SLOVENSKI STANDARD
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Vgrajeni gasilni sistemi - Sistemi za gašenje s plinom - 9. del: Fizikalne lastnosti in načrtovanje sistema za gašenje s plinom za gasilo IG-55

Fixed firefighting systems - Gas extinguishing systems - Part 9: Physical properties and system design of gas extinguishing systems for IG-55 extinguishant

Ortsfeste Brandbekämpfungsanlagen - Löschanlagen mit gasförmigen Löschmitteln - Teil 9: Physikalische Eigenschaften und Anlagenauslegung für Feuerlöschmittel IG-55

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Installations fixes de lutte contre l'incendie - Installations d'extinction à gaz - Partie 9: Propriétés physiques et conception des systèmes pour agent extincteur IG-55

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Fixed firefighting systems - Gas extinguishing systems - Part 9: Physical properties and system design of gas extinguishing systems for IG-55 extinguishant

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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.

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Foreword

This document (prEN 15004-9:2014) 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 15004-9:2008.

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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1 Scope

1.1 This part of EN 15004 contains specific requirements for gaseous fire-extinguishing systems, with respect to the IG-55 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 150 bar at 15 °C, 200 bar at 15 °C and 300 bar at 15 °C. This does not preclude the use of other systems, although design data for other pressures are not available at this time.

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.

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4 Characteristics and uses

4.1 General

IG-55 is a colourless, odourless, electrically non-conductive gas with a density approximately the same as that of air.

It is an inert gas mixture consisting nominally of 50 % argon and 50 % nitrogen. The mixture specification for IG-55 is as follows:

a) argon percentage range (50 ± 5) %

a) nitrogen percentage (50 ± 5) %

Extinguishant IG-55 shall comply with the specification shown in Table 1. The physical properties are shown in Table 2. IG-55 extinguishes fires by reduction of the oxygen concentration in the atmosphere of the hazard enclosure.

Table 1 — Specification for IG-55

Component	Argon	Nitrogen
Purity	> 99,9 %	> 99,9 %
Moisture	< 15 × 10^{-6}	< 10 × 10^{-6}
NOTE Only principal contaminants are shown. Other measurements may include hydrocarbons, CO, NO, NO_2, CO_2, O_2, etc. Most are < 20 x 10^{-6}.		

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Table 2 — Physical properties of IG-55

Property	Units	Value
Molecular mass	—	33,98
Boiling point at 1,013 bar (absolute)	°C	—
Freezing point	°C	—
Critical temperature	°C	—
Critical pressure	bar abs	—
Critical volume	cm^3/mol	—
Critical density	kg/m^3	—
Vapour pressure 20 °C	bar abs	—
Liquid density 20 °C	kg/m^3	—
Saturated vapour density 20 °C	kg/m^3	—
Specific volume of superheated vapour at 1,013 bar and 20 °C	m^3/kg	0,708
Components	N_2 50 % by volume Ar 50 % by volume	
NOTE IG-55 is a mixture of two gases. For further details on its physical properties refer to ISO standards for the individual gases.		

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4.2 Use of IG-55 systems

IG-55 total flooding systems may be used for extinguishing fires of all classes within the limits specified in clause 4 of EN 15004 -1.

The extinguishing concentrations and design concentrations for heptane and surface class A hazards are shown in Table 4. Concentrations for other fuels are shown in Table 5.

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.

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Table 3 — IG-55 total flooding quantity

Temperature T °C	Specific vapour volume S m³/kg	IG-55 volume requirements per unit volume of protected space, V/V (m³/m³) Design concentration (by volume)							
		34 %	38 %	42 %	46 %	50 %	54 %	58 %	62 %
–40	0.5632	0.524	0.603	0.687	0.778	0.875	0.980	1.095	1.221
–35	0.5752	0.513	0.591	0.673	0.761	0.856	0.959	1.072	1.195
–30	0.5873	0.503	0.578	0.659	0.746	0.839	0.940	1.050	1.171
–25	0.5994	0.493	0.567	0.646	0.731	0.822	0.921	1.029	1.147
–20	0.6115	0.483	0.556	0.633	0.716	0.806	0.902	1.008	1.125
–15	0.6236	0.474	0.545	0.621	0.702	0.790	0.885	0.989	1.103
–10	0.6356	0.465	0.534	0.609	0.689	0.775	0.868	0.970	1.082
–5	0.6477	0.456	0.524	0.598	0.676	0.761	0.852	0.952	1.062
0	0.6598	0.448	0.515	0.587	0.664	0.747	0.836	0.934	1.042
5	0.6719	0.440	0.506	0.576	0.652	0.733	0.821	0.918	1.023
10	0.6840	0.432	0.497	0.566	0.640	0.720	0.807	0.901	1.005
15	0.6960	0.424	0.488	0.556	0.629	0.708	0.793	0.886	0.988
20	0.7081	0.417	0.480	0.547	0.618	0.696	0.779	0.871	0.971
25	0.7202	0.410	0.472	0.538	0.608	0.684	0.766	0.856	0.955
30	0.7323	0.403	0.464	0.529	0.598	0.673	0.754	0.842	0.939
35	0.7444	0.397	0.456	0.520	0.588	0.662	0.741	0.828	0.924
40	0.7564	0.390	0.449	0.512	0.579	0.651	0.730	0.815	0.909
45	0.7685	0.384	0.442	0.504	0.570	0.641	0.718	0.802	0.895
50	0.7806	0.378	0.435	0.496	0.561	0.631	0.707	0.790	0.881
55	0.7927	0.373	0.429	0.488	0.552	0.621	0.696	0.778	0.867
60	0.8048	0.367	0.422	0.481	0.544	0.612	0.686	0.766	0.854
65	0.8168	0.362	0.416	0.474	0.536	0.603	0.676	0.755	0.842
70	0.8289	0.356	0.410	0.467	0.528	0.594	0.666	0.744	0.830
75	0.8410	0.351	0.404	0.460	0.521	0.586	0.656	0.733	0.818
80	0.8531	0.346	0.398	0.454	0.513	0.577	0.647	0.723	0.806
85	0.8652	0.341	0.393	0.447	0.506	0.569	0.638	0.713	0.795
90	0.8772	0.337	0.387	0.441	0.499	0.562	0.629	0.703	0.784
95	0.8893	0.332	0.382	0.435	0.492	0.554	0.621	0.693	0.773
100	0.9014	0.328	0.377	0.429	0.486	0.546	0.612	0.684	0.763

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NOTE This information refers only to the product IG 55, and does not represent any other products containing argon and nitrogen as components.

Symbols:

V/V is the agent volume requirements (m^3/m^3); i.e. the quantity Q_R (m^3) of agent required at a reference temperature of 20°C and a pressure of 1,013 bar per cubic metre of protected volume to produce the indicated concentration at the temperature specified:

$$Q_R = m \cdot S_R ;$$

where

S_R is the specific reference volume (m^3/kg); i.e. the specific vapour volume at the filling reference temperature for superheated IG-01vapour at a pressure of 1,013 bar which may be approximated by the formula:

$$S_R = k_1 + k_2 \cdot T_R ;$$

where

k_1 = 0,659 8

k_2 = 0,002 416

T_R *is the reference temperature* (ºC); i.e. filling temperature (20ºC in the table)

$$m = \frac{V}{S} \cdot \ln\left(\frac{100}{100 - c}\right)$$

V is the net volume of hazard (m^3); i.e. the enclosed volume minus the fixed structures impervious to extinguishant;

T is the temperature (°C); i.e. the design temperature of the protected area;

S is the specific volume (m^3/kg); the specific volume of superheated IG-55 vapour at a pressure of 1,013 bar may be approximated by the formula:

$$S = k_1 + k_2 \cdot T$$

where

c is the concentration (%); i.e. the volumetric concentration of IG-55 in air at the temperature indicated, and a pressure of 1,013 bar absolute.

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Table 4 — IG-55 reference extinguishing and design concentrations

Fuel	Extinguishment % by volume	Minimum design % by volume
Class B		
Heptane (cup burner)	36,5	47,6
Heptane (room test)	36,6	
Surface class A		
Wood Crib	28,7	
PMMA	30,7	40,3
PP	29,3	
ABS	31,0	
Higher Hazard Class A	See Note 4	45,2

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.

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NOTE 4 Higher Hazard Class A hazards are those having the characteristics described in the CAUTION statement of EN 15004 -1 paragraph 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 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.