



SLOVENSKI STANDARD
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Vgrajeni gasilni sistemi - Sistemi za gašenje s plinom - 5. del: Fizikalne lastnosti in načrtovanje sistema za gašenje s plinom za gasilo HFC 227 ea

Fixed firefighting systems - Gas extinguishing systems - Part 5: Physical properties and system design of gas extinguishing systems for HFC 227ea extinguishant

Ortsfeste Brandbekämpfungsanlagen - Löschanlagen mit gasförmigen Löschmitteln - Teil 5: Physikalische Eigenschaften und Anlagenauslegung für Feuerlöschmittel HFC 227a

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Installations fixes de lutte contre l'incendie - Installation d'extinction à gaz - Partie 5: Propriétés physiques et conception des systèmes pour agent extincteur HFC 227ea

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Fixed firefighting systems - Gas extinguishing systems - Part 5: Physical properties and system design of gas extinguishing systems for HFC 227ea extinguishant

Installations fixes de lutte contre l'incendie - Installation
d'extinction à gaz - Partie 5: Propriétés physiques et
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gasförmigen Löschmitteln - Teil 5: Physikalische
Eigenschaften und Anlagenauslegung für Feuerlöschmittel
HFC 227a

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 15004-5:2014) 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 15004-5:2008.

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”*

prEN 15004-5:2014 (E)**1 Scope**

1.1 This part of EN 15004 contains specific requirements for gaseous fire-extinguishing systems, with respect to the HFC 227ea extinguishant. It includes details of physical properties, specification, usage and safety aspects.

1.2 This part of EN 15004 covers systems operating at nominal pressures of 25 bar, 42 bar and 50 bar with nitrogen propellant. 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 HFC 227ea shall comply with the specification shown in Table 1.

HFC 227ea is a colourless, almost odourless, electrically non-conductive gas, with a density approximately six times that of air.

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The physical properties are shown in Table 2.

HFC 227ea extinguishes fires mainly by physical means but by some chemical means.

Table 1 — Specification for HFC 227ea

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 — Physical properties of HFC 227ea

Property	Units	Value
Molecular mass	—	170
Boiling point at 1,013 bar (absolute)	°C	-16,4
Freezing point	°C	-127
Critical temperature	°C	101,7
Critical pressure	bar abs	29,26
Critical volume	cm ³ /mol	274
Critical density	kg/m ³	573
Vapour pressure 20 °C	bar abs	3,90
Liquid density 20 °C	kg/m ³	1 410
Saturated vapour density 20 °C	kg/m ³	31,035
Specific volume of superheated vapour at 1,013 bar and 20 °C	m ³ /kg	0,1374
Chemical formula	CF ₃ CHFCF ₃	
Chemical name	Heptafluoropropane	

4.2 Use of HFC 227ea systems

HFC 227ea 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 other fuels are shown in Table 5 and inerting concentrations are shown in Table 6.

