



SLOVENSKI STANDARD
oSIST prEN 15004-6:2015
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Vgrajeni gasilni sistemi - Sistemi za gašenje s plinom - 6. del: Fizikalne lastnosti in načrtovanje sistema za gašenje s plinom za gasilo HFC 23

Fixed firefighting systems - Gas extinguishing systems - Part 6: Physical properties and system design of gas extinguishing systems for HFC 23 extinguishant

Ortsfeste Brandbekämpfungsanlagen - Löschanlagen mit gasförmigen Löschmitteln - Teil 6: Physikalische Eigenschaften und Anlagenauslegung für Feuerlöschmittel HFC 23

Installations fixes de lutte contre l'incendie - Installations d'extinction à gaz - Partie 6: Propriétés physiques et conception des systèmes pour agent extincteur HFC 23

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Fixed firefighting systems - Gas extinguishing systems - Part 6: Physical properties and system design of gas extinguishing systems for HFC 23 extinguishant

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gasförmigen Löschmitteln - Teil 6: Physikalische
Eigenschaften und Anlagenauslegung für Feuerlöschmittel
HFC 23

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 191.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Foreword

This document (prEN 15004-6:2014) 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 15004-6:2008.

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*”

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prEN 15004-6:2014 (E)**1 Scope**

This part of EN 15004 contains specific requirements for gaseous fire-extinguishing systems, with respect to the HFC 23 extinguishant. It includes details of physical properties, specification, usage and safety aspects and is applicable to systems operating at a nominal pressure of 41 bar without nitrogen superpressurization and 70 bar superpressurized with nitrogen.

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 HFC 23 shall comply with the specification shown in Table 1.

HFC 23 is a colourless, almost odourless, electrically non-conductive gas with a density approximately 2,4 times that of air.

The physical properties are shown in Table 2.

HFC 23 extinguishes fires mainly by physical means, but by some chemical means.

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Table 1 — Specification for HFC 23

Property	Requirement
Purity	99,6 % (mol/mol), 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 — Physical properties of HFC 23

Property	Units	Value
Molecular mass	—	70
Boiling point at 1,013 bar (absolute)	°C	-82,0
Freezing point	°C	-155,2
Critical temperature	°C	25,9
Critical pressure	bar abs	48,36
Critical volume	cm ³ /mol	133
Critical density	kg/m ³	525
Vapour pressure 20 °C	bar abs	41,80
Liquid density 20 °C	kg/m ³	806,6
Saturated vapour density 20 °C	kg/m ³	263,0
Specific volume of superheated vapour at 1,013 bar and 20 °C	m ³ /kg	0,3409
Chemical formula	CHF ₃	
Chemical name	Trifluoromethane	

4.2 Use of HFC 23 systems

HFC 23 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 3 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 n-heptane and surface class A hazards are shown in Table 4. Concentrations for acetone heptane, methanol and toluene are shown in Table 5, and inerting concentrations are shown in Table 6.

