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Gaseous fire-extinguishing systems — Physical properties and system design —

Part 17: Halocarbon Blend 55

Systèmes d'extinction d'incendie utilisant des agents gazeux — Propriétés physiques et conception des systèmes —

Partie 17: Mélange d'hydrocarbures halogénés 55

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and firefighting*, Subcommittee SC 8, *Gaseous media and firefighting systems using gas.*

A list of all parts in the ISO 14520 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO 14520 series consists of the following parts, under the general title *Gaseous fire-extinguishing systems — Physical properties and system design*:

— Part 1: General requirements

— Part 2: Withdrawn

— Part 3: Withdrawn

— Part 4: Withdrawn

— Part 5: FK-5-1-12 extinguishant

— Part 6: Withdrawn

— Part 7: Withdrawn

— Part 8: HFC 125 extinguishant

— Part 9: HFC 227ea extinguishant

— Part 10: HFC 23 extinguishant

— Part 11: To be withdrawn

— Part 12: IG-01 extinguishant

— Part 13: IG-100 extinguishant

— Part 14: IG-55 extinguishant

— Part 15: IG-541 extinguishant

— Part 16: Withdrawn

— Part 17 (this document): Halocarbon Blend 55

Gaseous fire-extinguishing systems — Physical properties and system design —

Part 17: Halocarbon Blend 55

1 Scope

This document provides specific requirements for gaseous fire-extinguishing systems with respect to the Halocarbon Blend 55 extinguishant. It includes details of physical properties, specification, usage and safety aspects. It also covers systems operating at nominal pressures of 25 bar, 35 bar and 42 bar, superpressurized with nitrogen. This document does not preclude the use of other systems.

NOTE 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

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.

ISO 14520-1:—[1)], *Gaseous fire-extinguishing systems — Physical properties and system design — Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14520-1 apply.

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

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

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

4 Characteristics and uses

4.1 General

Extinguishant Halocarbon Blend 55 shall comply with the specifications shown in Table 1.

Halocarbon Blend 55 [blend of 50 ± 3 % HFO-1233zd(E) and 50 ± 3 % FK-5-1-12 (by mass)] is a colourless, almost odourless, electrically non-conductive gas, with a density approximately 6,38 times that of air.

Its physical properties are shown in Table 2.

Halocarbon Blend 55 extinguishes fires mainly by physical means, but also by some chemical means.

1) Under preparation. Stage at the time of publication ISO/DIS 14520-1:2022.

Table 1 — Specifications for Halocarbon Blend 55

Property	Requirement
Purity	99,5 % by mass, min.
Acidity	3×10^{-4} % by mass, max.
Water content	10×10^{-4} % by mass, max.
Non-volatile residue	300×10^{-4} % by mass, max.
Suspended matter or sediment	None visible
Kinetic dimers of HFP[a]	< 5 600 mg/kg
Thermodynamic dimer of HFP + HF adduct[b]	< 190 mg/kg

[a] Kinetic dimers of HFP (CAS 2070-70-4).

[b] Thermodynamic dimer of HFP (CAS 1584-03-8) + its HF adduct (CAS 30320-28-6).

Table 2 — Physical properties of Halocarbon Blend 55

Property	Units	Value
Molecular mass	—	184,72
Boiling point at 1,013 bar (absolute)	°C	20,7
Freezing point	°C	-107
Critical temperature	°C	159,2
Critical pressure	bar (absolute)	28,92
Critical volume	cm^3/mol	354,2
Critical density	kg/m^3	521,6
Vapour pressure 20 °C	bar (absolute)	0,988 0
Liquid density 20 °C	kg/m^3	1 431,6
Saturated vapour density 20 °C	kg/m^3	6,67
Specific volume of vapour at 1,013 bar (absolute) and 20,0 °C	m^3/kg	0,125 6
Chemical formula	$CF_3CH=CClH/C_6F_{12}O$	
Chemical name	50/50 % (by mass) Trans-1-chloro-3,3,3-trifluoroprop-1-ene/ 1,1,1,2,2,4,5,5,5-Nonafluoro-4-(trifluoromethyl)-3-pentanone	

NOTE 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

4.2 Use of Halocarbon Blend 55

Halocarbon Blend 55 total flooding systems may be used for extinguishing fires of all classes within the limits specified in ISO 14520-1:—[2], 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 ISO 14520-1:—, 7.7.

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 4.

2) Under preparation. Stage at the time of publication ISO/DIS 14520-1:2022.

