INTERNATIONAL STANDARD

ISO 6183

First edition
1990-07-01

Fire protection equipment — Carbon dioxide extinguishing systems for use on premises — Design and installation

Équipement de protection contre l'incendie — Installations fixes d'extinction par dioxyde de carbone utilisées dans les bâtiments — Conception et installation

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6183:1990
https://standards.iteh.ai/catalog/standards/sist/66c0b017-fdc6-46a0-aced-5aa62f922536/iso-6183-1990

Reference number
ISO 6183 : 1990 (E)

Contents

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6183:1990
https://standards.iteh.ai/catalog/standards/sist/66c0b017-fdc6-46a0-aced-5aa62f922536/iso-6183-1990

© ISO 1990
All rights reserved. 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 the publisher.

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Annexes

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6183:1990
https://standards.iteh.ai/catalog/standards/sist/66c0b017-fdc6-46a0-aced-5aa62f922536/iso-6183-1990

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.

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

International Standard ISO 6183 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting.*

ISO 6183:1990
https://standards.iteh.ai/catalog/standards/sist/06c0e017-fdc6-46a0-aced-5aa621922336/iso-6183-1990

This International Standard is one of a series providing recommendations and requirements for the design, installation and maintenance of fire extinguishing systems, in order that the system under consideration provides an adequate fire extinguishing capability. The related International Standards, to be published, include

ISO 6182, *Fire protection — Automatic sprinkler systems.*

ISO 7075, *Fire protection — Halogenated hydrocarbon extinguishing systems.*

ISO 7076, *Fire protection — Foam extinguishing systems.*

It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced personnel, for whose guidance it has been prepared.

Annexes A and B form an integral part of this International Standard. Annexes C and D are for information only.

Introduction

This International Standard is intended for use by those concerned with purchasing, designing, installing, testing, inspecting, approving, operating and maintaining carbon dioxide (CO_2) extinguishing systems, in order that such equipment will function as intended throughout its life.

Any automatic carbon dioxide fixed fire-extinguishing system designed and installed in accordance with this International Standard may be expected to be effective in operation and reasonably safe in relation to its role. However, in some countries other requirements may need to be met in order to satisfy national or local regulations. Before any installation is planned in detail, the position regarding national or local regulations should be checked. This can normally be done by reference to the authority having jurisdiction.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

This International Standard applies only to fixed fire-extinguishing systems in buildings and other premises on land. Although the general principles may well apply to other uses (e.g. maritime use), for these other uses additional considerations will almost certainly have to be taken into account and the application of the requirements in this International Standard is therefore unlikely to be fully satisfactory.

ISO 6183:1990
https://standards.iteh.ai/catalog/standards/sist/66e0b917-fbb6-46a0-be ef-5aa62f922536/iso-6183-1990

General information about carbon dioxide as an extinguishing medium is given in annex C. This may be useful background information for those unfamiliar with the characteristics of this medium.

This International Standard does not include requirements for pipe fittings, containers, flange bolting, flexible connectors and copper pipes and fittings: these requirements are covered in appropriate national standards.

It is a basic assumption of all technical standards work that each International Standard will be used only by persons competent in the field of application with which it deals. This is of particular importance in fire protection. Accordingly it is emphasized that the design requirements given are to be interpreted only by trained and experienced designers. Similarly, competent technicians should be used in the installation and testing of the equipment.

Unless otherwise stated, all pressures are gauge pressures, expressed in bars, with equivalent pressures in pascals.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
This page intentionally left blank
ISO 6183:1990
https://standards.iteh.ai/catalog/standards/sist/66c0b017-fdc6-46a0-aced-5aa62f922536/iso-6183-1990

Fire protection equipment — Carbon dioxide extinguishing systems for use on premises — Design and installation

1 Scope

This International Standard lays down requirements for the design and installation of fixed carbon dioxide fire-extinguishing systems for use on premises. The requirements are not valid for extinguishing systems on ships, in aircraft, on vehicles and mobile fire appliances or for below ground systems in the mining industry, nor are they valid for carbon dioxide preinerting systems.

Design of systems where unclosable opening(s) exceed a specified area and where the opening(s) may be subject to the effect of wind is not specified in this International Standard. General guidance on the procedure to be followed in such cases is, however, given in 15.6.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6183:1990
https://standards.iteh.ai/catalog/standards/sist/66c0b017-fdc6-46a0-aced-5aa62f922536/iso-6183-1990

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1182:1983, *Fire tests — Building materials — Non-combustibility test.*

ISO 4200:1985, *Plain and steel tubes, welded and seamless — General tables of dimensions and masses per unit length.*

ISO 5923:1984, *Fire protection — Fire extinguishing media — Carbon dioxide.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 carbon dioxide fire-extinguishing system: Fixed supply of carbon dioxide permanently connected to fixed piping and nozzles arranged to discharge carbon dioxide into the area being protected in such a manner that the design extinguishing concentration is achieved.

3.2 total flooding system: Fixed supply of carbon dioxide permanently connected to fixed piping with nozzles arranged to discharge carbon dioxide into an enclosed space or enclosure about the hazard so that the extinguishing concentration can be maintained.

3.3 local application system: Fixed supply of carbon dioxide permanently connected to fixed piping with nozzles arranged to discharge carbon dioxide directly on to the burning material or identified hazard.

3.4 automatic: Performing a function without the necessity of human intervention.

3.5 control device: Device to control the sequence of events leading to the release of carbon dioxide.

3.6 manual: Requiring human intervention to accomplish a function.

3.7 operating device: Any component involved between actuation of the system and the release of carbon dioxide.

3.8 release of carbon dioxide: Opening of container and selector valves leading to the physical discharge of carbon dioxide into the protected area.

3.9 inhibition time; holding time: Period during which the carbon dioxide at the design concentration surrounds the hazard.

3.10 authority having jurisdiction: Organization, office, or individual responsible for approving equipment, an installation, a procedure, or a system.

3.11 selector valve: Device for controlling the passage of carbon dioxide through a pipe manifold to direct it to a pre-selected area of protection.

4 Carbon dioxide

The extinguishing medium used shall be carbon dioxide complying with the requirements of ISO 5923.

Further information on carbon dioxide and its application is contained in annex C.

5 Safety requirements

In any proposed use of carbon dioxide extinguishing systems where there is a possibility that people may be trapped in or enter into the protected area, suitable safeguards shall be provided to ensure prompt evacuation of the area, to restrict entry into the area after discharge, except where necessary to provide means for prompt rescue of any trapped personnel. Such safety aspects as personnel training, warning signs, discharge alarms, and breaching apparatus shall be considered. The following requirements shall be taken into account:

a) provision of exit routes which shall be kept clear at all times and the provision of adequate direction signs;

b) provision of alarms within such areas that are distinctive from all other alarm signals and that will operate immediately upon detection of the fire and release of the carbon dioxide (see clause 6);

c) provision of only outward swinging self-closing doors which shall be openable from the inside even when locked from the outside;

d) provision of continuous visual and audible alarms at entrances, until the atmosphere has been made safe;

e) provision for adding an odour to the carbon dioxide so that hazardous atmospheres may be recognized;

f) provision of warning and instruction signs at entrances;

g) provision of self-contained breathing equipment and personnel trained in its use;

h) provision of a means of ventilating the areas after extinguishing the fire;

i) provision of any other safeguards that a careful study of each particular situation indicates are necessary.

6 Warning alarms

An audible alarm shall be provided on all total flooding systems, and on local flooding systems where dispersal of the carbon dioxide from the system into the room would give a concentration of more than 5 %. The alarm shall sound during any delay period between fire detection and discharge and throughout the discharge.

The sound intensity of the alarm described in 5 b) shall be such that it will be heard above the average local noise level; where this is abnormally high, visual indication shall also be provided.

Alarm devices shall be supplied from an energy source sufficient to allow continuous operation of the warning alarm for a minimum of 30 min.

NOTE — Alarms may not be necessary for local application systems, unless the quantity of carbon dioxide discharged relative to the room volume is capable of producing a concentration in excess of 5 %.

7 Automatic shut-down of plant equipment

Before, or simultaneously with, the release of a carbon dioxide system, all equipment capable of causing reignition of flammable material such as heating installations, gas burners, infrared lamps, etc. shall be automatically switched off.

8 Automatic pressure relief

Automatic pressure relief shall be provided at the highest point of any room which is tightly closed and which would otherwise be subjected to a dangerous increase of pressure when carbon dioxide is introduced.

NOTE — Leakage around doors, windows, ducts and dampers, though not apparent or easily determined, may provide sufficient venting relief for normal carbon dioxide systems without special provisions being made.

For otherwise airtight enclosures, the area necessary for free venting, X, (in square millimetres) may be calculated from the following equation:

$$X = 23{,}9 \frac{Q}{\sqrt{P}}$$

where

Q is the calculated carbon dioxide flow rate, in kilograms per minute;

P is the permissible strength (internal pressure) of enclosure (in bar).

In many instances, particularly when hazardous materials are involved, relief openings are already provided for explosion venting. These and other available openings often provide adequate venting.

9 Electrical earthing

Carbon dioxide extinguishing sysems shall be provided with adequate electrical earthing connections.

NOTE — Adequate earthing of the system will minimize the risk of electrostatic discharge. Where the system protects electrical installations, or is housed near or in a building with electrical installations, the system metalwork should be efficiently connected to the main earthing terminal of the electrical installation.

