



# **SAFETY TRAINING LEAFLET 03**

## **OXYGEN**

**AIGA 009.03/25**

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## OXYGEN

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## Table of Contents

<b>1</b>	<b>Introduction.....</b>	<b>1</b>
1.1	<i>Safety leaflets.....</i>	1
1.2	<i>Comprehension tests.....</i>	1
<b>2</b>	<b>Oxygen.....</b>	<b>1</b>
2.1	<i>Hazards of oxygen.....</i>	1
2.2	<i>Oxygen enrichment.....</i>	1
2.3	<i>Material compatibility and oxygen cleanliness.....</i>	2
2.4	<i>Oxygen cylinder filling specific hazards and prevention measures: .....</i>	2
2.5	<i>Liquid oxygen storage specific hazards and prevention measures .....</i>	2
2.6	<i>Protective clothing .....</i>	2
	<b>Appendix 1 – Oxygen – Test Questions .....</b>	<b>4</b>
	<b>Appendix 2 – Oxygen – Test Answers.....</b>	<b>5</b>

## 1 Introduction

### 1.1 Safety leaflets

Safety training leaflets summarise the basic operational safety knowledge which needs to be known by employees working in the gas industry.

Refer to AIGA 009 *Safety Training of Employees* for the various combinations of leaflets which define the scope of safety training for a variety of specific jobs.

Each leaflet addresses a specific topic as identified in the title.

### 1.2 Comprehension tests

There is a comprehension test for each leaflet, included in **Appendix 1**.

Each test comprises several questions. To pass the test it is suggested that the employee should score 75% at the first attempt. Incorrect answers should be discussed to confirm understanding.

Appendix 2 includes the list of correct answers.

## 2 Oxygen

Oxygen is referred to as O<sub>2</sub>. It is a colourless, odourless and tasteless gas. The atmosphere normally contains 21 % oxygen. An increase above this figure is known as enrichment; a decrease below this figure is known as deficiency.

### 2.1 Hazards of oxygen

- Oxygen is essential for life: if a person enters an oxygen deficient atmosphere they could collapse immediately and die if not rescued.
- When liquid oxygen evaporates the gas produced is very cold and so is much heavier than air. Therefore, it can collect in areas below ground level such as pits and trenches where it may be slow to disperse.
- Before entering areas and confined spaces in which an oxygen deficiency or enrichment could occur, make sure that the atmosphere has been tested to ensure that the oxygen content is 21 % (+/- uncertainty of measurement) and that causes for deviations from 21 % are identified and controlled.
- Read the Work Permit - see Safety Training Leaflet 23 *Work Permit* – and make sure it is valid (date, signature).

### 2.2 Oxygen enrichment

- Oxygen is not flammable but is essential for combustion. Even a slight enrichment of the atmosphere may cause increased risk of ignition and rapid combustion, while a high concentration of oxygen can cause burning at explosive rates. Conversely, if there is not enough oxygen combustion will stop or not start.
- In areas where oxygen enrichment can occur, do not smoke and do not use naked flames. If hot work (welding, flame cutting, soldering, grinding, etc...) has to be carried out, ensure that the atmosphere has been checked and confirmed as safe and obtain a Work Permit.
- Do not use oxygen for applications for which it is not intended. Do not use oxygen as a substitute for air, such as; for operating pneumatic tools, inflating tyres, starting diesel engines.

- Make sure that all items such as tools, cleaning rags and clothes which may come into contact with oxygen are free from oil and grease. Clean them with approved solvents and remove all traces of solvents before exposing them to oxygen - see Safety Training Leaflet 22 *Solvents*.
- If you have been in an oxygen-enriched atmosphere, ventilate your clothing in the open air for a minimum of 15 minutes before smoking or going near to a source of ignition.

