
Space systems — Oxygen safety —
Part 6:
Facility planning and implementation

Systèmes spatiaux — Sécurité des systèmes d'oxygène —
Partie 6: Planification et mise en oeuvre des équipements



Reference number
ISO 22538-6:2010(E)

Documents
Document Sharing Hub
© ISO 2010

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.



COPYRIGHT PROTECTED DOCUMENT

© ISO 2010

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
Introduction.....	vi
1 Scope	1
2 Normative references	1
3 Terms, definitions and abbreviated terms	1
3.1 Terms and definitions	1
3.2 Abbreviated terms	1
4 Planning and implementation	2
4.1 Planning.....	2
4.2 Environmental review	2
4.3 Vapour cloud dispersion	2
4.4 Fire/explosive protection	2
4.5 Quantity-distance relationships.....	2
4.6 Facility design guidelines.....	2
5 Hazards and reviews	3
5.1 Hazards.....	3
5.2 Hazards analysis	4
6 Storage systems.....	4
6.1 Bulk oxygen system.....	4
6.2 GOX location.....	4
6.3 Barriers	5
6.4 Mechanical devices, instruments and operating procedures.....	5
6.5 LOX location	5
6.6 Storage tanks and impounding areas	5
7 Storage vessels	5
8 Fire protection systems for oxygen-enriched environments	6
8.1 General	6
8.2 Fire-extinguishing systems	6
8.3 Fire-extinguishing agents.....	6
9 Barricades	7
9.1 Need	7
9.2 Liquid or vapour travel.....	7
9.3 Storage vessels	7
9.4 Types	7
9.5 Studies and test results	7
9.6 Pumps.....	8
9.7 Location of pressure vessels	8
10 Quantity-distance guidelines for bulk liquid oxygen storage.....	8
10.1 Criteria	8
10.2 Compatibility groups.....	8
10.3 Quantity-distance tables.....	8
10.4 Incompatible storage	8
10.5 Explosive equivalent.....	8
10.6 Inhabited buildings and public traffic routes	9
11 Quantity distance guidelines for bulk gaseous oxygen storage.....	9
11.1 General guidelines	9

11.2	Protective structures	10
12	Oxygen detection.....	10
12.1	Decision making	10
12.2	Oxygen detection and monitoring system.....	10
12.3	Approval	11
12.4	Planning requirements	11
12.5	Location requirements	11
13	Venting and disposal systems	12
13.1	Liquid oxygen disposal	12
13.2	Gaseous oxygen (vapour) venting.....	12
Annex A (informative) Tables		14
Bibliography		19

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 22538-6 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

ISO 22538 consists of the following parts, under the general title *Space systems — Oxygen safety*:

- *Part 1: Design of oxygen systems and components*
- *Part 2: Selection of metallic materials for oxygen systems and components*
- *Part 3: Selection of non-metallic materials for oxygen systems and components*
- *Part 4: Hazards analyses for oxygen systems and components*
- *Part 5: Operational and emergency procedures*
- *Part 6: Facility planning and implementation*

Introduction

This part of ISO 22538 describes a process to ensure the protection and safety of personnel and equipment associated with oxygen systems and components.

Space systems — Oxygen safety —

Part 6: Facility planning and implementation

1 Scope

This part of ISO 22538 describes a process to ensure the protection and safety of personnel and equipment associated with oxygen systems and components. This part of ISO 22538 applies to ground support equipment, launch vehicles and spacecraft.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 22538-5, *Space systems — Oxygen safety — Part 5: Operational and emergency procedures*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22538-5 and the following apply.

3.1.1

revetment

facing of masonry for protecting an embankment

3.2 Abbreviated terms

GOX	gaseous oxygen
LOX	liquid oxygen
NPSP	net positive suction pressure
NTP	normal temperature and pressure
TNT	trinitrotoluene

4 Planning and implementation

4.1 Planning

Because of the hazards associated with oxygen and oxygen-enriched air, planning for the protection and safety of personnel facilities and equipment shall start at the initial facility design stages.

4.2 Environmental review

An environmental review of liquid oxygen (LOX) and gaseous oxygen (GOX) facilities shall include an understanding of potential environmental effects and how they can be effectively controlled. Situations during transportation, storage, transfer, testing and vaporization, where life, health, environment and property may be exposed to substantial hazards, shall be considered. The probability of events occurring and causing spills, the nature of the spills and the risks of fires and explosions shall be included in the evaluation.

4.3 Vapour cloud dispersion

Vapour cloud dispersion studies shall be performed, taking into account evaporation rates, cold vapour stability, spill sizes and ground conditions. These studies include the effects of ignition under various stages of developing oxygen-enriched air-fuel mixtures.

4.4 Fire/explosive protection

Various techniques and methods have been developed to provide protection against fires and explosions:

- a) containers sufficiently strong to withstand explosions;
- b) venting methods to prevent vessel failures;
- c) sufficient clearances and separations between oxygen containers and incompatible materials, storage tanks, plant equipment, buildings and property lines, so that any accident or malfunction has a minimum effect on facility personnel and public safety: these may include protective enclosures such as barricades or cell enclosures;
- d) ignition and flame prevention techniques.

4.5 Quantity-distance relationships

Quantity-distance relationships are intended as a basic guide in choosing sites and separation distances. Quantity-distance criteria for bulk oxygen storage facilities are intended to provide protection from external fire exposure. Quantity-distance criteria for oxygen-fuel systems, however, are intended to reduce the effects of fire, explosion, fragmentation and detonation, by keeping the hazard source at a safe distance from people and facilities.

4.6 Facility design guidelines

Some general facility design guidelines for oxygen facilities are as follows:

- a) with a view to managing fires, provide an automatic remote shut-off to isolate critical components from all bulk oxygen supplies; water spray systems shall be provided;
- b) locate oxygen systems a safe distance from heat or radiation sources;
- c) limit ignition sources and provide lightning protection in the form of lightning rods, aerial cable and suitably connected ground rods in all preparation, storage and use areas; all equipment in buildings shall be interconnected and grounded to prevent inducing sparks between equipment during lightning strikes;