Table 3 — Extinguishant requirements per volume of protected space

Temperature	**Specific vapour volume**	**HFO-1233zd(E)/FK-5-1-12 mass requirements per unit volume of protected space,** m / V (kg/m^3)						
T	S	**Design concentration** (by volume)						
°C	m^3/kg	4 %	5 %	6 %	7 %	8 %	9 %	10 %
-10	0,112 2	0,371 3	0,469 0	0,568 8	0,670 7	0,774 8	0,881 3	0,990 1
-5	0,114 5	0,364 0	0,459 9	0,557 7	0,657 6	0,759 8	0,864 1	0,970 8
0	0,116 7	0,357 1	0,451 1	0,547 0	0,645 1	0,745 2	0,847 6	0,952 3
5	0,118 9	0,350 4	0,442 6	0,536 8	0,633 0	0,731 3	0,831 7	0,934 4
10	0,121 1	0,344 0	0,434 5	0,526 9	0,621 4	0,717 8	0,816 4	0,917 2
15	0,123 4	0,337 8	0,426 6	0,517 4	0,610 1	0,704 9	0,801 7	0,900 7
20	0,125 6	0,331 8	0,419 1	0,508 2	0,599 3	0,692 4	0,787 5	0,884 7
25	0,127 8	0,326 0	0,411 8	0,499 4	0,588 9	0,680 3	0,773 8	0,869 3
30	0,130 0	0,320 4	0,404 7	0,490 8	0,578 8	0,668 7	0,760 5	0,854 4
35	0,132 3	0,315 0	0,397 9	0,482 6	0,569 0	0,657 4	0,747 7	0,840 0
40	0,134 5	0,309 8	0,391 3	0,474 6	0,559 6	0,646 5	0,735 3	0,826 1
45	0,136 7	0,304 7	0,384 9	0,466 8	0,550 5	0,636 0	0,723 3	0,812 6
50	0,139 0	0,299 9	0,378 8	0,459 4	0,541 7	0,625 8	0,711 7	0,799 6
55	0,141 2	0,295 1	0,372 8	0,452 1	0,533 1	0,615 9	0,700 5	0,787 0
60	0,143 4	0,290 5	0,367 0	0,445 1	0,524 8	0,606 3	0,689 6	0,774 8
65	0,145 6	0,286 1	0,361 4	0,438 3	0,516 8	0,597 1	0,679 1	0,762 9
70	0,147 9	0,281 8	0,355 9	0,431 7	0,509 0	0,588 1	0,668 9	0,751 4
75	0,150 1	0,277 6	0,350 7	0,425 3	0,501 5	0,579 3	0,658 9	0,740 3
80	0,152 3	0,273 5	0,345 5	0,419 0	0,494 1	0,570 9	0,649 3	0,729 5
85	0,154 5	0,269 6	0,340 5	0,413 0	0,487 0	0,562 6	0,639 9	0,718 9

NOTE 1 This information refers only to the product Halocarbon Blend 55 and does not represent any other products containing HFO-1233zd(E) or FK-5-1-12 as components.

Key

m/V is the agent mass requirements (kg/m^3); i.e. mass, m, in kg of agent required per m^3 of protected volume, V, to produce the indicated concentration at the temperature specified;

V is the net volume of hazard (m^3); 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 (m^3/kg); the specific volume of superheated Halocarbon Blend 55 vapour at a pressure of 1,013 bar (absolute) may be approximated by the formula:

$S=k_1 + k_2 T$

where

k_1= 0,116 7

k_2= 0,000 445

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

NOTE 2 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

Table 4 — Halocarbon Blend 55 reference extinguishing and design concentrations

Fuel[a]	Extinguishment[b] % by volume	Minimum design[b] % by volume
Class B[c, d]		7,8
Heptane (cup burner)	5,5	
Heptane (room test)	6,0	
Surface Class A[c, e]		7,8
Wood Crib	6,0	
PMMA	5,4	
PP	5,4	
ABS	5,4	
Higher Hazard Class A	[f]	7,8

[a] See ISO 14520-1:—, 7.6.1.3 for guidance on Class A fuels.

[b] 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.

[c] The extinguishment values for the Class B and the Surface Class A fuels are determined by testing in accordance with ISO 14520-1: —, Annex B and Annex C.

[d] 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.

[e] 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 1,30. 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.

[f] 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.

5 Safety of personnel

Any hazard to personnel created by the discharge of Halocarbon Blend 55 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; and

c) breakdown products of the extinguishant resulting from exposure to fire.

For minimum safety requirements, see ISO 14520-1:—, Clause 5.

Toxicological information for Halocarbon Blend 55 is shown in Table 5.

Table 5 — Cardiac toxicological information for Halocarbon Blend 55

Property	Value % by volume
4hr-LC_{50}	> 11
No observed adverse effect level (NOAEL)	8,7
Lowest observed adverse effect level (LOAEL)	> 8,7

6 System design

6.1 Fill density

The fill density of the container shall not exceed the values shown in Tables 6, 7, 8 for 25, 35 and 42 bar systems.

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 Figures 1-3 for various levels of fill density.

Table 6 — 25 bar storage container characteristics for Halocarbon Blend 55

Property	Unit	Value
Maximum fill density	kg/m^3	1 308
Maximum container working pressure at 50 °C	bar	29
Superpressurization at 20 °C	bar	25
NOTE 1 Figure 1 provides further data on pressure/temperature relationships.		
NOTE 2 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.		

Table 7 — 35 bar storage container characteristics for Halocarbon Blend 55

Property	Unit	Value
Maximum fill density	kg/m^3	1 308
Maximum container working pressure at 50 °C	bar	40
Superpressurization at 20 °C	bar	35
NOTE 1 Figure 2 provides further data on pressure/temperature relationships.		
NOTE 2 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.		

Table 8 — 42 bar storage container characteristics for Halocarbon Blend 55

Property	Unit	Value
Maximum fill density	kg/m^3	1 201,5
Maximum container working pressure at 50 °C	bar	47
Superpressurization at 20 °C	bar	42
NOTE 1 Figure 3 provides further data on pressure/temperature relationships.		
NOTE 2 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.		

6.2 Superpressurization

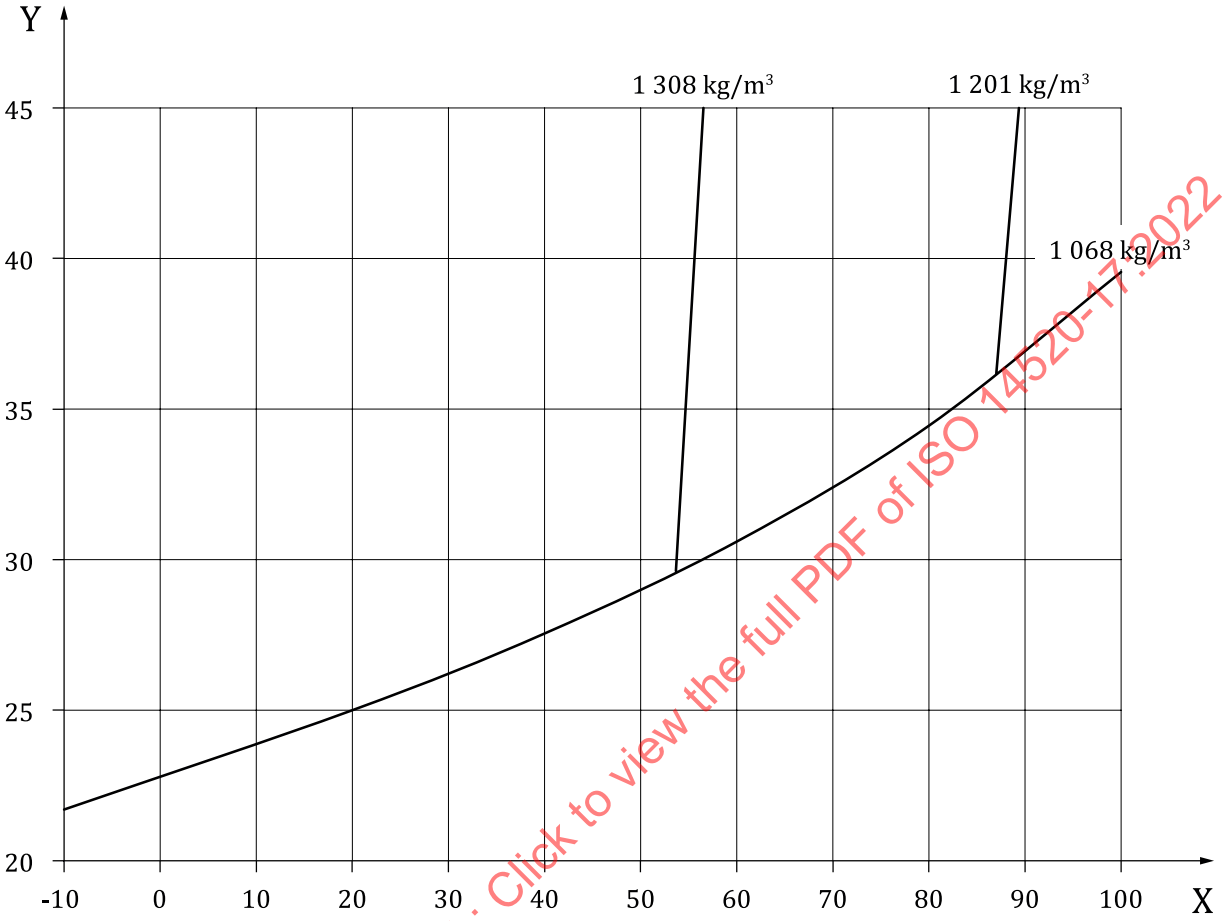
Containers shall be super pressurized with nitrogen with a moisture content of not more than 60×10^{-4} % by mass (60 ppm) to an equilibrium pressure of 25 bar, 35 bar or 42 bar $^{+5}_{-0}$ % at a temperature of 20 °C (see 6.4 for an exception).

6.3 Extinguishant quantity

The quantity of extinguishant shall be the minimum required to achieve the design concentration within the hazard volume at the minimum expected temperature, determined using Table 3 and the method specified in ISO 14520-1:—, 7.7.

The design concentrations shall be specified for relevant hazards shown in Table 4. This includes at least a 1,3 safety factor on the extinguishing concentration.

Consideration should be given to increasing this for particular hazards and seeking advice from the relevant authority.



Key

X temperature, °C

Y pressure, bar

NOTE 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

Figure 1 — Temperature/pressure graph for Halocarbon Blend 55 pressurized with nitrogen to 25 bar at 20 °C