



# SLOVENSKI STANDARD

## oSIST prEN 15004-1:2016

01-oktober-2016

---

**Vgrajeni gasilni sistemi - Sistemi za gašenje s plinom - 1. del: Načrtovanje, vgradnja in vzdrževanje (ISO 14520-1:2015, spremenjen)**

Fixed firefighting systems - Gas extinguishing systems - Part 1: Design, installation and maintenance (ISO 14520-1:2015, modified)

Ortsfeste Brandbekämpfungsanlagen - Löschanlagen mit gasförmigen Löschmitteln - Teil 1: Planung, Installation und Instandhaltung (ISO 14520-1:2015, modifiziert)

Installations fixes de lutte contre l'incendie - Installations d'extinction à gaz - Partie 1 : Calcul, installation et maintenance (ISO 14520-1:2015, modifiée)

**Ta slovenski standard je istoveten z: prEN 15004-1**

---

**ICS:**

13.220.10	Gašenje požara	Fire-fighting
-----------	----------------	---------------

**oSIST prEN 15004-1:2016**

**en,fr,de**



EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**DRAFT**  
**prEN 15004-1**

August 2016

ICS 13.220.20

Will supersede EN 15004-1:2008

English Version

**Fixed firefighting systems - Gas extinguishing systems -  
Part 1: Design, installation and maintenance (ISO 14520-  
1:2015, modified)**

Installations fixes de lutte contre l'incendie -  
Installations d'extinction à gaz - Partie 1 : Calcul,  
installation et maintenance (ISO 14520-1:2015,  
modifiée)

Ortsfeste Brandbekämpfungsanlagen - Löschanlagen  
mit gasförmigen Löschmitteln - Teil 1: Planung,  
Installation und Instandhaltung (ISO 14520-1:2015,  
modifiziert)

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 191.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

**Warning** : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

## Contents

Page

European foreword.....	7
Introduction .....	8
1 Scope .....	9
2 Normative references .....	10
3 Terms and definitions .....	10
4 Use and limitations.....	14
4.1 General.....	14
4.2 Extinguishants.....	15
4.2.1 Environmental properties .....	15
4.3 Electrostatic discharge.....	15
4.4 Compatibility with other extinguishants.....	15
4.5 Temperature limitations.....	16
5 Safety .....	16
5.1 Hazard to personnel.....	16
5.2 Safety precautions .....	16
5.2.1 General.....	16
5.2.2 For normally occupied areas .....	17
5.2.3 For normally unoccupied areas .....	18
5.2.4 For unoccupiable areas.....	18
5.3 Occupiable areas .....	18
5.4 Electrical hazards.....	19
5.5 Electrical earthing.....	20
5.6 Electrostatic discharge.....	20
6 System design .....	20
6.1 General.....	20
6.2 Extinguishant supply .....	20
6.2.1 Quantity .....	20
6.2.2 Quality.....	21
6.2.3 Container arrangement .....	21
6.2.4 Storage containers .....	21
6.3 Distribution .....	22
6.3.1 General.....	22
6.3.2 Piping.....	23
6.3.3 Fittings .....	23
6.3.4 Pipe and valve supports.....	24
6.3.5 Valves.....	25
6.3.6 Nozzles .....	25
6.3.7 Pressure reducing orifice assembly .....	26
6.4 Detection, actuation and control systems .....	26
6.4.1 General.....	26
6.4.2 Automatic detection.....	26
6.4.3 Operating devices .....	26
6.4.4 Control equipment.....	27
6.4.5 Operating alarms and indicators.....	27

