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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

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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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).

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For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 8, *Gaseous media and firefighting systems using gas*.

This third edition cancels and replaces the second edition (ISO 14520-6:2006), which has been technically revised with the following changes:

— changed the superpressurization value from 42 bar to 40 bar in Table 9 and Figure 2;

— added Clause 7.

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

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

Part 6:
HCFC Blend A extinguishant

1 Scope

This document 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.

This document covers systems operating at nominal pressures of 25 bar or 40 bar, superpressurized with nitrogen. This does not preclude the use of other systems.

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

3 Terms and definitions

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

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

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

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

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 and 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 also by some chemical means.

Table 1 — Specification for HCFC Blend A

Property	Requirement
Purity	99,6 % by mass, min.
Acidity	3×10^{-4} % by mass (3 parts per million), max.
Water content	10×10^{-4} % by mass (10 parts per million), 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 ISO 14520-1:2015, Clause 4.

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 ISO 14520-1:2015, 7.6.

The extinguishing concentrations and design concentrations for heptane and Surface Class A hazards are shown in Table 5. Inerting concentrations are shown in Table 6.

5 Safety of personnel

Any hazard to personnel created by the discharge of HCFC Blend A 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;

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

When 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 14520-1:2015, Clause 5.

Toxicological information for HCFC Blend A is shown in Table 7.

6 System design

6.1 Fill density

The fill density of the container shall not exceed the values given in Table 8 for 25 bar systems and Table 9 for 40 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^{-4} (60 parts per million) by mass to an equilibrium pressure of (25 ± 1,25) bar and (40 ± 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 ISO 14520-1:2015, 7.6.

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	**Specific vapour volume**	**HCFC Blend A mass requirements per unit volume of protected space,** m/V (kg/m³)									
T	S	**Design concentration** (by volume)									
°C	m³/kg	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	0,710	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

Table 4 *(continued)*

Temperature	**Specific vapour volume**	**HCFC Blend A mass requirements per unit volume of protected space**, m/V (kg/m³)									
T	S	**Design concentration** (by volume)									
°C	m³/kg	7 %	8 %	9 %	10 %	11 %	12 %	13 %	14 %	15 %	16 %
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 refers only to the product HCFC Blend A and does not represent any other products containing dichlorotrifluoroethane, chlorodifluoromethane, chlorotetrafluoroethane or isopropenyl-1-methyl-cyclohexane as components.

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 % by volume	Minimum design % by volume
Class B		
Heptane (cup burner)	10,0	13,0
Heptane (room test)	9,9	
Surface Class A		
Wood Crib	6,0	
PMMA	—	See Note 3
PP	—	
ABS	—	
Higher Hazard Class A	See Note 4	12,4

NOTE 1 The extinguishment values for the Class B and the Surface Class A fuels are determined by testing in accordance with ISO 14520-1:2015, Annexes B and C.

NOTE 2 The minimum design concentration for the Class B fuel is the higher value of the heptane cup burner or room test heptane extinguishment concentration multiplied by 1,3.

NOTE 3 The minimum design concentration for Surface Class A fuel is the highest value of the wood crib, PMMA, PP or ABS extinguishment concentrations multiplied by 1,3. In the absence of any of the four extinguishment values, the minimum design concentration for Surface Class A is that of Higher Hazard Class A.

NOTE 4 The minimum design concentration for Higher Hazard Class A fuels is the higher of the Surface Class A or 95 % of the Class B minimum design concentration.

NOTE 5 See ISO 14520-1:2015, 7.5.1.3 for guidance on Class A fuels.

In Table 5, the extinguishing and design concentrations for room-scale test fires are for informational purposes only. Lower and higher extinguishing concentrations than those shown for room-scale test fires may be achieved and allowed when validated by test reports from internationally recognized laboratories.

Table 6 — HCFC Blend A inerting and design concentrations

Fuel	Inertion % by volume	Minimum design % by volume
Methane	18,6	20,5
Propane	18,3	20,1
1,1-Difluoroethane (HFC-152a)	13,6	15,0
Difluoromethane (HFC-32)	8,6	9,5
Isobutane	18,4	20,2

NOTE Inerting concentrations were derived in accordance with the requirements of ISO 14520-1:2015, 7.5.2 and Annex D.

