SLOVENSKI STANDARD
oSIST prEN 15004-4:2019

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Vgrajeni gasilni sistemi - Sistemi za gašenje s plinom - 4. del: Fizikalne lastnosti in načrtovanje sistema za gašenje s plinom za gasilo HFC 125 (ISO 14520-8:2016, spremenjen)

Fixed firefighting systems - Gas extinguishing systems - Part 4: Physical properties and system design of gas extinguishing systems for HFC 125 extinguishant (ISO 14520-8:2016, modified)

Ortsfeste Brandbekämpfungsanlagen - Löschanlagen mit gasförmigen Löschmitteln - Teil 4: Physikalische Eigenschaften und Anlagenauslegung für Feuerlöschmittel HFC 125 (ISO 14520:2016, modifiziert)

Installations fixes de lutte contre l'incendie - Installations d'extinction à gaz - Partie 4 : Propriétés physiques et conception des systèmes pour agent extincteur HFC 125 (ISO 14520-8:2016, modifiée)

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Fixed firefighting systems - Gas extinguishing systems - Part 4: Physical properties and system design of gas extinguishing systems for HFC 125 extinguishant (ISO 14520-8:2016, modified)

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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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EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (prEN 15004-4:2019) 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 15004-4:2008.

The text of the International Standard ISO 14520-8:2016 from Technical Committee ISO/TC 21 “Equipment for fire protection and firefighting” of the International Organization for Standardization (ISO) has been taken over as a European Standard by Technical Committee CEN/TC 191 “Fixed firefighting systems”, the secretariat of which is held by BSI.

This document will consist 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 5: *Physical properties and system design of gas extinguishing systems for HFC 227ea 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*.

The International Standards ISO 14520-2 and ISO 14520-11, which dealt with CF_3I and HFC 236fa extinguishants, respectively, have not been implemented by CEN, as CF_3I is only valid for local application and HFC 236fa extinguishant is only applicable for portable fire extinguishers and local application, respectively, which is not covered by the scope.

1 Scope

This document specifies requirements for gaseous fire-extinguishing systems, with respect to the HFC 125 extinguishant. It includes details of physical properties, specification, usage and safety aspects.

This document is apploicable for systems operating at nominal pressures of 25 bar and 42 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.

EN 15004-1:2019, *Fixed firefighting systems — Gas extinguishing systems — Part 1: Design, installation and maintenance (ISO 14520-1:2015, modified)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 15004-1 apply.

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

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

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

4 Characteristics and uses

4.1 General

Extinguishant HFC 125 shall comply with the specification shown in Table 1.

HFC 125 is a colourless, almost odourless, electrically non-conductive gas, with a density approximately four times that of air.

The physical properties are shown in Table 2.

HFC 125 extinguishes fires mainly by physical means, but also by some chemical means.

Table 1 — Specification for HFC 125

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 — Physical properties of HFC 125

Property	Units	Value
Molecular mass	—	120,02
Boiling point at 1,013 bar (absolute)	°C	−48,09
Freezing point	°C	−101
Critical temperature	°C	66,02
Critical pressure	bar abs	36,18
Critical volume	cm^3/mol	210
Critical density	kg/m^3	573,6
Vapour pressure 20 °C	bar abs	12,05
Liquid density 20 °C	kg/m^3	1 218,0
Saturated vapour density 20 °C	kg/m^3	77,97
Specific volume of superheated vapour at 1,013 bar and 20 °C	m^3/kg	0,197 2
Chemical formula	CF_3CHF_2	
Chemical name	Pentafluoroethane	

4.2 Use of HFC 125 systems

HFC 125 total flooding systems may be used for extinguishing fires of all classes within the limits specified in EN 15004-1:2019, Clause 4.

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 EN 15004-1:2019, 7.6.

The extinguishing concentrations and design concentrations for *n*-heptane and surface class A hazards are shown in Table 4.

