

Fire extinguishing media — Foam concentrates —

Part 1:
Specification for low-expansion foam concentrates for top application to water-immiscible liquids

Agents extincteurs — Émulseurs —

Partie 1: Spécifications pour les émulseurs bas foisonnement destinés à une application par le haut sur les liquides non miscibles à l'eau

DIS stage

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A model manuscript of a draft International Standard (known as “The Rice Model”) is available at https://www.iso.org/iso/model_document-rice_model.pdf

Contents	Page
Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Grades and uses of foam concentrates	4
5 Tolerance of foam concentrates to freezing and thawing	4
6 Sediment in foam concentrates	4
7 Determination of viscosity	4
8 pH of foam concentrates	5
9 Surface tension of the foam solution	5
10 Interfacial tension between the foam solution and cyclohexane	5
11 Spreading coefficient of the foam solution on cyclohexane	6
12 Expansion and drainage of foam	6
13 Test fire performance	6
14 Marking, packaging and specification sheet	7
Annex A (normative) Preliminary sampling and conditioning of the foam concentrate	9
A.1 Preliminary sampling	9
A.2 Conditioning of foam concentrate	9
A.3 Subsequent testing	9
Annex B (normative) Determination of tolerance to freezing and thawing	10
B.1 Apparatus	10
B.2 Procedure	10
Annex C (normative) Determination of volume percentage of sediment	12
C.1 Sampling	12
C.2 Apparatus	12
C.3 Procedure	12
Annex D (normative) Determination of viscosity for pseudo-plastic foam concentrates	13
D.1 General	13
D.2 Viscosity determination	13
D.2.1 Apparatus	13
D.2.2 Test temperatures	13
D.2.3 Viscosity measurement	13
D.2.4 Results	14
Annex E (normative) Determination of surface tension, interfacial tension and spreading coefficient	15

E.1	Reagents and materials	15
E.2	Procedure for surface tension	15
E.3	Procedure for interfacial tension	15
E.4	Spreading coefficient	15
	Annex F (normative) Determination of expansion and drainage time	16
F.1	Apparatus	16
F.2	Temperature conditions	16
F.3	Procedure	16
	Annex G (normative) Determination of test fire performance	22
G.1	General	22
G.2	General conditions	22
G.2.1	Test series and criteria for success	22
G.2.1.1	Foam concentrates not compatible with sea water	22
G.2.1.2	Foam concentrates compatible with sea water	22
G.2.1.3	Decision tree fire test protocol	22
G.2.2	Temperature and wind speed	23
G.2.3	Records	23
G.2.4	Foam solution	24
G.2.5	Fuel	24
G.3	Forceful application fire test	24
G.3.1	Apparatus	24
G.3.2	Procedure	24
G.4	Gentle application fire test	25
G.4.1	Apparatus	25
G.4.2	Test procedure	26
G.5	Synthetic sea water	27
	Annex H (informative) Description of a radiation measurement method	28
H.1	Evaluation	28
H.2	General arrangement of test	28
H.3	Technical data for radiometers	28
H.4	Procedure	29
	Annex I (informative) Compatibility	32
I.1	Compatibility between foam concentrates and fire extinguishing powders	32
I.2	Compatibility between foam concentrates	32
	Annex J (informative) Small-scale fire test	33
J.1	General	33
J.2	Apparatus	33
J.3	Test procedure	33

J.3.1	Test conditions	34
J.3.2	Set-up	34
J.3.3	Fire test	34
	Bibliography	42

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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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 6, *Foam and powder media and firefighting systems using foam and powder*.

This third edition cancels and replaces the second edition (ISO 7203-1:2011), which has been technically revised.

The main changes compared to the previous edition are:

- addition of Part 4 containing specifications for Class A foam concentrates;
- extension of Clause 2;
- modification of Clause 12 to run two tests instead of one and take the average of both values instead of having just one datum;
- correction of figures;
- extension of Annex G by a scheme of a decision tree, and modification of the acceptable temperature range for testing fire performance;
- removal of Annex J: “Typical anticipated performance for various types of foam concentrate”.

A list of all parts in the ISO 7203 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

Firefighting foams are widely used to control and extinguish fires of Class B (flammable liquids) and/or Class A fuels (solid materials, usually of an organic nature) and for inhibiting reignition.

Foams can be used in combination with other extinguishing media, in particular halons, carbon dioxide and powders which are the subject of other International Standards, including, ISO 6183, ISO 7201-1, ISO 7201-2 and ISO 7202. A specification for foam systems can be found in ISO 7076.

Attention is drawn to Annex I, which deals with the compatibility of foam concentrates, and the compatibility of foams and powders.

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Fire extinguishing media — Foam concentrates — Part 1: Specification for low-expansion foam concentrates for top application to water-immiscible liquids

1 Scope

This document specifies the essential properties and performance of liquid foam concentrates used to make low-expansion foams for the control, the extinction and the inhibition of reignition of fires of water-immiscible liquids. Minimum performance on certain test fires is specified.