6.4.6	Stop device .....	27
7	Extinguishant system design .....	28
7.1	General .....	28
7.2	Specifications, plans and approvals .....	28
7.2.1	Specifications .....	28
7.2.2	Working documents .....	28
7.3	System flow calculations .....	28
7.3.1	General .....	28
7.3.2	Balanced and unbalanced system .....	28
7.3.3	Friction losses .....	30
7.3.4	Pressure drop .....	30
7.3.5	Valves and fittings .....	31
7.3.6	Piping length .....	31
7.3.7	Drawings .....	31
7.3.8	Liquefied gases — Specific requirements .....	31
7.4	Enclosures .....	31
7.5	Extinguishant concentration requirements .....	31
7.5.1	Flame extinguishment .....	31
7.5.2	Inerting .....	33
7.6	Total flooding quantity .....	33
7.6.1	General .....	33
7.6.2	Liquefied gases .....	33
7.6.3	Non-liquefied gas .....	33
7.7	Altitude adjustment .....	34
7.8	Duration of protection .....	35
7.9	System performance .....	35
7.9.1	Discharge time .....	35
7.9.2	Extended discharge .....	36
8	Commissioning and acceptance .....	36
8.1	General .....	36
8.2	Tests .....	36
8.2.1	General .....	36
8.2.2	Enclosure check .....	36
8.2.3	Review of mechanical components .....	36
8.2.4	Review of enclosure integrity .....	37
8.2.5	Review of electrical components .....	38
8.2.6	Preliminary functional tests .....	38
8.2.7	System functional operational test .....	39
8.2.8	Remote monitoring operations (if applicable) .....	39
8.2.9	Control panel primary power source .....	39
8.2.10	Completion of functional tests .....	40
8.3	Completion certificate and documentation .....	40
9	Inspection, maintenance, testing and training .....	40
9.1	General .....	40
9.2	Inspection .....	40
9.2.1	General .....	40
9.2.2	Container .....	41
9.2.3	Hose .....	41
9.2.4	Enclosures .....	41
9.3	Maintenance .....	41
9.3.1	General .....	41
9.3.2	User's programme of inspection .....	41

9.3.3	Service schedule .....	42
9.4	Training .....	42
	<b>Annex A (normative) Working documents .....</b>	<b>43</b>
A.1	General .....	43
A.2	Working documents .....	43
A.3	Specific details .....	44
A.3.1	Pre-engineered systems .....	44
A.3.2	Engineered systems .....	44
	<b>Annex B (normative) Determination of flame-extinguishing concentration of gaseous extinguishants by the cup burner method .....</b>	<b>45</b>
B.1	General .....	45
B.2	Principle .....	45
B.3	Requirements for apparatus .....	45
B.3.1	General .....	45
B.3.2	Cup .....	46
B.3.3	Chimney .....	46
B.3.4	Diffuser .....	46
B.3.5	Fuel supply .....	46
B.3.6	Manifold .....	46
B.3.7	Air supply .....	46
B.3.8	Extinguishant supply .....	46
B.3.9	Delivery system .....	46
B.4	Requirements for materials .....	46
B.4.1	Air .....	46
B.4.2	Fuel .....	47
B.4.3	Extinguishant .....	47
B.5	Procedure for inflammable liquids .....	47
B.6	Procedure for inflammable gases .....	48
B.7	Extinguishant extinguishing concentration .....	48
B.7.1	Preferred method .....	48
B.7.2	Alternative method .....	49
B.8	Reporting of results .....	50
	<b>Annex C (normative) Fire extinguishment/area coverage fire test procedure for engineered and pre-engineered extinguishing units .....</b>	<b>51</b>
C.1	Requirements .....	51
C.2	Type of test and report of test results .....	51
C.2.1	Type of test .....	51

C.2.2	Reporting of test results.....	52
C.3	Extinguishing system.....	54
C.4	Extinguishing concentration .....	55
C.4.1	Extinguishing agent concentration .....	55
C.4.2	Cold discharge test.....	56
C.5	Nozzle distribution verification tests.....	57
C.5.1	Nozzle minimum height/maximum area coverage test.....	57
C.5.2	Nozzle maximum height test .....	64
C.6	Extinguishing concentration tests.....	66
C.6.1	Wood crib test.....	66
C.6.2	Heptane pan test.....	72
C.6.3	Polymeric sheet fire test .....	74
Annex D (normative)	Method of evaluating inerting concentration of a fire extinguishant.....	81
D.1	General .....	81
D.2	Principle.....	81
D.3	Apparatus.....	81
D.4	Procedure .....	81
D.5	Inerting concentration.....	82
Annex E (normative)	Door fan test for determining of minimum hold time .....	83
E.1	General .....	83
E.2	Test for determination of predicted hold time.....	83
E.2.1	Principle.....	83
E.2.2	Apparatus .....	84
E.2.3	Calibration and accuracy of apparatus .....	84
E.2.4	Preliminary preparation.....	84
E.2.5	Evaluation of enclosure.....	85
E.2.6	Measurement of enclosure.....	85
E.2.7	Test procedure .....	86
E.2.8	Calculation.....	90
E.3	Treatment of enclosures with predicted hold times less than the recommended value .....	97
E.3.1	General .....	97
E.3.2	Leakage areas.....	97
E.3.3	Improved sealing of the enclosure .....	98
E.3.4	Quantification and location of leaks .....	98
E.4	Report .....	99
Annex F (informative)	System performance verification .....	100