Table 3 — HFC 125 total flooding quantity

Temperature *T* °C	Specific vapour volume *S*	HFC 125 mass requirements per unit volume of protected space, m/V (kg/m^3)									
		Design concentration (by volume)									
	m^3/kg	7 %	8 %	9 %	10 %	11 %	12 %	13 %	14 %	15 %	16 %
−45	0,149 7	0,502 8	0,580 9	0,6607	0,742 2	0,825 6	0,910 9	0,998 2	1,0874	1,178 8	1,272 4
−40	0,153 4	0,490 7	0,566 9	0,6447	0,724 3	0,805 7	0,888 9	0,974 1	1,0612	1,150 4	1,241 7
−35	0,157 2	0,478 8	0,553 2	0,6291	0,706 8	0,786 2	0,867 5	0,950 5	1,0356	1,122 6	1,211 7
−30	0,160 8	0,468 1	0,540 8	0,6151	0,691 0	0,768 6	0,848 0	0,929 3	1,0124	1,097 5	1,184 6
−25	0,164 5	0,457 6	0,528 6	0,601 2	0,675 4	0,751 3	0,829 0	0,908 4	0,989 6	1,072 8	1,157 9
−20	0,168 2	0,447 5	0,517 0	0,588 0	0,660 6	0,734 8	0,810 7	0,888 4	0,967 8	1,049 2	1,132 4
−15	0,171 9	0,437 9	0,505 9	0,575 3	0,646 4	0,719 0	0,793 3	0,869 3	0,947 0	1,026 6	1,108 1
−10	0,175 5	0,428 9	0,495 5	0,563 5	0,633 1	0,704 2	0,777 0	0,851 4	0,927 6	1,005 5	1,085 3

Temperature T °C	Specific vapour volume S	HFC 125 mass requirements per unit volume of protected space, m/V (kg/m^3)									
		Design concentration (by volume)									
	m^3/kg	7 %	8 %	9 %	10 %	11 %	12 %	13 %	14 %	15 %	16 %
–5	0,179 1	0,420 3	0,485 5	0,552 2	0,620 4	0,690 1	0,761 4	0,834 3	0,908 9	0,985 3	1,063 5
0	0,182 8	0,411 8	0,475 7	0,541 0	0,607 8	0,676 1	0,746 0	0,817 4	0,890 5	0,965 4	1,042 0
5	0,186 4	0,403 8	0,466 5	0,530 6	0,596 1	0,663 1	0,731 6	0,801 6	0,873 3	0,946 7	1,021 9
10	0,190 0	0,396 2	0,457 7	0,520 5	0,584 8	0,650 5	0,717 7	0,786 4	0,856 8	0,928 8	1,002 5
15	0,193 5	0,389 0	0,449 4	0,511 1	0,574 2	0,638 7	0,704 7	0,772 2	0,841 3	0,912 0	0,984 4
20	0,197 1	0,381 9	0,441 2	0,501 8	0,563 7	0,627 1	0,691 9	0,758 1	0,825 9	0,895 3	0,966 4
25	0,200 7	0,375 0	0,433 3	0,492 8	0,553 6	0,615 8	0,679 4	0,744 5	0,811 1	0,879 3	0,949 1
30	0,204 2	0,368 6	0,425 8	0,484 3	0,544 1	0,605 3	0,667 8	0,731 8	0,797 2	0,864 2	0,932 8
35	0,207 8	0,362 2	0,418 5	0,475 9	0,534 7	0,594 8	0,656 2	0,719 1	0,783 4	0,849 2	0,916 6
40	0,211 3	0,356 2	0,411 5	0,468 1	0,525 8	0,584 9	0,645 4	0,707 2	0,770 4	0,835 2	0,901 4
45	0,214 9	0,350 3	0,404 6	0,460 2	0,517 0	0,575 1	0,634 5	0,695 3	0,757 5	0,821 2	0,886 3
50	0,218 4	0,344 6	0,398 2	0,452 8	0,508 8	0,565 9	0,624 4	0,684 2	0,745 4	0,808 0	0,872 1
55	0,221 9	0,339 2	0,391 9	0,445 7	0,500 7	0,557 0	0,614 5	0,673 4	0,733 6	0,795 3	0,858 4
60	0,225 4	0,333 9	0,385 8	0,438 8	0,493 0	0,548 3	0,605 0	0,662 9	0,722 2	0,782 9	0,845 1
65	0,228 9	0,328 8	0,379 9	0,432 1	0,485 4	0,540 0	0,595 7	0,652 8	0,711 2	0,771 0	0,832 1
70	0,232 4	0,323 9	0,374 2	0,425 6	0,478 1	0,531 8	0,586 8	0,643 0	0,700 5	0,759 3	0,819 6
75	0,235 8	0,319 2	0,368 8	0,419 4	0,471 2	0,524 2	0,578 3	0,633 7	0,690 4	0,748 4	0,807 8
80	0,239 3	0,314 5	0,363 4	0,413 3	0,464 3	0,516 5	0,569 8	0,624 4	0,680 3	0,737 4	0,796 0
85	0,242 8	0,310 0	0,358 1	0,407 3	0,457 6	0,509 0	0,561 6	0,615 4	0,670 5	0,726 8	0,784 5
90	0,246 3	0,305 6	0,353 1	0,401 5	0,451 1	0,501 8	0,553 6	0,606 7	0,660 9	0,716 5	0,773 4
95	0,249 8	0,301 3	0,348 1	0,395 9	0,444 8	0,494 8	0,545 9	0,598 2	0,651 7	0,706 4	0,762 5

