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Gaseous fire-extinguishing systems — Physical properties and system design —

Part 1: General requirements

Systèmes d'extinction d'incendie utilisant des agents gazeux — Propriétés physiques et conception des systèmes —

Partie 1: Exigences générales

Reference number
ISO 14520-1:2023(E)

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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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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*.

This fourth edition cancels and replaces the third edition (ISO 14520-1:2015), which has been technically revised. It also cancels and replaces ISO/TR 23107:2021.

The main changes are as follows:

— the Scope has been extended to cover an additional agent, halocarbon blend 55;

— subclause 5.2.1 has been amended to require upper limit threshold concentrations to be established for any impurity that could result in acute toxicity at concentrations below the cardiac sensitization NOAEL of the agent. Subclause G.4.4 has also been added to provide further information on these requirements;

— a new subclause (6.4.4.2) has been added requiring that in the event of an electrical actuator being removed from a container valve or selector valve, an audible and visual alarm is to be provided at the control panel;

— subclause 7.4.1 has been amended to draw attention to ISO 21805;

— a new subclause (7.5) has been added providing guidance regarding the effects of noise that can be caused by the alarm devices or the discharge of the agent;

— subclause 7.6.1.3, (previously 7.5.1.3) has been amended to give several scenarios to explain the recommended selection of regular and high hazard design concentrations;

— Annex I has been added to reflect the content of the withdrawn document ISO/TR 12854;

— Annex J has been added to reflect the content of ISO/TR 23107 (to be withdrawn).

A list of all parts in the ISO 14520 series can be found on the ISO website.

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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

Firefighting systems covered in this document are designed to provide information on 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 document has been prepared to meet this need.

The requirements of this document 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 can potentially affect the implementation of the recommendations.

It has been assumed in the preparation of this document 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 and those that contribute towards climate change.

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

Gaseous extinguishants have been a recognized effective medium for the extinction of flammable liquid fires and fires in the presence of electrical and ordinary Class A hazards for many years. However, in the planning of comprehensive schemes, it should be remembered that these media are not suitable for all hazards. Additionally, in certain circumstances or situations there can be dangers relating to their use which require 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. Also, 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 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).

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Gaseous fire-extinguishing systems — Physical properties and system design —

Part 1: General requirements

1 Scope

This document specifies requirements and gives recommendations for the design, installation, testing, maintenance and safety of gaseous firefighting 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 document does not apply to explosion suppression.

This document is not intended to indicate approval of the extinguishants listed therein by the appropriate authorities, as other extinguishants can be equally acceptable. CO_2 is not included as it is covered by other International Standards.

This document applies to the extinguishants listed in Table 1. It is essential that it be used in conjunction with the separate parts of the ISO 14520 series for specific extinguishants, as cited in Table 1.

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Table 1 — Listed extinguishant

Extinguishant	Chemical	Formula	CAS No.	International Standard
FK-5-1-12	Dodecafluoro-2-methylpentan-3-one	$CF_3CF_2C(O)CF(CF_3)_2$	756-13-8	ISO 14520-5
HCFC-123	Dichlorotrifluoroethane	$CHCl_2CF_3$	306-83-2	
HCFC-22	Chlorodifluoromethane	$CHClF_2$	75-45-6	ISO 14520-6
HCFC-124	Chlorotetrafluoroethane	$CFClFCF_3$	2837-89-0	
	Isopropenyl-1-methylcyclohexene	$C_{10}H_{16}$	5989-27-5	
HFC 125	Pentafluoroethane	CHF_2CF_3	354-33-6	ISO 14520-8
HFC 227ea	Heptafluoropropane	CF_3CHFCF_3	2252-84-8	ISO 14520-9
HFC 23	Trifluoromethane	CHF_3	75-46-7	ISO 14520-10
IG-01	Argon	Ar	74040-37-1	ISO 14520-12
IG-100	Nitrogen	N_2	7727-37-9	ISO 14520-13
IG-55	Nitrogen (50 %)	N_2	7727-37-9	ISO 14520-14
	Argon (50 %)	Ar	74040-37-1	
IG-541	Nitrogen (52 %)	N_2	7727-37-9	ISO 14520-15
	Argon (40 %)	Ar	74040-37-1	
	Carbon dioxide (8 %)	CO_2	124-38-9	
Halocarbon Blend 55	E-1-chloro-3,3,3-trifluoropropene (50 % by mass)	$CF_3CHCHCl$	102687-65-0	ISO 14520-17
	Dodecafluoro-2-methylpentan-3-one (50% by mass)	$CF_3CF_2C(O)CF(CF_3)_2$	756-13-8	

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 14520-5:2019, *Gaseous fire-extinguishing systems — Physical properties and system design — Part 5: FK-5-1-12 extinguishant*

ISO 14520-8:2019, *Gaseous fire-extinguishing systems — Physical properties and system design — Part 8: HFC 125 extinguishant*

ISO 14520-9:2019, *Gaseous fire-extinguishing systems — Physical properties and system design — Part 9: HFC 227ea extinguishant*

ISO 14520-10:2019, *Gaseous fire-extinguishing systems — Physical properties and system design — Part 10: HFC 23 extinguishant*

ISO 14520-12:2015, *Gaseous fire-extinguishing systems — Physical properties and system design — Part 12: IG-01 extinguishant*

ISO 14520-13:2015, *Gaseous fire-extinguishing systems — Physical properties and system design — Part 13: IG-100 extinguishant*

ISO 14520-14:2015, *Gaseous fire-extinguishing systems — Physical properties and system design — Part 14: IG-55 extinguishant*

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ISO 14520-15:2015, *Gaseous fire-extinguishing systems — Physical properties and system design — Part 15: IG-541 extinguishant*

ISO 14520-17:2022, *Gaseous fire-extinguishing systems — Physical properties and system design — Part 17: Halocarbon Blend 55*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Terms and definitions

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

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

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

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

NOTE For the purposes of this document, the term "bar"[1)] is taken as "gauge", unless otherwise indicated. Concentrations or quantities expressed in percentages (%) are taken as by volume unless otherwise indicated.

3.1
approved
acceptable to a relevant *authority* (3.2)

Note 1 to entry: In determining the acceptability of installations or procedures, equipment, or materials, the authority can base acceptance on conformance 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
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 this document.

3.5
clearance
air gap between equipment, including piping and nozzles and unenclosed or uninsulated live electrical components at other than the ground potential

3.6 Terms relating to concentration

3.6.1
design concentration
concentration of extinguishant, including a safety factor, required for system design purposes

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1N/mm^2

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3.6.2
maximum concentration
concentration achieved from the actual extinguishant quantity at the maximum ambient temperature in the protected area

3.6.3
extinguishing concentration
minimum concentration of extinguishant required to extinguish a fire involving a particular fuel under defined experimental conditions excluding any safety factor

3.7
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 a specific method

Note 1 to entry: The specfic method used for calculating the size of each section of pipe and nozzle orifice is provided in Annex H.

3.8
fill density
mass of extinguishant per unit volume of the container

3.9
flooding quantity
mass or volume of extinguishant required to achieve the design concentration within the protected volume

3.10
net volume
volume enclosed by the building elements around the protected enclosure, minus the volume of any permanent impermeable building elements within the enclosure

3.11
hold time
period of time during which a concentration of extinguishant, not less than 85 % of the design concentration, surrounds the hazard

3.12
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.

3.13
liquefied gas
gas or gas mixture (normally a halocarbon), which is liquid at the container pressurization level at room temperature (20 °C)

3.14
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 indicates system isolation.

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

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3.15
lowest observed adverse effect level
LOAEL
lowest concentration at which an adverse toxicological or physiological effect has been observed

3.16
maintenance
thorough check, comprising a thorough examination and any necessary repair or replacement of system component, to give maximum assurance that the extinguishing system will operate as intended

3.17
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.

3.18
no observed adverse effect level
NOAEL
highest concentration at which no adverse toxicological or physiological effect has been observed

3.19
non-liquefied gas
gas or gas mixture (normally an inert gas), which, under normal service pressure and permissible service temperature conditions, is always present in the gaseous form

3.20
normally occupied area
area intended for occupancy

3.21
normally unoccupied area
area not normally occupied by people, but which can be entered occasionally for brief periods

3.22
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.

3.23
regulated system
non-liquefied gas system where the pressure downstream of a pressure regulation device is limited to some maximum pressure under both flow and no-flow conditions

3.24
safety factor
multiplier of the agent extinguishing concentration to determine the agent minimum design concentration

3.25
sea-level equivalent of the agent
agent concentration (volume percent) at sea level for which the partial pressure of agent matches the ambient partial pressure of agent at a given altitude

3.26
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

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3.27
selector valve
valve installed in the discharge piping downstream of the agent containers, to direct the agent to the appropriate hazard enclosure

Note 1 to entry: This is used where one or more agent containers are arranged to selectively discharge agent to any of several separate hazard enclosures.

3.28
superpressurization
addition of gas to the extinguishant container, where necessary, to achieve the required pressure for proper system operation

3.29
total flooding system
system arranged to discharge extinguishant into an enclosed space to achieve the appropriate design concentration

3.30
unoccupiable area
area that cannot be occupied due to dimensional or other physical constraints

EXAMPLE Shallow voids and cabinets.

4 Use and limitations

4.1 General

The design, installation, service and maintenance of gaseous fire-extinguishing systems shall be performed by those competent in fire extinguishing system technology. Maintenance and installation shall only be performed by qualified personnel and companies.

The hazards against which these systems offer protection, and any limitations on their use, shall be contained in the system supplier's design manual.

Total flooding fire-extinguishing systems are used primarily for protection against hazards that are in enclosures or equipment that, in itself, includes an enclosure to contain the extinguishant. The following are typical of such hazards, but the list is not exhaustive:

a) electrical and electronic hazards;

b) telecommunications facilities;

c) flammable and combustible liquids and gases;

d) other high-value assets.

4.2 Extinguishants

4.2.1 General

Any agent that is to be recognized by this document or proposed for inclusion in this document shall first be evaluated in accordance with Annex J. This is equivalent to the process used by the U.S. Environmental Protection Agency's (EPA) SNAP Program or other internationally recognized extinguishing agent approval institutions.

The extinguishants referred to in this document are electrically non-conductive media.

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