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Oxygen reduction systems for fire prevention — Design, installation, planning and maintenance

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Contents

Page

Foreword ..... **v**

Introduction ..... **vi**

1 Scope **1**

2 Normative references **1**

3 Terms and definitions **2**

4 System requirements **3**
4.1 General 3
4.2 Personnel safety 3
4.3 Effectiveness and application 4
4.4 Alarm organization and emergency plan 4

5 Design **5**
5.1 Qualification of the designer 5
5.2 Fire protection concept 5
5.3 Structural specifications for the protected area 5
5.4 Oxygen concentration 5
5.5 Oxygen reduction to prevent fire 6
5.6 Safety margins 6
5.7 Oxygen reduced air quantity 9
5.7.1 Continuous oxygen reduction 9
5.7.2 Emergency plan 9
5.7.3 Oxygen reduced air 10
5.7.4 Fault signals 10
5.8 Technical areas 11
5.8.1 Technical area for control panel 11
5.8.2 Technical area for reduced oxygen air generation 11

6 Distribution pipework **12**
6.1 Pipework 12
6.2 Pipe supports 12
6.3 Components in the pipework 12

7 Monitoring the oxygen concentration **13**

8 Alarms and notifications **14**

9 Control equipment **15**
9.1 Function 15
9.2 Requirements 16
9.3 Electrical power supply 16
9.4 Electrical cabling installations 16
9.5 Data recording 16

10 System operation **17**
10.1 Instruction and training of personnel 17
10.2 Inspections 17
10.3 Operations log 17
10.4 Further obligations 17

11 Maintenance **18**

12 Documentation **18**

13 Installation **19**
13.1 Qualification of the installer 19
13.2 General specifications — Installation 19

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Annex A (normative) **Ignition thresholds for oxygen reduction using nitrogen-enriched air in fire prevention** **20**

Bibliography **24**

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 8, *Gaseous media and firefighting systems using gas*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Oxygen reduction systems are designed to prevent fires from starting or spreading, by means of the introduction of oxygen reduced air and creating an atmosphere in an area which is having lower permanent oxygen concentration in respect to ambient conditions. Oxygen reduction systems are not designed to extinguish fires. The design and installation are based on detailed knowledge of the protected area, its occupancy and the materials in question. It is important to suit the fire protection measures to the hazard as a whole.

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Oxygen reduction systems for fire prevention — Design, installation, planning and maintenance

1 Scope

This document specifies minimum requirements and defines the specifications governing the design, installation and maintenance of fixed oxygen reduction systems with oxygen reduced air for fire prevention in buildings and industrial production plants. It also applies to the extension and modification of existing systems.

This document applies to oxygen reduction systems using nitrogen-enriched-air which are designed for continual oxygen reduction in enclosed spaces.

NOTE Nitrogen is, today, the most suitable gas to be used for oxygen reduction. For other gases, this document can be used as a reference.

This document does not apply to:

— oxygen reduction systems that use water mist or combustion gases;

— explosion suppression systems;

— explosion prevention systems, *in case of chemicals or materials containing their own supply of oxygen, such as cellulose nitrate*;

— fire extinguishing systems using gaseous extinguishing agents;

— inertization of portable containers;

— systems in which oxygen levels are reduced for reasons other than fire prevention (e.g. steel processing in the presence of inert gas to avoid the formation of oxide film);

— inerting required during repair work on systems or equipment (e.g. welding) in order to eliminate the risk of fire or explosion.

In addition to the conditions for the actual oxygen reduction system and its individual components, this document also covers certain structural specifications for the protected area.

The space protected by an oxygen reduction system is a controlled and continuously monitored indoor climate for extended occupation. This document does not cover unventilated confined spaces that can contain hazardous gases.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 7240 (all parts), *Fire detection and alarm systems*

EN 12094-1, *Fixed firefighting systems — Components for gas extinguishing systems — Part 1: Requirements and test methods for electrical automatic control and delay devices*

EN 50104, *Electrical apparatus for the detection and measurement of oxygen — Performance requirements and test methods*

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3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
alarm threshold
value of a process parameter which, when reached, triggers an alarm and, where necessary, initiates automatic protection measures

3.2
design concentration
oxygen concentration level determined by subtraction of the safety margin from the ignition threshold

Note 1 to entry: See also Figure 1 and Table 2.

Note 2 to entry: The design concentration represents the maximum oxygen concentration which shall not be exceeded at any time.

3.3
combustible material
material capable of combustion or being ignited

Note 1 to entry: For the purposes of this document, whether the quantity of a combustible material is to be regarded as significant or not should be determined by means of a risk analysis as part of the fire protection design.

3.4
ignition threshold
maximum oxygen concentration in a mixture of a combustible material with air and inert gas, in which there can be no ignition, determined under established test conditions

Note 1 to entry: This is a specific characteristic of combustible material and inert gas (see A.1).

3.5
detection and alarm installation
remote detection system for the reliable detection of risk to people and property

3.6
measuring zones
virtual separation of the protected volume for oxygen measuring

3.7
normal operation
situation in which the equipment, protection systems and components are able to carry out their designated functions within their design parameters

3.8
oxygen reduced air
air with an oxygen concentration lower than that in normal atmospheric conditions

3.9
oxygen reduced air supply
nitrogen enriched air stream with an oxygen concentration lower than that in normal atmospheric conditions, ready to be introduced into a protected volume

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3.10
protected volume
space to be protected by oxygen reduction system

Note 1 to entry: Protected volume is measured in cubic meters.

3.11
system
combination of components whose function and compatibility guarantees the safety of the installation

3.12
technical area
area where the control panel, the nitrogen-enriched-air production unit and/or other relevant system components are placed

3.13
control panel
electrical device for monitoring, controlling and operating the alarm and other functions of the oxygen reduction system

4 System requirements

4.1 General

An oxygen reduction system shall consist at its minimum of:

a) a supply of oxygen reduced air;

b) a fixed pipework system with fittings, valves, nozzles, outlets;

c) oxygen sensors and control panel;

d) alarms.

Oxygen reduced air is produced by air separation or by injecting inert gas or gas mixture into the protected area.

The oxygen concentration in the protected area shall be monitored by means of measuring equipment. During operation, the supply of nitrogen-enriched air shall be controlled automatically according to demand. Where necessary, as a result of a risk analysis, additional means shall be provided to operate the supply manually or an additional supply operated manually or automatically.

The oxygen reduction system can be equipped with automatic equipment designed to shut down machinery and to close fire doors and other equipment, with the aim of creating and maintaining the required oxygen concentration.

The level of oxygen reduction is defined by the individual risks of these areas (see Annex A).

Individual components should comply with the relevant technical standards, if they exist.

Alternatively, for electrical/electronic/programmable electronic safety related systems, IEC 61508 (all parts) should be used.

4.2 Personnel safety

Oxygen reduced air can be dangerous for personnel within protected volumes, technical areas housing the oxygen reduction systems and adjacent areas.

Requirements for unventilated confined spaces do not necessarily apply to space protected by oxygen reduction systems that control and continuously monitor indoor climate for extended occupation.

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