These foams are suitable for top application to fires of water-immiscible liquids. The foams that conform with ISO 7203-3 are also suitable for top application to fires of water-miscible liquids.

The foam concentrates can be suitable for use in non-aspirating sprayers or for subsurface application to liquid fires, but the requirements specific to those applications are outside the scope of this document.

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 304, *Surface active agents — Determination of surface tension by drawing up liquid films*

ISO 3104, *Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity*

ISO 3219, *Plastics — Polymers/resins in the liquid state or as emulsions or dispersions — Determination of viscosity using a rotational viscometer with defined shear rate*

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

ISO 3506-1, *Mechanical properties of corrosion-resistant stainless steel fasteners — Part 1: Bolts, screws and studs*

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods*

ISO 3734, *Petroleum products — Determination of water and sediment in residual fuel oils — Centrifuge method*

ISO 7203-2, *Fire extinguishing media — Foam concentrates — Part 2: Specification for medium- and high-expansion foam concentrates for top application to water-immiscible liquids*

ISO 7203-3, *Fire extinguishing media — Foam concentrates — Part 3: Specification for low-expansion foam concentrates for top application to water-miscible liquids*

BS 5117-1.3:1985, *Testing corrosion inhibiting, engine coolant concentrate ("antifreeze"). Methods of test for determination of physical and chemical properties. Determination of freezing point*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

characteristic value

value declared by the foam concentrate supplier for the chemical and physical properties and the performances of the foam, foam solution, and foam concentrate

3.2

25 % drainage time

time for 25 % of the liquid content of a foam to drain out

3.3

expansion

ratio of the volume of foam to the volume of the foam solution from which it was made

3.4

low-expansion

expansion (3.3) in the range 1 to 20, as applied to foam and to associated equipment, systems and concentrates

3.5

medium-expansion

expansion (3.3) in the range 21 to 200, as applied to foam and to associated equipment, systems and concentrates

3.6

high-expansion

expansion (3.3) greater than 200, as applied to foam and to associated equipment, systems and concentrates

3.7

foam

<firefighting> aggregate of air-filled bubbles formed from an aqueous solution of a suitable foam concentrate

3.8

concentrate

<foam> liquid that, when mixed with water in the appropriate concentration, gives a foam solution

3.9

protein foam concentrate

P

foam *concentrate* (3.8) derived from hydrolysed protein materials

3.10

fluoroprotein foam concentrate

FP

protein foam *concentrate* (3.8) with added fluorinated surface-active agents

3.11

synthetic foam concentrate

S

foam *concentrate* (3.8) based on a mixture of hydrocarbon surface-active agents and which can contain fluorocarbons with additional stabilizers

3.12

alcohol-resistant foam concentrate

AR

foam *concentrate* (3.8) resistant to breakdown when applied to the surface of alcohol or other water-miscible solvents

3.13

aqueous film-forming foam concentrate

AFFF

foam *concentrate* (3.8) based on a mixture of hydrocarbon and fluorinated surface-active agents with the ability to form an aqueous film on the surface of some hydrocarbons

3.14

film-forming fluoroprotein foam concentrate

FFFP

fluoroprotein foam *concentrate* (3.8) that has the ability to form an aqueous film on the surface of some hydrocarbons

3.15

foam solution

solution of foam *concentrate* (3.8) and water

3.16

forceful application

application of foam such that it falls directly onto the surface of a liquid fuel

3.17

gentle application

application of foam indirectly to the surface of a liquid fuel via a backboard, tank wall or other surface

3.18

sediment

insoluble particles in the foam concentrate

3.19

spreading coefficient

value calculated from the measured surface and interfacial tensions to indicate the ability of one liquid to spontaneously spread across the surface of another

3.20

temperature for use

maximum and minimum temperatures claimed by the manufacturer between which the foam concentrate is ready for use

3.21

fluorine-free foam concentrate

F3

foam *concentrate* (3.8) which does not form an aqueous film on hydrocarbon fuels, but which targets Class B performance at forceful application and which does not contain any fluorochemicals

3.22

Class A foam concentrate

foam *concentrate* (3.8) for use on *Class A fires* (3.23)

3.23

Class A fire

fire involving solid materials, usually of an organic nature, in which combustion normally takes place with the formation of glowing embers

Note 1 to entry: Adapted from ISO 3941:2007, Clause 2.

Note 2 to entry: Class A fires involve solid materials, usually of an organic nature (such as vegetation, wood, cloth and paper), rubber, and some plastics, in which combustion can occur at or below the surface of the material, with or without the formation of glowing embers.

4 Grades and uses of foam concentrates

4.1 Grades

According to its test fire performance (see Clause 13), a foam concentrate shall be graded

- as Class I, II or III for extinguishing performance, and
- as Level A, B, C or D for burn-back resistance.

4.2 Use with sea water

If a foam concentrate is marked as suitable for use with sea water, the recommended concentrations for use with fresh water and for use with sea water shall be identical.