NOTE This information refers only to the product HFC 125 and does not represent any other products containing pentafluoroethane 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 HFC 125 vapour at a pressure of 1,013 bar may be approximated by the formula

$S = k_1 + k_2 T$

where

k1 = 0,182 5

k2 = 0,000 7

c is the concentration (%); i.e. the volumetric concentration of HFC 125 in air at the temperature indicated and a pressure of 1,013 bar.

Table 4 — HFC 125 reference extinguishing and design concentrations

Fuel	Extinguishment % by volume	Minimum design % by volume
Class B Heptane (cup burner) Heptane (room test)	9,3 9,3	12,1
Surface Class A Wood Crib PMMA PP ABS	6,7 8,6 8,6 8,6	11,2
Higher Hazard Class A	See Note 4	11,5

NOTE 1 The extinguishment values for the Class B and the Surface Class A fuels are determined by testing in accordance with EN 15004-1:2019, 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 Hazard Class A hazards are those having the characteristics described in the CAUTION statement of EN 15004 -1:2009, 7.5.1.3. 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 EN 15004-1:2019, 7.5.1.3 for guidance on Class A fuels.

In Table 4, 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 from ISO 14520-8:2016 has been removed because no data was available to verify the given values.

5 Safety of personnel

Any hazard to personnel created by the discharge of HFC 125 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) breakdown products of the extinguishant resulting from exposure to fire.

For minimum safety requirements, see EN 15004-1:2019, Clause 5.

Toxicological information for HFC 125 is shown in Table 5.

Table 5 — Toxicological information for HFC 125

Property	**Value** % by volume
ALC	> 70
No observed adverse effect level (NOAEL)	7,5
Lowest observed adverse effect level (LOAEL)	10
NOTE ALC is the approximate lethal concentration for a rat population during a 4-h exposure.	

6 System design

6.1 Fill density

The fill density of the container shall not exceed the values shown in Table 6 for 25 bar system and Table 7 for 42 bar system.

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 Figure 1 for various levels of fill density.

Table 6 — 25 bar storage container characteristics for HFC 125

Property	**Unit**	**Value**
Maximum fill density	kg/m^3	929
Maximum container working pressure at 50 °C	bar	40
Superpressurization at 22 °C	bar	25
NOTE Reference should be made to Figure 1 for further data on pressure/temperature relationships.		

Table 7 — 42 bar storage container characteristics for HFC 125

Property	**Unit**	**Value**
Maximum fill density	kg/m^3	929
Maximum container working pressure at 50 °C	bar	73
Superpressurization at 22 °C	bar	42