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

Part 6: HCFC Blend A extinguishant

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

Partie 6: Agent extincteur HCFC mélange A

Reference number
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Foreword

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.

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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.

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International Standard ISO 14520-6 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 6: **HCFC Blend A extinguishant**

1 Scope

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

1.2 This part of ISO 14520 covers systems operating at nominal pressures of 25 bar or 42 bar, superpressurized with nitrogen. 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 HCFC Blend A shall comply with the specification shown in Table 1, and its components with the tolerances specified in Table 2.

HCFC Blend A is a colourless, electrically non-conductive gas with a citrus-like odour, with a density approximately three times that of air.

The physical properties are shown in Table 3.

HCFC Blend A extinguishes fires mainly by physical means but by some chemical means.

Table 1 — Specification for HCFC Blend A

Property	Requirement
Purity	99,6 % by mass, min.
Acidity	3×10^{-6} by mass, max.
Water content	10×10^{-6} by mass, max.
Non-volatile residue	0,01 % by mass, max.
Suspended matter or sediment	None visible

Table 2 — HCFC Blend A component specification

Component	**Tolerance** (by mass)
$CHCl_2CF_3$	± 0,5 %
$CHClF_2$	± 0,8 %
$CHClFCF_3$	± 0,9 %
$C_{10}H_{16}$	± 0,5 %

Table 3 — Physical properties of HCFC Blend A

Property	Units	Value
Molecular mass	—	92,9
Boiling point at 1,013 bar (absolute)	°C	–38,3
Freezing point	°C	< –107,2
Critical temperature	°C	125
Critical pressure	bar abs	66,50
Critical volume	cm^3/mol	170
Critical density	kg/m^3	580
Vapour pressure 20 °C	bar abs	8,25
Liquid density 20 °C	kg/m^3	1 200
Saturated vapour density 20 °C	kg/m^3	31
Specific volume of superheated vapour at 1,013 bar and 20 °C	m^3/kg	0,259
Chemical formulae	**Component**	**Percentage**
	$CHCl_2CF_3$	4,75 %
	$CHClF_2$	82 %
	$CHClFCF_3$	9,5 %
	$C_{10}H_{16}$	3,75 %

4.2 Use of HCFC Blend A systems

HCFC Blend A 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 4 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 5. Concentrations for other fuels are shown in Table 6 and inerting concentrations are shown in Table 7.

5 Safety of personnel

Any hazard to personnel created by the discharge of HCFC Blend 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.

Since the design concentration exceeds the LOAEL, HCFC Blend A shall be used only for total flooding in normally unoccupied areas. For minimum safety requirements, see ISO 14520-1:2000, clause 5.

Toxicological information for HCFC Blend A is shown in Table 8.

6 System design

6.1 Fill density

The fill density of the container shall not exceed the values given in Table 9 for 25 bar systems and Table 10 for 42 bar systems.

Exceeding the maximum fill density may result in the container becoming "liquid full", with the effect that an extremely high rise in pressure occurs with small increases in temperature, which could adversely affect the integrity of the container assembly.

The relationships between pressure and temperature are shown in Figures 1 and 2 for maximum fill density.

6.2 Superpressurization

Containers shall be superpressurized with nitrogen with a moisture content of not more than 60×10^{-6} by mass to an equilibrium pressure of (25 ± 1,25) bar and (42 ± 1,25) bar at a temperature of 20 °C.

6.3 Extinguishant quantity

The quantity of extinguishant shall be the minimum required to achieve the design concentration within the hazard volume at the minimum expected temperature, determined using Table 4 and the method specified in 7.6 of ISO 14520-1:2000.

The design concentrations shall be that specified for relevant hazards shown in Table 5. This includes at least a 1,3 safety factor on the extinguishing concentration.

Consideration should be given to increasing this for particular hazards, and seeking advice from the relevant authority.