<b>Annex G (informative) Safe personnel exposure guidelines .....</b>	<b>101</b>
<b>G.1 General .....</b>	<b>101</b>
<b>G.2 Safety .....</b>	<b>101</b>
<b>G.3 Hazards to personnel — Potential hazards .....</b>	<b>101</b>
<b>G.3.1 Agent itself .....</b>	<b>101</b>
<b>G.3.2 Noise .....</b>	<b>101</b>
<b>G.3.3 Turbulence .....</b>	<b>101</b>
<b>G.3.4 Low temperature .....</b>	<b>101</b>
<b>G.4 Halocarbon agents .....</b>	<b>102</b>
<b>G.4.1 Toxicity of halocarbons (liquefied gases) .....</b>	<b>102</b>
<b>G.4.2 PBPK model .....</b>	<b>103</b>
<b>G.4.3 Safe exposure guidelines for halocarbons .....</b>	<b>104</b>
<b>G.5 Inert gas (non-liquefied gas) .....</b>	<b>106</b>
<b>G.5.1 Physiological effects of inert gas agents .....</b>	<b>106</b>
<b>G.5.2 Safe exposure guidelines for inert gas agents .....</b>	<b>106</b>
<b>Annex H (informative) Flow calculation implementation method and flow calculation verification and testing for approvals .....</b>	<b>108</b>
<b>H.1 General .....</b>	<b>108</b>
<b>H.2 Calculation method implementation .....</b>	<b>108</b>
<b>H.3 Minimum accuracy recommendations .....</b>	<b>109</b>
<b>H.3.1 Recommended design limits to be included inside the flow calculation method (software) .....</b>	<b>109</b>
<b>H.4 Recommended testing procedure for system flow calculation method (software) validation .....</b>	<b>109</b>
<b>H.4.1 General .....</b>	<b>109</b>
<b>H.4.2 System design for testing .....</b>	<b>110</b>
<b>H.5 Pass/fail criteria .....</b>	<b>111</b>
<b>Bibliography .....</b>	<b>112</b>



## European foreword

This document (prEN 15004-1:2016) has been prepared by Technical Committee CEN/TC 191 “Fixed firefighting systems”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 15004-2:2008.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association

The text of the International Standard ISO 14520-1:2015 from Technical Committee ISO/TC 21 “Equipment for fire protection and firefighting” of the International Organization for Standardization (ISO) has been taken over as a European Standard by Technical Committee CEN/TC 191 “Fixed firefighting systems”, the secretariat of which is held by BSI, with common modifications which are indicated by a straight line in the margin of the text.

This European Standard will consist of the following parts, under the general title *Fixed firefighting systems – Gas extinguishing systems*:

- *Part 1: Design, installation and maintenance;*
- *Part 2: Physical properties and system design of gas extinguishing systems for FK-5-1-12 extinguishant;*
- *Part 3: Physical properties and system design of gas extinguishing systems for HCFC Blend A extinguishant;*
- *Part 4: Physical properties and system design of gas extinguishing systems for HFC 125 extinguishant;*
- *Part 5: Physical properties and system design of gas extinguishing systems for HFC 227ea extinguishant;*
- *Part 6: Physical properties and system design of gas extinguishing systems for HFC 23 extinguishant;*
- *Part 7: Physical properties and system design of gas extinguishing systems for IG-01 extinguishant;*
- *Part 8: Physical properties and system design of gas extinguishing systems for IG-100 extinguishant;*
- *Part 9: Physical properties and system design of gas extinguishing systems for IG-55 extinguishant;*
- *Part 10: Physical properties and system design of gas extinguishing systems for IG-541 extinguishant.*

The International Standards ISO 14520-2 and ISO 14520-11, which dealt with CF<sub>3</sub>I and HFC 236fa extinguishants, respectively, have not been implemented by CEN, as CF<sub>3</sub>I is only valid for local application and HFC 236fa extinguishant is only applicable for portable fire extinguishers and local application, respectively, which is not covered by the scope.

