INTERNATIONAL STANDARD

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

Part 2: CF_3I extinguishant

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

Partie 2: Agent extincteur CF_3I

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 part of ISO 14520 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 14520-2 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 8, *Gaseous media fire extinguishing systems*.

ISO 14520 consists of the following parts, under the general title *Gaseous fire-extinguishing systems — Physical properties and system design*:

— *Part 1: General requirements*

— *Part 2: CF_3I extinguishant*

— *Part 3: FC-2-1-8 extinguishant*

— *Part 4: FC-3-1-10 extinguishant*

— *Part 6: HCFC Blend A extinguishant*

— *Part 7: HCFC 124 extinguishant*

— *Part 8: HCFC 125 extinguishant*

— *Part 9: HFC 227ea extinguishant*

— *Part 10: HFC 23 extinguishant*

— *Part 11: HFC 236fa extinguishant*

— *Part 12: IG-01 extinguishant*

— *Part 13: IG-100 extinguishant*

— *Part 14: IG-55 extinguishant*

— *Part 15: IG-541 extinguishant*

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

Part 2: CF_3I extinguishant

1 Scope

1.1 This part of ISO 14520 contains specific requirements for gaseous fire-extinguishing systems, with respect to the CF_3I extinguishant. It includes details of physical properties, specification, usage and safety aspects.

1.2 This part of ISO 14520 covers systems operating at a nominal pressure of 25 bar. This does not preclude the use of other systems.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this part of ISO 14520. For dated references, subsequent amendments to, or revisions of, this publication do not apply. However, parties to agreements based on this part of ISO 14520 are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 14520-1:2000, *Gaseous fire-extinguishing systems — Physical properties and system design — Part 1: General requirements*.

3 Terms and definitions

For the purposes of this part of ISO 14520, the terms and definitions given in ISO 14520-1 apply.

4 Characteristics and uses

4.1 General

Extinguishant CF_3I shall comply with the specification shown in Table 1.

CF_3I is a colourless, almost odourless, electrically non-conductive gas with a density approximately seven times that of air.

The physical properties are shown in Table 2.

CF_3I extinguishes fires mainly by chemical means but by some physical means.

Table 1 — Specification for CF_3I

Property	Requirement
Purity	99,9 % by mass, min.
Acidity	1×10^{-6} by mass, max.
Water content	6×10^{-6} by mass, max.
Non-volatile residue	100×10^{-6} by mass, max.
Suspended matter or sediment	None visible

Table 2 — Physical properties of CF_3I

Property	Units	Value
Molecular mass	—	195,9
Boiling point at 1,013 bar (absolute)	°C	–22,5
Freezing point	°C	–110
Critical temperature	°C	122
Critical pressure	bar abs	40,40
Critical volume	cm^3/mol	225,0
Critical density	kg/m^3	871
Vapour pressure 20 °C	bar abs	4,65
Liquid density 20 °C	kg/m^3	2 096
Saturated vapour density 20 °C	kg/m^3	8,051
Specific volume of superheated vapour at 1,013 bar and 20 °C	m^3/kg	0,124
Chemical formula	CF_3I	
Chemical name	Trifluoroiodomethane	

4.2 Use of CF_3I systems

CF_3I total flooding systems may be used for extinguishing fires of all classes within the limits specified in clause 4 of ISO 14520-1:2000.

The extinguishant requirements per volume of protected space are shown in Table 3 for various levels of concentration. These are based on methods shown in 7.6 of ISO 14520-1:2000.

The extinguishing concentrations and design concentrations for *n*-heptane and surface class A hazards are shown in Table 4. Concentrations for other fuels are shown in Table 5 and inerting concentrations are shown in Table 6.

Table 3 — CF_3I total flooding quantity

Temperature T °C	Specific volume S m³/kg	CF_3I mass requirements per unit volume of protected space m/V (kg/m³)							
		Design concentration (by volume)							
		3 %	4 %	5 %	6 %	7 %	8 %	9 %	10 %
–25	0,1013	0,3053	0,4113	0,5196	0,6301	0,7430	0,8584	0,9763	1,0969
–20	0,1038	0,2980	0,4014	0,5070	0,6149	0,7251	0,8377	0,9528	1,0704
–15	0,1063	0,2909	0,3920	0,4851	0,6005	0,7081	0,8180	0,9304	1,0453
–10	0,1088	0,2843	0,3830	0,4837	0,5867	0,6918	0,7992	0,9090	1,0212
–5	0,1113	0,2779	0,3744	0,4729	0,5735	0,6763	0,7813	0,8886	0.9983
0	0,1138	0,2718	0,3661	0,4625	0,5609	0,6614	0,7641	0,8691	0,9764
5	0,1163	0,2659	0,3583	0,4526	0,5488	0,6472	0,7477	0,8504	0,9554
10	0,1188	0,2603	0,3507	0,4430	0,5373	0,6336	0,7320	0,8325	0,9353
15	0,1213	0,2550	0,3436	0,4339	0,5262	0,6205	0,7169	0,8153	0,9160
20	0,1238	0,2498	0,3366	0,4251	0,5156	0,6080	0,7024	0,7989	0,8975
25	0,1263	0,2449	0,3299	0,4167	0,5054	0,5960	0,6885	0,7831	0,8797
30	0,1288	0,2401	0,3235	0,4086	0,4956	0,5844	0,6751	0,7679	0,8627
35	0,1313	0,2356	0,3173	0,4008	0,4861	0,5733	0,6623	0,7532	0,8462
40	0,1338	0,2311	0,3114	0,3934	0,4771	0,5625	0,6499	0,7392	0,8304
45	0,1363	0,2269	0,3057	0,3861	0,4683	0,5522	0,6380	0,7256	0,8152
50	0,1388	0,2228	0,3002	0,3792	0,4599	0,5423	0,6265	0,7125	0,8005
55	0,1413	0,2189	0,2949	0,3725	0,4517	0,5327	0,6154	0,6999	0,7863
60	0,1438	0,2151	0,2898	0,3660	0,4439	0,5234	0,6047	0,6878	0,7727
65	0,1463	0,2114	0,2848	0,3598	0,4363	0,5145	0,5944	0,6760	0,7595
70	0,1488	0,2078	0,2800	0,3537	0,4290	0,5058	0,5844	0,6647	0,7467
75	0,1513	0,2044	0,2754	0,3479	0,4219	0,4975	0,5747	0,6537	0,7344
80	0,1538	0,2011	0,2709	0,3422	0,4150	0,4894	0,5654	0,6431	0,7224
85	0,1563	0,1979	0,2666	0,3367	0,4084	0,4816	0,5563	0,6328	0,7109
90	0,1588	0,1948	0,2624	0,3314	0,4020	0,4740	0,5476	0,6228	0,6997
95	0,1613	0,1917	0,2583	0,3263	0,3957	0,4666	0,5391	0,6132	0,6888
100	0,1638	0,1888	0,2544	0,3213	0,3897	0,4595	0,5309	0,6038	0,6783

NOTE This information was supplied by Pacific Scientific Co., USA. It refers only to the product, Triodide™, and may not represent any other products containing CF_3I.

Symbols:

m/V is the agent mass requirements (kg/m³); i.e. mass, m, in kilograms of agent required per cubic metre of protected volume V to produce the indicated concentration at the temperature specified;

V is the net volume of hazard (m³); i.e the enclosed volume minus the fixed structures impervious to extinguishant

$$m = \left(\frac{c}{100 - c}\right)\frac{V}{S}$$

T is the temperature (°C); i.e. the design temperature in the hazard area;

S is the specific volume (m³/kg); the specific volume of superheated CF_3I vapour at a pressure of 1,013 bar may be approximated by the formula:

$$S = k_1 + k_2 T$$

where

k_1 = 0,113 8

k_2 = 0,000 5

c is the concentration (%); i.e. the volumetric concentration of CF_3I in air at the temperature indicated, and a pressure of 1,013 bar absolute.

Table 4 — CF_3I reference extinguishing and design concentrations

Fuel	Extinguishment %	Minimum design %
Heptane	3,0	3,9
Surface class A hazards [a]	Not available at this time	Not available at this time
NOTE Extinguishing values were derived using the NMERI standard cup burner method.		
[a] See 7.5.1.3 of ISO 14520-1:2000.		

Table 5 — CF_3I extinguishing and design concentrations for other fuels

Fuel	Extinguishment %	Minimum design %
Acetonitrile	1,7	2,2
Aviation gasoline	3,7	4,8
n-Butanol	3,3	4,3
n-Butyl acetate	2,5	3,3
Diesel No. 2	3,3	4,3
Ethanol	3,0	3,9
Ethyl acetate	3,0	3,9
Ethylene glycol	2,4	3,1
Gas (unleaded, 7,8 % ethanol)	3,6	4,7
Hydraulic fluid No. 1	2,3	3,0
JP-4	3,3	4,3
JP-5	3,2	4,2
Methane	2,0	2,6
Methanol	3,8	4,9
Methyl ethyl ketone	4,4	5,7
Methyl isobutyl ketone	2,9	3,8
Propane	3,0	4,3
Pyrrollidine	2,8	3,6
Turbo hydraulic oil 2380	2,1	2,7
Xylene	5,5	7,2
NOTE Extinguishing values were derived using the NMERI standard cup burner method.		

Table 6 — CF_3I inerting and design concentrations

Fuel	Inertion %	Minimum design %
Propane	6,5	7,2
NOTE Inerting concentrations were determined in accordance with the requirements of ISO 14520-1:2000, 7.5.2 and annex D.		

5 Safety of personnel

Any hazard to personnel created by the discharge of CF_3I shall be considered in the design of the system.

Potential hazards can arise from the following:

a) the extinguishant itself;

b) the combustion products of the fire; and

c) breakdown products of the extinguishant resulting from exposure to fire.

Toxicological information for CF_3I is shown in Table 7.

Since the design concentrations exceed the LOAEL under normal design conditions, CF_3I shall only be used for total flooding in normally unoccupied areas. For minimum safety requirements see ISO 14520-1:2000, clause 5.

Table 7 — Toxicological information for CF_3I

Property	Value %
LC_{50}	27,4
ALC	>12,8
No observed adverse effect level (NOAEL)	0,2
Lowest observed adverse effect level (LOAEL)	0,4
NOTE LC_{50} is the concentration lethal to 50 % of a rat population during a 15-min exposure. ALC is the approximate lethal concentration for a rat population during a 4-h exposure.	