### **2.3 Material compatibility and oxygen cleanliness**

- Only certain materials are suitable for use in oxygen service. Most materials will burn in pure oxygen, even if they cannot be ignited in air. Some organic materials, in particular oils, grease and materials contaminated with these substances can catch fire spontaneously in an enriched atmosphere. When ignited, metals burn in oxygen.
- Check with your supervisor that the materials or substances which you use are approved for oxygen service.
- Parts used for oxygen service shall be labelled accordingly and preserved with packaging that maintains the cleanliness required for oxygen service. When equipment for oxygen service undergoes maintenance, it shall be ensured, that the work-area is clean and specifically free of oil and grease.

### **2.4 Oxygen cylinder filling specific hazards and prevention measures:**

- Contamination of oxygen cylinders with moisture is hazardous as it causes corrosion which in turn may cause cylinders to burst when pressurized.
- You must know how to stop the cylinder filling process in case of an emergency.
- When not connected to the filling rack, cylinders must be capped and secured.
- You must know the cylinder filling diagram (pressure, time, temperature) and the maximum allowed temperature of oxygen cylinders during filling.
- Oxygen cylinders used for medical service are subject to specific rules that you must be instructed in.

### **2.5 Liquid oxygen storage specific hazards and prevention measures**

- Liquid oxygen is stored in pressure vessels designed for that purpose; there is an identification plate, you must know what the engraved information means. Tank pressure monitoring and control is critical, overpressure protection must be kept in good condition, operating instructions must be known, uncontrolled deviations must be reported.
- Liquid oxygen storage requires specific regulations to be known and respected.
- Storage area must be clean and free from oil and grease.
- It is hazardous to overfill liquid storage tanks; level in the tank must be monitored.
- A liquid oxygen release in the atmosphere generates a thick cloud made of condensed moisture. Do not expose yourself to the cloud.
- Transfilling of liquid oxygen shall only be carried out in designated areas which are designed for the purpose, e.g. the floor shall not be asphalt, wood or other combustible materials since this can ignite if exposed to oxygen.

### **2.6 Protective clothing**

- Clothing worn when handling oxygen shall be Flame resistant clothing (FRC) or natural fibre material, e.g., cotton or wool (See AIGA 066, *Selection of Personal Protective Equipment*).

- Flame resistant clothing will not support combustion after the heat source is removed.
- Inner garments including underwear worn under FRC should be constructed of natural fibre material, e.g., cotton or wool, or flame-resistant materials. Other synthetic materials can melt and cause serious burns due to the adhesion of molten material to the skin.

**Appendix 1 – Oxygen – Test Questions**

*Tick the correct answer (s) or write in the blank spaces as requested.*

1. The most important characteristic of oxygen is that it is:  

<b>A.</b> Flammable	<b>C.</b> Able to help things to burn fiercely
<b>B.</b> Cryogenic	<b>D.</b> Inert
2. Which two of the following hazards can be caused when using oxygen?  

<b>A.</b> Toxicity	<b>C.</b> Oxygen enrichment
<b>B.</b> Incompatibility of materials	<b>D.</b> Oxygen deficiency
3. Oxygen is less dense than air.  

<b>A.</b> True	<b>B.</b> False
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4. If there has been oxygen enrichment, i.e. in atmosphere with more than 21 % oxygen, what is the biggest risk that exists?
5. How long should clothes that have been soaked with oxygen be aired?  

<b>A.</b> 10 Minutes	<b>C.</b> 15 Minutes
<b>B.</b> 1 hour	<b>D.</b> 24 hours
6. Tick the materials that may react violently with oxygen.  

<b>A.</b> Greases	<b>D.</b> Oils
<b>B.</b> Concrete	<b>E.</b> Organic waste
<b>C.</b> Copper	<b>F.</b> Dirty Teflon
7. The main uses of oxygen are operating pneumatic tools and starting diesel engines:  

<b>A.</b> True	<b>B.</b> False
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8. Before transferring liquid oxygen, the required personal protective equipment must be correctly in place.  

<b>A.</b> True	<b>B.</b> False
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**Appendix 2 – Oxygen – Test Answers**

1. C
2. B and C
3. B
4. Fire.
5. C
6. A, D, E, and F
7. B
8. A