## Introduction

Fire fighting systems covered in this part of EN 15004 are designed to provide a supply of gaseous extinguishing medium for the extinction of fire.

Several different methods of supplying extinguishant to, and applying it at, the required point of discharge for fire extinction have been developed in recent years, and there is a need for dissemination of information on established systems and methods. This part of EN 15004 has been prepared to meet this need.

The requirements of this part of EN 15004 are made in the light of the best technical data known to the working group at the time of writing but, since a wide field is covered, it has been impracticable to consider every possible factor or circumstance that might affect implementation of the recommendations.

It has been assumed in the preparation of this part of EN 15004 that the execution of its provisions is entrusted to people appropriately qualified and experienced in the specification, design, installation, testing, approval, inspection, operation and maintenance of systems and equipment, for whose guidance it has been prepared, and who can be expected to exercise a duty of care to avoid unnecessary release of extinguishant.

Attention is drawn to the Montreal Protocol on substances that deplete the ozone layer.

It is important that the fire protection of a building or plant be considered as a whole. Gaseous extinguishant systems form only a part, though an important part, of the available facilities, but it should not be assumed that their adoption necessarily removes the need to consider supplementary measures, such as the provision of portable fire extinguishers or other mobile appliances for first aid or emergency use, or to deal with special hazards.

Gaseous extinguishants have for many years been a recognized effective medium for the extinction of inflammable liquid fires and fires in the presence of electrical and ordinary Class A hazards, but it should not be forgotten, in the planning of comprehensive schemes, that there may be hazards for which these media are not suitable, or that in certain circumstances or situations there may be dangers in their use requiring special precautions.

Advice on these matters can be obtained from the appropriate manufacturer of the extinguishant or the extinguishing system. Information may also be sought from the appropriate fire authority, the health and safety authorities and insurers. In addition, reference should be made as necessary to other national standards and statutory regulations of the particular country.

It is essential that fire-fighting equipment be carefully maintained to ensure instant readiness when required. Routine maintenance is liable to be overlooked or given insufficient attention by the owner of the system. It is, however, neglected at peril to the lives of occupants of the premises and at the risk of crippling financial loss. The importance of maintenance cannot be too highly emphasized. Installation and maintenance should only be done by qualified personnel.

Inspection preferably by a third party, should include an evaluation that the extinguishing system continues to provide adequate protection for the risk (protected zones, as well as state of the art can change over time).

## 1 Scope

This part of EN 15004 specifies requirements and gives recommendations for the design, installation, testing, maintenance and safety of gaseous fire fighting systems in buildings, plants or other structures, and the characteristics of the various extinguishants and types of fire for which they are a suitable extinguishing medium.

It covers total flooding systems primarily related to buildings, plants and other specific applications, utilizing electrically non-conducting gaseous fire extinguishants that do not leave a residue after discharge and for which there are sufficient data currently available to enable validation of performance and safety characteristics by an appropriate independent authority. This part of EN 15004 is not applicable to explosion suppression.

This part of EN 15004 is not intended to indicate approval of the extinguishants listed therein by the appropriate authorities, as other extinguishants may be equally acceptable. CO<sub>2</sub> is not included as it is covered by other International Standards.

This part of EN 15004 is applicable to the extinguishants listed in Table 1. It is essential that it be used in conjunction with the separate parts of EN 15004 for specific extinguishants, as cited in Table 1.

**Table 1 — Listed extinguishant**

Extinguishant	Chemical	Formula	CAS No.	European Standard
FK-5-1-12	Dodecafluoro-2-methylpentan-3-one	CF <sub>3</sub> CF <sub>2</sub> C(O)CF(CF <sub>3</sub> ) <sub>2</sub>	756-13-8	EN 15004-2
HCFC Blend A				EN 15004-3
HCFC-123	Dichlorotrifluoroethane	CHCl <sub>2</sub> CF <sub>3</sub>	306-83-2	
HCFC-22	Chlorodifluoromethane	CHClF <sub>2</sub>	75-45-6	
HCFC-124	Chlorotetrafluoroethane	CFCIFCF <sub>3</sub>	2837-89-0	
	Isopropenyl-1-methylcyclohexene	C <sub>10</sub> H <sub>16</sub>	5989-27-5	
HFC 125	Pentafluoroethane	CHF <sub>2</sub> CF <sub>3</sub>	354-33-6	EN 15004-4
HFC 227ea	Heptafluoropropane	CF <sub>3</sub> CHFCF <sub>3</sub>	2252-84-8	EN 15004-5
HFC 23	Trifluoromethane	CHF <sub>3</sub>	75-46-7	EN 15004-6
IG-01	Argon	Ar	74040-37-1	EN 15004-7
IG-100	Nitrogen	N <sub>2</sub>	7727-37-9	EN 15004-8
	Nitrogen (50 %)	N <sub>2</sub>	7727-37-9	
IG-55	Argon (50 %)	Ar	74040-37-1	EN 15004-9
	Nitrogen (52 %)	N <sub>2</sub>	7727-37-9	
IG-541	Argon (40 %)	Ar	74040-37-1	EN 15004-10
	Carbon dioxide (8 %)	CO <sub>2</sub>	124-38-9	

## 2 Normative references

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

EN 2, *Classification of fires*

EN 54 (all parts), *Fire detection and fire alarm systems*

EN 12094 (all parts), *Fixed firefighting systems – Components for gas extinguishing systems*

EN 15004-2, *Fixed firefighting systems - Gas extinguishing systems - Part 2: Physical properties and system design of gas extinguishing systems for FK-5-1-12 extinguishant (ISO 14520-5:2006, modified)*

EN 15004-3, *Fixed firefighting systems - Gas extinguishing systems - Part 3: Physical properties and system design of gas extinguishing systems for HCFC Blend A extinguishant (ISO 14520-6:2006, modified)*

EN 15004-4, *Fixed firefighting systems - Gas extinguishing systems - Part 4: Physical properties and system design of gas extinguishing systems for HFC 125 extinguishant (ISO 14520-8:2006, modified)*

EN 15004-5, *Fixed firefighting systems - Gas extinguishing systems - Part 5: Physical properties and system design of gas extinguishing systems for HFC 227ea extinguishant (ISO 14520-9:2006, modified)*

EN 15004-6, *Fixed firefighting systems - Gas extinguishing systems - Part 6: Physical properties and system design of gas extinguishing systems for HFC 23 extinguishant (ISO 14520-10:2005, modified)*

EN 15004-7, *Fixed firefighting systems - Gas extinguishing systems - Part 7: Physical properties and system design of gas extinguishing systems for IG-01 extinguishant (ISO 14520-12:2005, modified)*

EN 15004-8, *Fixed firefighting systems - Gas extinguishing systems - Part 8: Physical properties and system design of gas extinguishing systems for IG-100 extinguishant (ISO 14520-13:2005, modified)*

EN 15004-9, *Fixed firefighting systems - Gas extinguishing systems - Part 9: Physical properties and system design of gas extinguishing systems for IG-55 extinguishant (ISO 14520-14:2005, modified)*

EN 15004-10, *Fixed firefighting systems - Gas extinguishing systems - Part 10: Physical properties and system design of gas extinguishing systems for IG-541 extinguishant (ISO 14520-15:2005, modified)*

## 3 Terms and definitions

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

### 3.1

#### **approved**

acceptable to a relevant authority

Note 1 to entry: See 3.2.

Note 2 to entry: In determining the acceptability of installations or procedures, equipment, or materials, the authority can base acceptance on compliance with the appropriate International Standards.

### 3.2

#### **authority**

organization, office, or individual responsible for approving equipment, installations, or procedures

**3.3****automatic/manual switch**

means of converting the system from automatic to manual actuation

Note 1 to entry: This can be in the form of a manual switch on the control panel or other units, or a personnel door interlock. In all cases, this changes the actuation mode of the system from automatic and manual to manual only or vice versa.

**3.4****competent person**

designated person, suitably trained, qualified by knowledge and practical experience and with the necessary instructions to enable the required tests and examinations to be carried out

**3.5****disable device**

manual shut-off valve installed into the discharge piping downstream of the agent containers; or another type of device that mechanically prevents agent container actuation

Note 1 to entry: The actuation of this device provides an indication of system isolation.

Note 2 to entry: The intent is to prevent the discharge of agent into the hazard area when the disable device is activated.

**3.6****extinguishant**

electrically non-conducting gaseous fire extinguishing agent that, upon evaporation, does not leave a residue

Note 1 to entry: See Table 1.

Note 2 to entry: The terms “extinguishant” and “agent” are used interchangeably throughout in this part of EN 15004.

**3.7****clearance**

air gap between equipment, including piping and nozzles and unenclosed or uninsulated live electrical components at other than ground potential

**3.8****concentration****3.8.1****design concentration**

concentration of extinguishant, including a safety factor, required for system design purposes

**3.8.2****maximum concentration**

concentration achieved from the actual extinguishant quantity at the maximum ambient temperature in the protected area

**3.8.3****extinguishing concentration**

minimum concentration of extinguishant required to extinguish a fire involving a particular fuel under defined experimental conditions excluding any safety factor

**3.9****engineered system**

system in which the supply of extinguishant stored centrally is discharged through a system of pipes and nozzles in which the size of each section of pipe and nozzle orifice has been calculated in accordance with relevant parts of EN 15004

**3.10****fill density**

mass of extinguishant per unit volume of container

**3.11****flooded quantity**

mass or volume of extinguishant required to achieve the design concentration within the protected volume

**3.12****net volume**

volume enclosed by the building elements around the protected enclosure, minus the volume of any permanent impermeable building elements within the enclosure

**3.13****hold time**

period of time during which a concentration of extinguishant greater than the fire extinguishing concentration surrounds the hazard

**3.14****inspection**

visual check to give reasonable assurance that the extinguishing system is fully charged and operable

Note 1 to entry: This is done by seeing that the system is in place, that it has not been activated or tampered with, and that there is no obvious physical damage or condition to prevent operation.

**3.15****installer**

legal person that is responsible for the design and installation and is able to ensure that the quality assurance is exercised

**3.16****lock-off device**

manual shut-off valve installed in the discharge piping downstream of the agent containers or another type of device that mechanically prevents agent container actuation

Note 1 to entry: The actuation of this device provides an indication of system isolation.

Note 2 to entry: The intent is to prevent the discharge of agent into the hazard area when the lock-off device is activated.

**3.17****lowest observed adverse effect level****LOAEL**

lowest concentration at which an adverse toxicological or physiological effect has been observed

**3.18****maintenance**

combination of all technical, administrative and managerial actions during the life cycle of an item intended to retain it in, or restore it to, a state in which it can perform the required function

**3.19****maximum working pressure**

equilibrium pressure within a container at the maximum working temperature

Note 1 to entry: For liquefied gases, this is at the maximum fill density and can include superpressurization.

Note 2 to entry: The equilibrium pressure for a container in transit can differ from that in storage within a building.

**3.20****no observed adverse effect level****NOAEL**

highest concentration at which no adverse toxicological or physiological effect has been observed

**3.21****non-liquefied gas**

gas or gas mixture (normally an inert gas), which, under service pressure and permissible service temperature conditions, is always present in the gaseous form

**3.22****normally occupied area**

area intended for occupancy

**3.23****normally unoccupied area**

area not normally occupied by people but which may be entered occasionally for brief periods

**3.24****pre-engineered systems**

system consisting of a supply of extinguishant of specified capacity coupled to pipework with a balanced nozzle arrangement up to a maximum permitted design

Note 1 to entry: No deviation is permitted from the limits specified by the manufacturer or authority.

**3.25****regulated system**

non-liquefied gas systems which produce a flow of gas at controlled reduced where the pressure downstream of a pressure regulation device is limited to some maximum pressure under both flow and no flow conditions during the discharge period

**3.26****safety factor**

multiplier of the agent extinguishing concentration to determine the agent minimum design concentration

**3.27****sea level equivalent of oxygen**

oxygen concentration (volume percent) at sea level for which the partial pressure of oxygen matches the ambient partial pressure of oxygen at a given altitude