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Vgrajeni gasilni sistemi - Sistemi za gašenje s plinom - 3. del: Fizikalne lastnosti in načrtovanje sistema za gašenje s plinom za gasilo HCFC, mešanica A

Fixed firefighting systems - Gas extinguishing systems - Part 3: Physical properties and system design of gas extinguishing systems for HCFC Blend A extinguishant

Ortsfeste Brandbekämpfungsanlagen - Löschanlagen mit gasförmigen Löschmitteln - Teil 3: Physikalische Eigenschaften und Anlagenauslegung für Feuerlöschmittel HCFC/A

Installations fixes de lutte contre l'incendie - Installations d'extinction à gaz - Partie 3: Propriétés physiques et conception des systèmes pour agent extincteur HCFC, mélange A

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Contents

Foreword

This document (prEN 15004-3:2014) has been prepared by Technical Committee CEN/TC 191 “Fixed firefighting systems”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 15004-3:2008.

EN 15004 consists of the following parts, under the general title Fixed firefighting systems – Gas extinguishing systems:

— *Part 1: Design, installation and maintenance”*

— *Part 2: Physical properties and system design of gas extinguishing systems for FK-5-1-12 extinguishant”*

— *Part 3: Physical properties and system design of gas extinguishing systems for HCFC Blend A extinguishant”*

— *Part 4: Physical properties and system design of gas extinguishing systems for HFC 125 extinguishant”*

— *Part 6: Physical properties and system design of gas extinguishing systems for HFC 23 extinguishant”*

— *Part 7: Physical properties and system design of gas extinguishing systems for IG-01 extinguishant “*

— *Part 8: Physical properties and system design of gas extinguishing systems for IG-100 extinguishant”*

— *Part 9: Physical properties and system design of gas extinguishing systems for IG-55 extinguishant”*

— *Part 10: Physical properties and system design of gas extinguishing systems for IG-541 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 references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 15004-1, *Gaseous fire-extinguishing systems — Physical properties and system design — Part 1: General requirements.*

3 Terms and definitions

For the purposes of this part of EN 15004, the terms and definitions given in EN 15004-1 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 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 (3ppm), max.
Water content	10×10^{-4} % by mass (10ppm), 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 EN 15004-1.

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 EN 15004-1.

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 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.

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, 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 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 x 10^{-4} % (60ppm) 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 EN 15004-1.

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	Specific vapour volume S	HCFC Blend A mass requirements per unit volume of protected space, m/V (kg/m^3)									
		Design concentration (by volume)									
°C	m^3/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
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-methylcyclohexane as components.

Symbols:

m/V is the agent mass requirements (kg/m^3); 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 (m^3); 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 (m^3/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) Heptane (room test)	 10,0 9,9	 13,0
Surface Class A Wood Crib PMMA PP ABS	 6,0 - - -	 See Note 3
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 Annexes B and C of EN 15004-1.

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 4 extinguishment values, the minimum design concentration for Surface Class A shall be that of Higher Hazard Class A.

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

NOTE 5 See 7.5.1.3 of EN 15004-1 for guidance on Class A fuels.

NOTE 6 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 EN15004-1, Section 7.5.2 and Annex D.