Table 7 — Toxicological information for HCFC Blend A

Property	Value % by volume
4 h LC_{50}	64
No observed adverse effect level (NOAEL)	10
Lowest observed adverse effect level (LOAEL)	>10

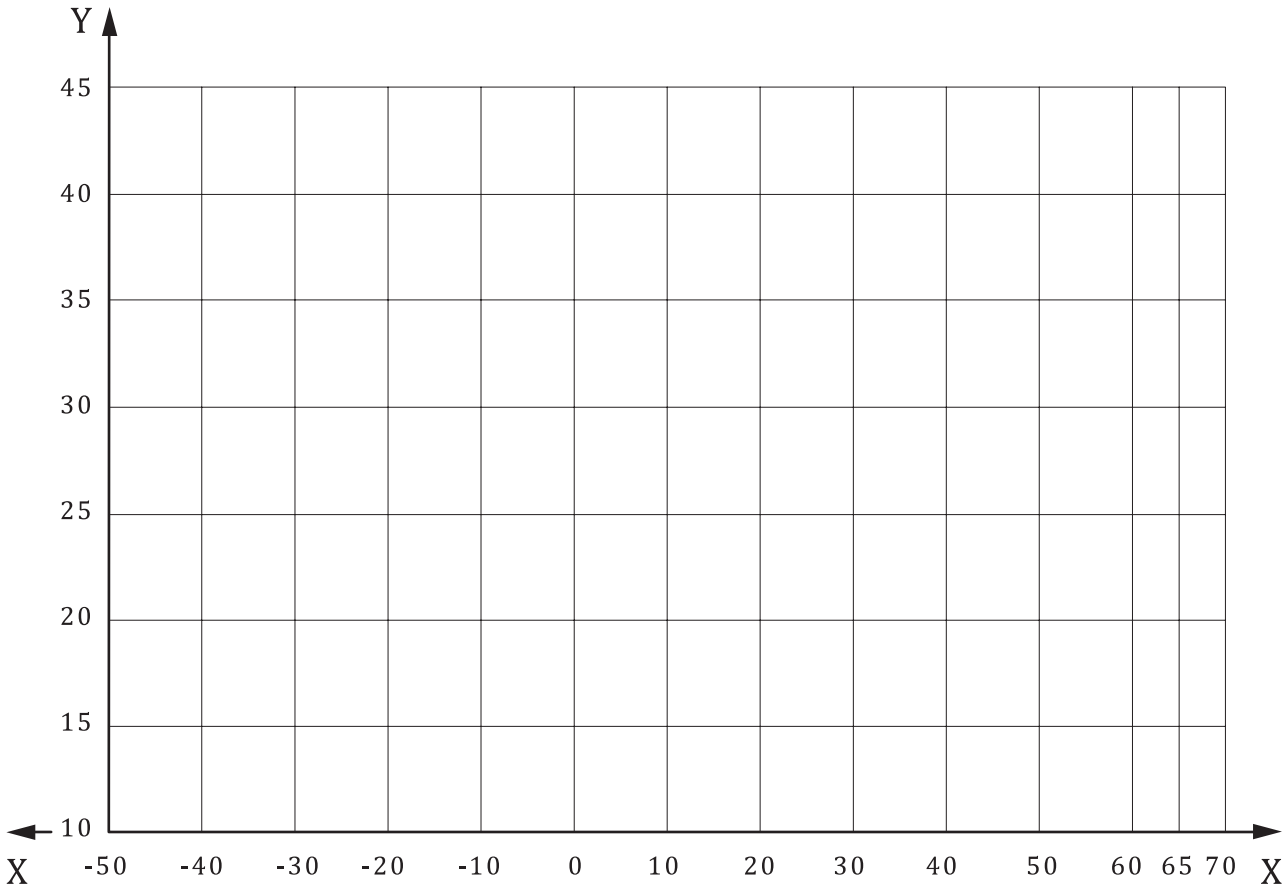
NOTE 4 h LC_{50} is the approximate concentration lethal to 50 % of a rat population during a 4 h exposure.

Table 8 — 25 bar storage container characteristics for HCFC Blend A

Property	Unit	Value
Maximum fill density	kg/m^3	900
Maximum container working pressure at 50 °C	bar	35
Superpressurization at 20 °C	bar	25
NOTE Reference should be made to Figure 1 for further data on pressure/temperature relationships.		

Table 9 — 40 bar storage container characteristics for HCFC Blend A

Property	Unit	Value
Maximum fill density	kg/m^3	900
Maximum container working pressure at 50 °C	bar	53
Superpressurization at 20 °C	bar	40
NOTE Reference should be made to Figure 2 for further data on pressure/temperature relationships.		