Table 4 — HCFC Blend A total flooding quantity

Temperature T °C	Specific vapour volume S m³/kg	HCFC Blend A mass requirements per unit volume of protected space, m/V (kg/m³) Design concentration (by volume)									
		7 %	8 %	9 %	10 %	11 %	12 %	13 %	14 %	15 %	16 %
35	0,210	0,358	0,413	0,470	0,528	0,588	0,648	710	0,774	0,839	0,906
–30	0,215	0,351	0,405	0,461	0,517	0,576	0,635	696	0,758	0,822	0,887
–25	0,219	0,343	0,397	0,451	0,507	0,564	0,622	682	0,743	0,805	0,869
–20	0,224	0,337	0,389	0,442	0,497	0,553	0,610	668	0,728	0,790	0,852
–15	0,228	0,330	0,381	0,434	0,487	0,542	0,598	0,655	0,714	0,774	0,835
–10	0,232	0,324	0,374	0,426	0,478	0,532	0,587	0,643	0,700	0,760	0,819
–5	0,237	0,318	0,367	0,418	0,469	0,522	0,576	0,631	0,687	0,745	0,804
0	0,241	0,312	0,360	0,410	0,461	0,512	0,565	0,619	0,675	0,731	0,789
5	0,246	0,306	0,354	0,403	0,452	0,503	0,555	0,608	0,663	0,718	0,775
10	0,250	0,301	0,348	0,396	0,444	0,494	0,545	0,598	0,651	0,706	0,762
15	0,254	0,296	0,342	0,389	0,437	0,486	0,536	0,587	0,640	0,693	0,748
20	0,259	0,291	0,336	0,382	0,429	0,477	0,527	0,577	0,629	0,682	0,736
25	0,263	0,286	0,330	0,376	0,422	0,469	0,518	0,568	0,618	0,670	0,723
30	0,268	0,281	0,325	0,369	0,415	0,462	0,509	0,558	0,608	0,659	0,711
35	0,272	0,277	0,320	0,363	0,408	0,454	0,501	0,549	0,598	0,648	0,700
40	0,277	0,272	0,314	0,358	0,402	0,447	0,493	0,540	0,589	0,638	0,689
45	0,281	0,268	0,310	0,352	0,395	0,440	0,485	0,532	0,579	0,628	0,678
50	0,285	0,264	0,305	0,347	0,389	0,433	0,478	0,524	0,570	0,618	0,667
55	0,290	0,260	0,300	0,341	0,383	0,427	0,471	0,516	0,562	0,609	0,657
60	0,294	0,256	0,296	0,336	0,378	0,420	0,463	0,508	0,553	0,600	0,647
65	0,299	0,252	0,291	0,331	0,372	0,414	0,457	0,500	0,545	0,591	0,638
70	0,303	0,248	0,287	0,326	0,367	0,408	0,450	0,593	0,537	0,582	0,628
75	0,307	0,245	0,283	0,322	0,361	0,402	0,444	0,486	0,529	0,573	0,620
80	0,312	0,241	0,279	0,317	0,356	0,396	0,437	0,479	0,522	0,566	0,611
85	0,317	0,238	0,275	0,313	0,351	0,391	0,432	0,472	0,515	0,558	0,602
90	0,321	0,235	0,271	0,308	0,346	0,385	0,425	0,466	0,508	0,550	0,594
95	0,325	0,232	0,267	0,304	0,342	0,380	0,419	0,460	0,501	0,543	0,586

NOTE This information was supplied by the manufacturer, North American Fire Guardian Technology Ltd., Canada. It refers only to the product NAF S-III, and may not represent any other products containing HCFC Blend A.

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 HCFC Blend A vapour at a pressure of 1,013 bar may be approximated by the formula:

$$S = k_1 + k_2 T$$

where

$k_1 = 0{,}241\,3$

$k_2 = 0{,}000\,88$

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

Table 5 — HCFC Blend A reference extinguishing and design concentrations

Fuel	Extinguishment %	Minimum design %
Heptane	9,9	12,9
Surface class A hazard [a]	7,2	9,4
NOTE Values are based on the NMERI standard cup burner method, verified by ULC.		
[a] See 7.5.1.3 of ISO 14520-1:2000.		

Table 6 — HCFC Blend A extinguishing and design concentrations for other fuels

Fuel	Extinguishment %	Minimum design %
Acetone	9,5	12,4
Acetronitrile	7,0	10,9
Aviation gasoline	11,4	14,8
n-Butanol	12,2	15,9
n-Butyl acetate	9,8	12,7
Cyclohexane	9,9	12,9
Cyclohexanone	10,3	13,4
Diesel No. 2	9,6	12,5
Ethanol	11,0	14,3
Ethyl acetate	10,6	13,8
Ethylene glycol	11,4	14,8
Gas (unleaded, 7,8 ethanol)	9,8	12,7
Hexane	10,9	14,2
Hydraulic fluid No.1	9,6	12,5
Hydrogen	20,1	26,1
Isoctane	9,8	12,7
Isopropanol	10,6	13,8
JP-4	10,2	13,3
JP-5	9,0	11,7
Methane (gas)	13,7	17,8
Methanol	15,1	19,6
Methyl isobutyl ketone	9,4	12,2
Morpholine	13,7	17,8
Natural gas	12,4	16,1
Propane (gas)	12,6	16,4
Isopropanol	10,6	13,8
Pyrrollidine	10,1	13,1
Tetrahydrofuran	12,0	15,6
Toluene	7,0	9,1
Xylene	8,7	11,3
NOTE Extinguishing values were derived using the NMERI standard cup burner method.		