Table 3 — HFC 23 total flooding quantity

Temperature <i>T</i> °C	Specific vapour volume <i>S</i> m ³ /kg	HCFC 125 mass requirements per unit volume of protected space, <i>m/V</i> (kg/m ³)									
		Design concentration (by volume)									
		7%	8%	9%	10%	11%	12%	13%	14%	15%	16%
-60	0,2428	0,4576	0,5616	0,6705	0,7268	0,7845	0,8436	0,9041	1,0297	1,1617	1,3006
-55	0,2492	0,4459	0,5472	0,6533	0,7081	0,7644	0,8219	0,8809	1,0032	1,1318	1,2672
-50	0,2555	0,4349	0,5337	0,6371	0,6907	0,7455	0,8016	0,8591	0,9785	1,1039	1,236
-45	0,2617	0,4246	0,5211	0,6221	0,6743	0,7278	0,7826	0,8388	0,9553	1,0778	1,2067
-40	0,268	0,4146	0,5088	0,6074	0,6585	0,7107	0,7643	0,8191	0,9328	1,0524	1,1783
-35	0,2742	0,4052	0,4973	0,5937	0,6436	0,6947	0,747	0,8006	0,9117	1,0286	1,1517
-30	0,2803	0,3964	0,4865	0,5808	0,6296	0,6795	0,7307	0,7831	0,8919	1,0062	1,1266
-25	0,2865	0,3878	0,476	0,5682	0,616	0,6648	0,7149	0,7662	0,8726	0,9845	1,1022
-15	0,2987	0,372	0,4565	0,545	0,5908	0,6377	0,6857	0,7349	0,837	0,9443	1,0572
-10	0,3047	0,3647	0,4475	0,5343	0,5792	0,6251	0,6722	0,7204	0,8205	0,9257	1,0364
-5	0,3108	0,3575	0,4388	0,5238	0,5678	0,6129	0,659	0,7063	0,8044	0,9075	1,0161
0	0,3168	0,3507	0,4304	0,5139	0,557	0,6013	0,6465	0,6929	0,7891	0,8903	0,9968
5	0,3229	0,3441	0,4223	0,5042	0,5465	0,5899	0,6343	0,6798	0,7742	0,8735	0,978
10	0,3289	0,3378	0,4146	0,495	0,5365	0,5791	0,6227	0,6674	0,7601	0,8576	0,9601
15	0,3349	0,3318	0,4072	0,4861	0,5269	0,5688	0,6116	0,6555	0,7465	0,8422	0,9429
20	0,3409	0,3259	0,4	0,4775	0,5177	0,5587	0,6008	0,6439	0,7334	0,8274	0,9263
25	0,3468	0,3204	0,3932	0,4694	0,5089	0,5492	0,5906	0,633	0,7209	0,8133	0,9106
30	0,3528	0,3149	0,3865	0,4614	0,5002	0,5399	0,5806	0,6222	0,7086	0,7995	0,8951
35	0,3588	0,3097	0,3801	0,4537	0,4918	0,5309	0,5708	0,6118	0,6968	0,7861	0,8801
40	0,3647	0,3047	0,3739	0,4464	0,4839	0,5223	0,5616	0,6019	0,6855	0,7734	0,8659
45	0,3707	0,2997	0,3679	0,4391	0,476	0,5138	0,5525	0,5922	0,6744	0,7609	0,8519
50	0,3766	0,295	0,3621	0,4323	0,4686	0,5058	0,5439	0,5829	0,6638	0,7489	0,8385
55	0,3826	0,2904	0,3564	0,4255	0,4612	0,4978	0,5353	0,5737	0,6534	0,7372	0,8254
60	0,3885	0,286	0,351	0,419	0,4542	0,4903	0,5272	0,565	0,6435	0,726	0,8128
65	0,3944	0,2817	0,3457	0,4128	0,4474	0,483	0,5193	0,5566	0,6339	0,7151	0,8007
70	0,4004	0,2775	0,3406	0,4066	0,4407	0,4757	0,5115	0,5482	0,6244	0,7044	0,7887

NOTE This information refers only to the product HFC-23, and does not represent any other products containing trifluoromethane as a component.

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

$$S = k_1 + k_2 T$$

where

$$k_1 = 0,3164$$

$$k_2 = 0,0012$$

c is the concentration (%); i.e. the volumetric concentration of HCFC 23 in air at the temperature indicated, and a pressure of 1,013 bar.

Table 4 — HFC 23 reference extinguishing and design concentrations

Fuel	Extinguishment % by volume	Minimum design % by volume
Class B		
Heptane (cup burner)	12,6	16,4
Heptane (room test)	12,3	
Surface class A		
Wood Crib	10,5	16,3
PMMA	12,5	
PP	12,5	
ABS	12,4	
Higher Hazard Class A	See Note 4	16,3

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 5 — HFC 23 extinguishing and design concentrations for other fuels

Fuel	Extinguishment % by volume	Minimum design % by volume
Acetone	13,2	17,2
Ethanol	16,1	20,9
Ethyl acetate	13,4	17,4
Kerosene	13,2	17,2
Methanol	18,2	23,7
Propane	14,2	18,5
Toluene	12,6	16,4

NOTE Extinguishing concentrations for all Class B fuels listed were derived in accordance with EN 15004 -1, Annex B.

Minimum design values have been increased to the minimum design concentration established for heptane in accordance with EN 15004-1, section 7.5.1.

Table 6 — HFC 23 inerting and design concentrations

Fuel	Extinguishment % by volume	Minimum design % by volume
Methane	20,2	22,2
Propane	20,2	22,2

NOTE Inerting concentrations were derived in accordance with the requirements of EN 15004-1, Annex D and 7.5.2.

5 Safety of personnel

Any hazard to personnel created by the discharge of HFC 23 shall be considered in the design of the system.

Potential hazards can arise from the following:

- the extinguishant itself;
- the combustion products of the fire; and
- breakdown products of the extinguishant resulting from exposure to fire.

For minimum safety requirements see EN 15004-1, clause 5.

Toxicological information for HFC 23 is shown in Table 7.

Table 7 — Physiological information for IG-55

Property	Value
ALC	>65
No observed adverse effect level (NOAEL)	30
Lowest observed adverse effect level (LOAEL)	>30

NOTE ALC is the approximate lethal concentration for a rat population during a 4-h exposure.