10 Precautions for low-lying parts of protected areas

Where it is possible for carbon dioxide gas to collect in pits, wells, shaft bottoms or other low-lying areas, consideration shall be given to adding an odoriferous substance to the carbon dioxide, and/or to providing additional ventilation systems to remove the carbon dioxide after discharage.

NOTE — The carbon dioxide should comply with the requirements of ISO 5923 after addition of any odoriferous substance (see clause 4).

For carbon dioxide container systems the odoriferous substance shall be introduced by proper means into the supply pipe to the protected zone.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6183:1990
https://standards.iteh.ai/catalog/standards/sist/06e9b017-fdc0-46a0-aeed-5aa62f922536/iso-6183-1990

11 Safety signs

For all total flooding systems, and those local application systems which may cause critical concentrations, a warning notice shall be displayed on the inside and outside of every door to the protected area.

The notice shall warn that, in case of alarm or discharge of carbon dioxide, personnel should leave the room immediately and not enter again before the room has been thoroughly ventilated because of the danger of suffocation.

12 Precautions during maintenance work

On automatic total flooding systems, protecting normally unoccupied rooms, provision shall be made for the prevention of automatic discharge during periods of entry by personnel where they may not be able to leave the room during any delay period (see clause 6).

NOTE — This precaution is not usually necessary for local application systems but should be provided where hazardous concentrations may be produced in any area which may be occupied.

13 Discharge testing where there may be explosive mixtures

iTeh STANDARD PREVIEW
(standards.iteh.ai)

In circumstances where explosive air/vapour mixtures may be present, the hazard area shall be carefully checked before test discharges are made, due to the possibility of ignition by electrostatic discharge.

ISO 6183:1990
https://standards.iteh.ai/catalog/standards/sist/06c06017-fdc0-46a0-aced-5aa62f922536/iso-6183-1990

14 Basis for design of carbon dioxide systems

The construction of the enclosures to be protected by total flooding carbon dioxide systems shall be such that the carbon dioxide cannot readily escape. The walls and doors shall be capable of withstanding the effects of the fire for a sufficient time so as to allow carbon dioxide discharge to be maintained at the design concentration during the inhibition time.

NOTE — ISO 834[1)] should be used for the assessment of fire resistance of elements of construction.

Where possible, openings shall be shut automatically and ventilation systems shall be shut down automatically before or at least simultaneously with the initiation of discharge of the carbon dioxide and remain closed.

Where openings cannot be shut and where there is an absence of walls and/or ceilings, additional carbon dioxide shall be provided as specified in 15.6.

When these openings are to the outside atmosphere, where wind conditions may greatly affect the carbon dioxide losses, special precautions should be taken. These cases shall be treated as a special application and may require a discharge test to determine that the proper design concentration has been obtained.

15 Design of total flooding systems

15.1 Factors to be considered

To determine the quantity of the carbon dioxide required, the volume of the room or of the enclosure to be protected shall be taken as a basis. From this volume only solid structural members such as foundations, columns, beams and the like shall be deducted.

The following shall be taken into account:

- room size;
- material to be protected;
- particular hazards;
- openings that cannot be shut;
- ventilation systems which cannot be shut down.

There shall be no openings in the floor.

15.2 Determination of carbon dioxide design quantity

The design quantity of carbon dioxide, m, in kilograms, shall be calculated using the following formula:

$$m = K_B \times (0{,}2\,A + 0{,}7\,V)$$

where

$$A = A_V = 30\,A_{OV}$$

$$V = V_V + V_Z - V_G$$

A_V is the total surface area of all sides, floor and ceiling (including the openings A_{OV}) of the enclosure to be protected, in square metres;

A_{OV} is the total surface area of all openings which can be assumed will be open in the event of a fire, in square metres (see 15.6);

V_V is the volume of the enclosure to be protected, in cubic metres (see 15.1);

V_Z is the additional volume removed during the inhibition time (see table 1) by ventilation systems which cannot be shut down, in cubic metres (see 15.5);

V_G is the volume of the building structure which can be deducted, in cubic metres (see 15.1);

1) ISO 834:1975, *Fire-resistance tests — Elements of building construction.*

K_B is the factor for the material to be protected which shall be equal to or greater than one (see 15.3 and table 1);

the number 0,2, in kilograms per square metre, comprises the portion of carbon dioxide that can escape;

the number 0,7, in kilograms per cubic metre, comprises the minimum quantity of carbon dioxide taken as a basis for the formula.

For calculation examples, see annex D.

NOTE — The two numbers 0,2 and 0,7 take into account the effect of room size, i.e. the ratio of the room volume (V_V) to room surface area (A_V).

15.3 K_B factor

The material factor K_B shown in table 1 shall be taken into account when designing for combustible materials and particular risks that require a higher than normal concentration.