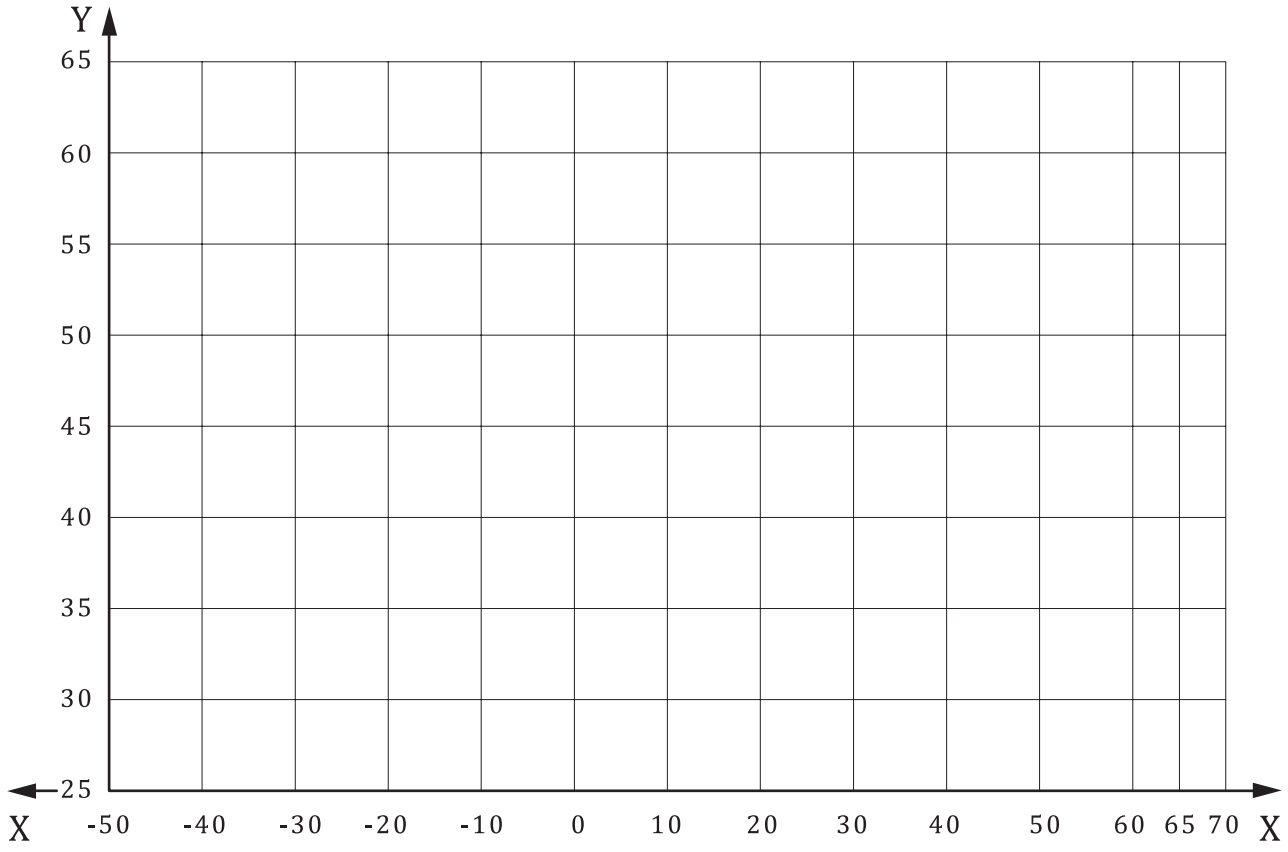


Key

X temperature, °C

Y pressure, bar

Figure 1 — Temperature/pressure graph for HCFC Blend A pressurized with nitrogen to 25 bar at 20 °C



Key

X temperature, °C

Y pressure, bar

Figure 2 — Temperature/pressure graph for HCFC Blend A pressurized with nitrogen to 40 bar at 20 °C

7 Environmental properties

For information purposes, environmental properties of HCFC Blend A extinguishant are provided:

GWP (100 years ITH)	1 550
ODP	0,048

NOTE 1 See ISO 14520-1:2015, 4.2.1 for a discussion of GWP values and their relation to the impact of a gas on climate change/global warming.

NOTE 2 Environmental properties were derived from the following:

— 2005 IPCC/TEAP Special Report Safeguarding the Ozone Layer and the Global Climate System: Issues Related to Hydrofluorocarbons and Perfluorocarbons;

— 2007 Fourth Assessment Report of the Intergovernmental Panel on Climate Change;

— U.S. EPA.

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