential Symptoms: Cough; dizziness; sore throat; visual disturbances at very high concentrations.

- At 100% oxygen for more than 24 hours: symptoms above plus weakness, fatigue, pain in joints and muscles, numbness and tingling in arms and legs, palpitations, headache, nasal congestion, ear disturbances, nausea, vomiting, loss of appetite, fever and swelling of mucous membranes.
- OSHA does not have a PEL for oxygen. Minimum acceptable breathing air contains 19.5% oxygen.
- Supplying oxygen to animals has been known to produce tissue damage, with toxicity increasing with the increase of oxygen concentrations and exposure pressures.

Oxygen Enrichment

Oxygen therapy is administered to decrease tissue hypoxia and to relieve arterial hypoxemia. High concentrations of oxygen are often used in patients with adult respiratory distress syndrome.

- End-organ damage from hyperoxia depends on both the concentration of oxygen administered and the oxygen pressure during exposure.
- Prolonged exposure to hyperbaric oxygen causes central nervous system and pulmonary toxicity which results in atelectasis, pulmonary edema, and seizures.
- Lung damage may occur as a result of normobaric hyperoxia.
- A severe retinopathy (retrolental fibroplasia) occurs in neonates during oxygen exposures.

Oxygen Depletion

If the oxygen concentration in air decreases or, if the concentration of any *other* gases increase, a situation is rapidly reached where the risks of asphyxiation are significant. For this reason any depletion of oxygen below 20.9 % must be treated with concern.

O_2 (Vol %)	Effects and Symptoms
18-21	**No discernible symptoms** can be detected by the individual. A risk assessment must be undertaken to understand the causes and determine whether it is safe to continue working.
11-18	Reduction of physical and intellectual performance **without the sufferer being aware**.
8-11	Possibility of fainting within a few minutes without prior warning. **Risk of death below 11%.**
6-8	Fainting occurs after a short time. **Resuscitation possible** if carried out immediately.
0-6	Fainting almost immediate. **Brain damage**, even if rescued.

Oxygen Depletion

Inert gases give no warning. It is essential to understand that with inert gases such as nitrogen, argon, helium, etc., asphyxia is insidious - there are no warning signs.

- Inert gases are odorless, colorless and tasteless. They are undetectable and can therefore be a great deal more dangerous than toxic gases such as chlorine, ammonia, or hydrogen sulfide, which can be detected by their odor at very low concentrations.
- The asphyxiating effect of inert gases occurs without any preliminary physiological sign that could alert the victim. Lack of oxygen may cause vertigo, headache or speech difficulties, but the victim is not capable of recognizing these symptoms as asphyxiation.
- Asphyxiation leads rapidly to loss of consciousness – for very low oxygen concentrations this can occur within seconds.

Oxygen Depletion

Inert cryogenic liquids such as nitrogen or helium: Once vaporized both products will generate a large volume of cold inert gas that will displace ambient air, causing oxygen deficiency and may accumulate in low points.

- In processes where cryogenic liquids are handled and vaporization takes place, special care must be taken to avoid situations where personnel are exposed to oxygen deficiency.
- Examples of such spaces include: rooms where cryogenic liquid cylinders are filled and/or stored, laboratories, elevators used for transport, where liquid nitrogen freezers are operated, Magnetic Resonance Imaging (MRI) scanner or other liquid helium cooled equipment.

Industry Applications

Agriculture

AM, PH

Bakery

CO, EX

Cement

CO, HS

Chemical - Petroleum

HS, EX, OX, SO

CL, CD, HS, CN

AM, NO, ND, PD, MO

Construction

CO, HS, OX, EX, MO

Fire / Hazmat

CO, EX, OX, PD, MO

Food Processing

AM, CO, OX, EX, HS

HVAC

CO, CO2

Mining

CO, EX, OX, HS

Pulp and Paper

HS, ME, SO, CL, CD

Power Plants

CO, HS, OX, EX

Semi-Conductor / Electronics

CO, CN, SO, CD, AM, NO, ND, Other Exotic Gases

Steel

CO, OX, SO, EX

Tele-Communications

CO, OX, HS

Transport

CO, OX, HS, EX

Waste Water & Water

CO, OX, HS, SO, CL

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Industry Applications

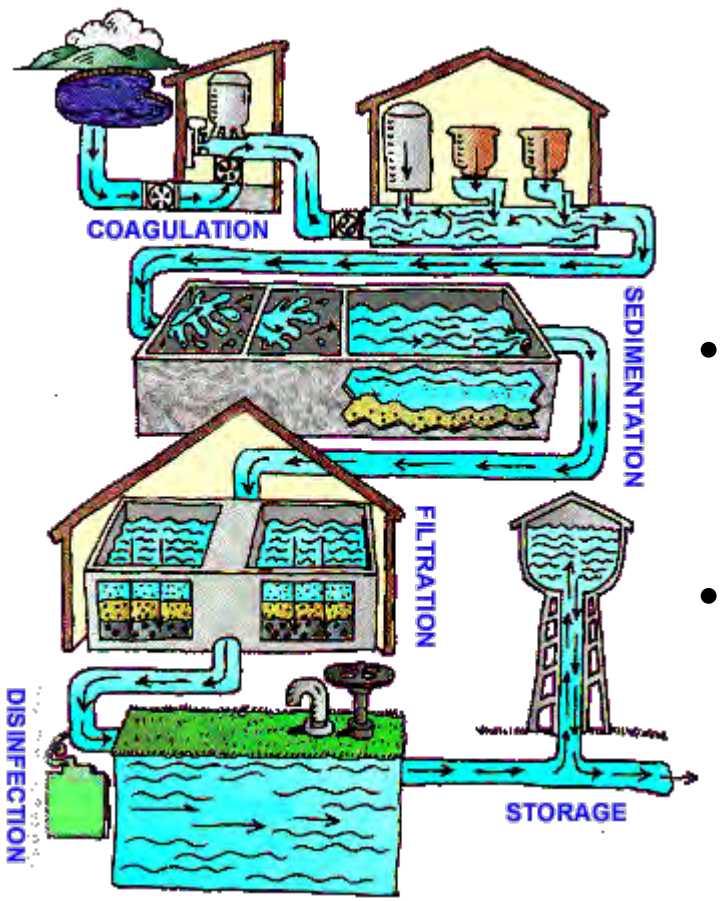
Oxygen is used in many industries including metal and glass manufacturing, chemicals and petroleum processing, pharmaceuticals, pulp and paper, aerospace, wastewater treatment and even fish farming.

- Oxygen promotes combustion, so it helps manufacturers save fuel and energy and reduce the emission of greenhouse gases such as carbon dioxide, nitrogen oxide or sulfur oxide.
- Using oxygen-enriched air increases production efficiency in steel, rocket fuel, glass, chemical and metallurgical processing applications.
- Manufacturers of aluminum, copper, gold and lead use oxygen to remove metals from ore more efficiently. As a result, they can often use lower-grade ores and raw materials, which helps conserve and extend our natural resources.

Industry Applications

- For **metal fabrication**, oxygen is often used with acetylene, propane, and other gases to cut and weld metals.
- The **chemical and petroleum industries** combine oxygen with hydrocarbon building blocks to make products such as antifreeze, plastic and nylon.
- The **pulp and paper industry** uses oxygen to increase paper whiteness while reducing the need for other bleaching chemicals. They also use it to reduce odors and other emissions.

Industry Applications



- Municipal and industrial **wastewater plants** use oxygen to make the treatment process more efficient and increase basin capacity during plant expansions or plant upsets.
- Municipal **water plants** use oxygen as feed gas to their ozone systems to remove taste, odor and color from drinking water.
- Oxygenated water also improves the health and size of the fish for **fish farming operations** so farmers around the world can supply high-quality food.

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Oxygen and Fire Danger

Extremely flammable in the presence of the following materials or conditions: reducing materials, combustible materials and organic materials.

- Increased levels of oxygen may dramatically **increase the flammability** of any combustible matter. If oxygen levels exceed 24% volume, even materials such as clothing which might normally just smolder may burst into flame.
- The risk from oxygen enrichment exists where pure oxygen is stored; for example in **hospitals and industrial gas manufacturing and distribution plants.**

Oxygen and Fire Danger

Oxygen itself is not flammable, but an oxygen-rich environment causes everything within it to burn faster and hotter.

- The **risk of fire increases** when oxygen levels in the air are higher than normal. Clothing and hair readily trap oxygen and are highly combustible.
- Any product containing petroleum, such as some skin lotions, “chapstick” or lubricants, may spontaneously self-ignite when brought into oxygen-rich environments.
- It is important to have good ventilation when working with oxygen and to periodically test the atmospheres in confined areas to ensure that oxygen levels do not increase and create an increased fire hazard.

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Oxygen Detection

The new Macurco OX-6 and OX-12 Oxygen Detectors will be field calibrated with ambient air and bump tested with 17% oxygen v/v gas.

- Fan relay actuation: selectable at “dIS” (disabled), 18, 18.1… , 20.2 (default), 20.3, 20.4 & 20.5% v/v
- Alarm relay settings: “dIS” (disabled), 18.5, 19, 19.5 (default), 20, 20.5% v/v
- If oxygen levels rise to 23.5% v/v the Fan Relay and Alarm Relay will be activated. This is a preset function and is not selectable.

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