Table 3 — HFC 227ea 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%
-10	0,1215	0,5254	0,6196	0,7158	0,8142	0,9147	1,0174	1,1225	1,2301	1,3401	1,4527
-5	0,1241	0,5142	0,6064	0,7005	0,7967	0,8951	0,9957	1,0985	1,2038	1,3114	1,4216
0	0,1268	0,5034	0,5936	0,6858	0,78	0,8763	0,9748	1,0755	1,1785	1,2839	1,3918
5	0,1294	0,4932	0,5816	0,6719	0,7642	0,8586	0,955	1,0537	1,1546	1,2579	1,3636
10	0,132	0,4834	0,57	0,6585	0,749	0,8414	0,936	1,0327	1,1316	1,2328	1,3364
15	0,1347	0,474	0,5589	0,6457	0,7344	0,8251	0,9178	1,0126	1,1096	1,2089	1,3105
20	0,1373	0,465	0,5483	0,6335	0,7205	0,8094	0,9004	0,9934	1,0886	1,1859	1,2856
25	0,1399	0,4564	0,5382	0,6217	0,7071	0,7944	0,8837	0,975	1,0684	1,164	1,2618
30	0,1425	0,4481	0,5284	0,6104	0,6943	0,78	0,8676	0,9573	1,049	1,1428	1,2388
35	0,145	0,4401	0,519	0,5996	0,6819	0,7661	0,8522	0,9402	1,0303	1,1224	1,2168
40	0,1476	0,4324	0,5099	0,5891	0,6701	0,7528	0,8374	0,9239	1,0124	1,1029	1,1956
45	0,1502	0,425	0,5012	0,579	0,6586	0,7399	0,823	0,908	0,995	1,084	1,1751
50	0,1527	0,418	0,4929	0,5694	0,6476	0,7276	0,8093	0,8929	0,9784	1,066	1,1555
55	0,1553	0,4111	0,4847	0,56	0,6369	0,7156	0,796	0,8782	0,9623	1,0484	1,1365
60	0,1578	0,4045	0,477	0,551	0,6267	0,7041	0,7832	0,8641	0,9469	1,0316	1,1183
65	0,1604	0,398	0,4694	0,5423	0,6167	0,6929	0,7707	0,8504	0,9318	1,0152	1,1005
70	0,1629	0,3919	0,4621	0,5338	0,6072	0,6821	0,7588	0,8371	0,9173	0,9994	1,0834
75	0,1654	0,3859	0,455	0,5257	0,5979	0,6717	0,7471	0,8243	0,9033	0,9841	1,0668
80	0,1679	0,3801	0,4482	0,5178	0,589	0,6617	0,736	0,812	0,8898	0,9694	1,0509
85	0,1704	0,3745	0,4416	0,5102	0,5803	0,6519	0,7251	0,8	0,8767	0,9551	1,0354
90	0,173	0,369	0,4351	0,5027	0,5717	0,6423	0,7145	0,7883	0,8638	0,9411	1,0202
95	0,1755	0,3638	0,429	0,4956	0,5636	0,6332	0,7044	0,7771	0,8516	0,9277	1,0057
100	0,178	0,3587	0,4229	0,4886	0,5557	0,6243	0,6945	0,7662	0,8396	0,9147	0,9916

NOTE This information refers only to the product HFC-227ea, and does not represent any other products containing 1,1,1,2,3,3,3-heptafluoropropane 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 227ea vapour at a pressure of 1,013 bar may be approximated by the formula:

$$S = k_1 + k_2 T$$

where

$$k_1 = 0,1269$$

$$k_2 = 0,000513$$

c is the concentration (%); i.e. the volumetric concentration of HCFC 227ea in air at the temperature indicated, and a pressure of 1,013 bar.

Table 4 — HFC 227ea reference extinguishing and design concentrations

Fuel	Extinguishment % by volume	Minimum design % by volume
Class B		
Heptane (cup burner)	6,7	9,0
Heptane (room test)	6,9	
Surface class A		
Wood Crib	4,9	7,9
PMMA	6,1	
PP	6,1	
ABS	6,1	
Higher Hazard Class A	See Note 4	8,5
<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>NOTE 5 See 7.5.1.3 of EN 15004 -1 for guidance on Class A fuels.</p> <p>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.</p>		

Table 5 — HFC 125 extinguishing and design concentrations for other fuels

Fuel	Extinguishment % by volume	Minimum design % by volume
Acetone	6,7	8,7
Ethanol	8,4	10,9
Ethyl acetate	6,7	8,7
Ethylene glycol	7,8	10,1
Kerosene	6,1	7,9
Methanol	9,5	12,4
Propane	7,4	9,6
Toluene	4,9	6,4

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.

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Table 6 — HFC 227ea inerting and design concentrations
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Fuel	Extinguishment % by volume	Minimum design % by volume
Isobutane	11,3	12,4
1-Chloro-1,1-difluoroethane (HCFC 1416)	6,7	8,7
1,1-Difluoroethane (HCFC 152a)	8,6	9,5
Difluoromethane (HCFC 32)	6,7	8,7
Ethylene oxide	13,6	15,0
Methane	8,0	8,8
Pentane	11,6	12,8
Propane	11,6	12,8

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 125 shall be considered in the design of the system.

Any hazard to personnel created by the discharge of HFC 227ea shall be considered in the design of the system.

Potential hazards can arise from the following: