SLOVENSKI STANDARD
SIST EN 15004-10:2018

01-februar-2018

Nadomešča:
SIST EN 15004-10:2008

Vgrajeni gasilni sistemi - Sistemi za gašenje s plinom - 10. del: Fizikalne lastnosti in načrtovanje sistema za gašenje s plinom za gasilo IG-541 (ISO 14520-15:2015, spremenjen)

Fixed firefighting systems - Gas extinguishing systems - Part 10: Physical properties and system design of gas extinguishing systems for IG-541 (ISO 14520-15:2015, modified)

Ortsfeste Brandbekämpfungsanlagen - Löschanlagen mit gasförmigen Löschmitteln - Teil 10: Physikalische Eigenschaften und Anlagenauslegung für Löschmittel IG-541 (ISO 14520-15:2015, modifiziert)

Installations fixes de lutte contre l'incendie - Installations d'extinction à gaz - Partie 10 : Propriétés physiques et conception des systèmes pour agent extincteur IG-541 (ISO 14520-15:2015, modifiée)

Ta slovenski standard je istoveten z: **EN 15004-10:2017**

ICS:

13.220.10	Gašenje požara	Fire-fighting

SIST EN 15004-10:2018 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15004-10

December 2017

ICS 13.220.20

Supersedes EN 15004-10:2008

English Version

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This European Standard was approved by CEN on 25 September 2017.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 15004-10:2017) has been prepared by Technical Committee CEN/TC 191 “Fixed firefighting systems”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2018, and conflicting national standards shall be withdrawn at the latest by June 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 15004-10:2008.

The text of the International Standard ISO 14520-15:2015 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, with common modifications which are indicated by a straight line in the margin of the text.

This European Standard 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.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

1.1 This document specifies requirements for gaseous fire-extinguishing systems, with respect to the IG-541 extinguishant. It includes details of physical properties, specification, usage and safety aspects.

1.2 This document is applicable for systems operating at nominal pressures of 150 bar, 200 bar 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 15004-1:2017, *Fixed firefighting systems - Gas extinguishing systems - Part 1: Design, installation and maintenance (ISO 14520-1:2006, modified)*

3 Terms and definitions

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

4 Characteristics and uses

4.1 General

IG-541 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 52 % nitrogen, 40 % argon and 8 % carbon dioxide. The mixture specification for IG-541 (based on 8 % carbon dioxide with tolerance of ± 5 %) is as follows:

a) carbon dioxide percentage range 7,6 % to 8,4 %;

b) argon percentage range 37,2 % to 42,8 %;

c) nitrogen percentage range 48,8 % to 55,2 %.

Individual container or batch analysis is based on carbon dioxide measurement only.

Extinguishant IG-541 shall comply with the specification shown in Table 1.

The physical properties are shown in Table 2.

IG-541 extinguishes fires mainly by a reduction of oxygen concentration in the atmosphere of the hazard enclosure.

Table 1 — Component gas specification for IG-541

	Argon	Nitrogen	Carbon dioxide
Purity	99,997 % by volume, min.	99,99 % by volume, min.	99,5 % by volume, min.
Moisture	4 ppm by mass, max.	5 ppm by mass, max.	10 ppm by mass, max.
Oxygen	3×10^{-6} by mass, max.	3×10^{-6} by mass, max.	10×10^{-6} by mass, max.
NOTE Only principal contaminants are shown. Other measurements may include hydrocarbons, CO, NO, NO_2. Most are < 20×10^{-6}.			

Table 2 — Physical properties of IG-541

Property	Units	Value
Molecular mass	—	34,0
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	0,706
Components	N_2 52 % by volume Ar 40 % by volume CO_2 8 % by volume	
Chemical name	Nitrogen/argon/carbon dioxide	

4.2 Use of IG-541 systems

IG-541 total flooding systems may be used for extinguishing fires of all classes within the limits specified in Clause 4 of EN 15004-1:2017.

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 15004-1:2017, 7.6.

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

Table 3 — IG-541 total flooding quantity

Temperature T °C	**Specific vapour volume** S	**Amount of IG-541 per unit volume of protected space** V/V (m^3/m^3)							
		Design concentration (by volume)							
	m^3/kg	34 %	38 %	42 %	46 %	50 %	54 %	58 %	62 %
–40	0,5624	0,521	0,600	0,684	0,773	0,870	0,975	1,089	1,214
–35	0,5743	0,511	0,587	0,669	0,757	0,852	0,954	1,066	1,189
–30	0,5863	0,500	0,575	0,656	0,742	0,834	0,935	1,044	1,165
–25	0,5982	0,490	0,564	0,643	0,727	0,818	0,916	1,023	1,142
–20	0,6102	0,481	0,553	0,630	0,713	0,802	0,898	1,003	1,119
–15	0,6221	0,471	0,542	0,618	0,699	0,786	0,881	0,984	1,098
–10	0,6341	0,463	0,532	0,606	0,686	0,772	0,864	0,966	1,077
–5	0,6460	0,454	0,522	0,595	0,673	0,757	0,848	0,948	1,057
0	0,6580	0,446	0,513	0,584	0,661	0,744	0,833	0,931	1,038
5	0,6699	0,438	0,504	0,574	0,649	0,730	0,818	0,914	1,019
10	0,6819	0,430	0,495	0,564	0,638	0,717	0,804	0,898	1,001
15	0,6938	0,423	0,486	0,554	0,627	0,705	0,790	0,882	0,984
20	0,7058	0,416	0,478	0,545	0,616	0,693	0,777	0,868	0,968
25	0,7177	0,409	0,470	0,536	0,606	0,682	0,764	0,853	0,951
30	0,7297	0,402	0,462	0,527	0,596	0,670	0,751	0,839	0,936
35	0,7416	0,395	0,455	0,518	0,586	0,660	0,739	0,826	0,921
40	0,7536	0,389	0,448	0,510	0,577	0,649	0,727	0,812	0,906
45	0,7655	0,383	0,441	0,502	0,568	0,639	0,716	0,800	0,892
50	0,7775	0,377	0,434	0,494	0,559	0,629	0,705	0,787	0,878
55	0,7894	0,371	0,427	0,487	0,551	0,620	0,694	0,776	0,865
60	0,8014	0,366	0,421	0,480	0,543	0,610	0,684	0,764	0,852
65	0,8133	0,361	0,415	0,473	0,535	0,601	0,674	0,753	0,840
70	0,8253	0,355	0,409	0,466	0,527	0,593	0,664	0,742	0,827
75	0,8372	0,350	0,403	0,459	0,519	0,584	0,655	0,731	0,816
80	0,8492	0,345	0,397	0,453	0,512	0,576	0,645	0,721	0,804
85	0,8611	0,341	0,392	0,446	0,505	0,568	0,636	0,711	0,793

Temperature T °C	**Specific vapour volume** S	**Amount of IG-541 per unit volume of protected space** V/V (m^3/m^3)							
		Design concentration (by volume)							
	m^3/kg	34 %	38 %	42 %	46 %	50 %	54 %	58 %	62 %
90	0,8731	0,336	0,386	0,440	0,498	0,560	0,628	0,701	0,782
95	0,8850	0,331	0,381	0,434	0,491	0,553	0,619	0,692	0,772
100	0,8970	0,327	0,376	0,429	0,485	0,545	0,611	0,683	0,761

NOTE This information refers only to the product IG-541, and does not represent any other products containing argon, nitrogen or carbon dioxide 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-541 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 = 0,657 99

k_2 = 0,00239

T_R *is the reference temperature* (°C); i.e. filling temperature (20°C 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-541 vapour at a pressure of 1,013 bar may be approximated by the formula:

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

c is the concentration (%); i.e. the volumetric concentration of IG-541 in air at the temperature indicated, and a pressure of 1,013 bar absolute.