K_B factors for hazards not listed in section A of table 1 shall be determined by using the cup burner apparatus described in annex C or other test method giving equivalent results.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

15.4 Effect of materials with formation of glowing embers

For materials with the formation of glowing embers there are special conditions to be considered. Table 1 gives examples of such materials.

ISO 6183:1990
https://standards.iteh.ai/catalog/standards/sist/...-46a0-aced-5aa62f922536/iso-6183-1990

15.5 Effect of ventilation system that cannot be shut down

To determine the quantity of carbon dioxide to be used, the volume of the room (V_V) shall be increased by the volume of the air (V_Z) which is charged into or expelled from the room whilst the room is being flooded with carbon dioxide and during the inhibition time stated in table 1.

15.6 Effect of openings (see introduction)

The effect of all openings, including explosion vents in walls and ceiling which will not be shut during a fire, are included in the formula in 15.2 by A_{OV}.

The porosity of the enclosure materials, or leaks around doors, windows, shutters, etc., shall not be considered as openings, as they are already included in the formula.

Openings are not permitted when an inhibition time is required unless additional carbon dioxide is applied to maintain the required concentration during the specified inhibition period.

When the ratio $R = A_{OV}/A_V > 0,03$ the system shall be designed as a local application system (see clause 16). This does not preclude the use of a local application system when R is less than 0,03.

When R is greater than 0,03 and where the openings may be subject to the effect of wind, then practical tests under the likely maximum adverse conditions should be carried out to the satisfaction of the authority having jurisdiction.

15.7 Simultaneous flooding of interconnected volumes

In two or more interconnected volumes where "free flow" of carbon dioxide can take place, or where the possibility of fire spread from one area to the other could occur, the carbon dioxide quantity shall be the sum of the quantities calculated for each volume. If one volume requires greater than normal concentration, the higher concentration shall be used in all interconnected volumes.

15.8 Duration of discharge

The time taken substantially to discharge the calculated design quantity of carbon dioxide, m (see 15.2), shall be in accordance with table 2. For fires involving solid materials, for example those listed in table 1 as requiring an inhibition time, the design quantity shall be discharged within 7 min but the rate shall be not less than that necessary to develop a concentration of 30 % in 2 min.

Table 1 — Material factors, design concentrations and inhibition times

Combustible material	Material factor K_B	Design CO_2 concentration %	Inhibition time min
A Fires involving gases and liquids [1]			
acetone	1	34	—
acetylene	2,57	66	—
aviation fuel grades 115/145	1,06	36	—
benzol, benzene	1,1	37	—
butadiene	1,26	41	—
butane	1	34	—
butene-1	1,1	37	—
carbon disulfide	3,03	72	—
carbon monoxide	2,43	64	—
coal or natural gas	1,1	37	—
cyclopropane	1,1	37	—
diesel fuel	1	34	—
dimethyl ether	1,22	40	—
dowtherm	1,47	46	—
ethane	1,22	40	—
ethyl alcohol	1,34	43	—
ethyl ether	1,47	46	—
ethylene	1,6	49	—
ethylene dichloride	1	34	—
ethylene oxide	1,8	53	—
gasoline	1	34	—
hexane	1,03	35	—
n-heptane	1,03	35	—
hydrogen	3,3	75	—
hydrogen sulfide	1,06	36	—
isobutane	1,06	36	—
isobutylene	1	34	—
isobutyl formate	1	34	—
JP-4	1,06	36	—
kerosene	1	34	—
methane	1	34	—
methyl acetate	1,03	35	—
methyl alcohol	1,22	40	—
methyl butane-I	1,06	36	—
methyl ethyl ketone	1,22	40	—
methyl formate	1,18	39	—
n-octane	1,03	35	—
pentane	1,03	35	—
propane	1,06	36	—
propylene	1,06	36	—
quench, lube oils	1	34	—
B Fires involving solid materials [2]			
cellulosic material	2,25	62	20
cotton	2	58	20
paper, corrugated paper	2,25	62	20
plastics material (granular)	2	58	20
polystyrene	1	34	—
polyurethane, cured only	1	34	—
C Special application cases			
cable rooms and cable ducts	1,5	47	10
data handling areas	2,25	62	20
electrical computer installations	1,5	47	10
electrical switch and distribution rooms	1,2	40	10
generators, including cooling systems	2	58	until stopped
oil filled transformers	2	58	—
output printing areas	2,25	62	20
paint spray and drying installations	1,2	40	—
spinning machines	2	58	—

1) The figures given are a compilation of information from Bureau of Mines, Limits of Flammability of Gases and Vapours, Bulletins 503 and 627.

2) Fire involving solid materials, usually of an organic nature in which combustion normally takes place with the formation of glowing embers.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6183:1990
https://standards.iteh.ai/catalog/standards/sist/66c0b017-fdc6-46d0-aced-5aa62f922536/iso-6183-1990