5 Tolerance of foam concentrates to freezing and thawing

A foam concentrate that the supplier claims not to be adversely affected by freezing and thawing shall show no visual signs of either stratification or non-homogeneity before and after temperature conditioning in accordance with A.2, when tested in accordance with Annex B.

Foam concentrates complying with this clause shall be tested for compliance with the appropriate requirements given in other clauses of this document after freezing and thawing in accordance with A.2.1.

6 Sediment in foam concentrates

6.1 Sediment before ageing

Any sediment in the concentrate sampled in accordance with A.1 shall be dispersible through a 180 µm sieve, and the volume percentage of sediment shall be not more than 0,25 % when tested in accordance with Annex C.

6.2 Sediment after ageing

Any sediment in the concentrate aged in accordance with C.1 shall be dispersible through a 180 µm sieve, and the volume percentage of sediment shall be not more than 1,0 % when tested in accordance with Annex C.

7 Determination of viscosity

7.1 Newtonian foam concentrates

The viscosity of the foam concentrate at the lowest temperature for use claimed by the manufacturer shall be determined in accordance with ISO 3104. If the viscosity is greater than 200 mm²s⁻¹, the container shall be marked as follows: "This concentrate can require special proportioning equipment".

7.2 Pseudo-plastic foam concentrates

The viscosity of the foam concentrate shall be determined in accordance with Annex D. If the viscosity at the lowest temperature for use is greater than or equal to 120 mPa*s at 375/s, the container shall be marked as follows: "This concentrate can require special proportioning equipment".

NOTE Pseudo-plastic foam concentrates are a particular class of non-Newtonian foam concentrates and have a viscosity that decreases with increasing shear rate at constant temperature.

8 pH of foam concentrates

8.1 pH limits

The pH of the foam concentrate, before and after temperature conditioning in accordance with A.2, shall be not less than 6,0 and not more than 8,5 at $(20 \pm 2) ^\circ\text{C}$.

8.2 Sensitivity to temperature

The difference in pH between before and after temperature conditioning shall not be greater than 1,0 pH units.

9 Surface tension of the foam solution

9.1 Before temperature conditioning

The surface tension of the foam solution prepared from the concentrate, before temperature conditioning in accordance with A.2, at the supplier's recommended concentration, shall be within $\pm 10\%$ of the characteristic value when determined in accordance with E.2.

9.2 Temperature sensitivity

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The surface tension of the foam solution prepared from the concentrate, after temperature conditioning in accordance with A.2, at the supplier's recommended concentration, shall be determined in accordance with E.2.

The value obtained after temperature conditioning shall not be less than 0,95 times, or more than 1,05 times, the value obtained before temperature conditioning.

10 Interfacial tension between the foam solution and cyclohexane

10.1 General

Interfacial tension shall only be tested on foam agents which are declared by the manufacturer to be aqueous film-forming.

10.2 Before temperature conditioning

Before temperature conditioning in accordance with A.2, the difference between a) the interfacial tension between the foam solution prepared from the foam concentrate and cyclohexane (when determined in accordance with E.3) and b) the characteristic value for interfacial tension shall not exceed 1,0 mN/m or 10 % of the characteristic value, whichever is greater.

10.3 Temperature sensitivity

After temperature conditioning in accordance with A.2, the interfacial tension between the foam solution prepared from the foam concentrate and cyclohexane shall be determined in accordance with E.3.

The two values obtained before and after temperature conditioning shall not differ by more than 0,5 mN/m.

11 Spreading coefficient of the foam solution on cyclohexane

The spreading coefficient shall only be tested on foam agents which are declared by the manufacturer to be aqueous film-forming.

Before and after temperature conditioning in accordance with A.2, the spreading coefficient of the foam solution prepared from a concentrate claimed by the supplier to be film-forming shall be positive when calculated in accordance with E.4.

NOTE Foam concentrates conforming with this clause are more likely to be of type AFFF or FFFP than of type FP, P, F3 or S.

12 Expansion and drainage of foam

12.1 General

Either of the following tests shall be conducted twice with potable water and if appropriate twice with synthetic sea water, and the average of both series shall be recorded.

12.2 Expansion limits

The foam produced from the foam concentrate, before and after temperature conditioning in accordance with A.2, with potable water and, if appropriate, with the synthetic sea water according to G.2.4, shall have an average expansion within either ± 20 % of the characteristic value or $\pm 1,0$ of the characteristic value, whichever is greater, when tested in accordance with Annex F.

12.3 Drainage limits

The foam produced from the foam concentrate, before and after temperature conditioning in accordance with A.2, with potable water and, if appropriate, with the synthetic sea water according to G.2.4, shall have a 25 % average drainage time within ± 20 % of the characteristic value when tested in accordance with Annex F.

13 Test fire performance

The foam produced from the foam concentrate with potable water and, if appropriate, with the synthetic sea water according to G.2.4, shall have an extinguishing performance class and burn-back resistance level as specified in Table 1 when tested in accordance with G.2 and G.3, G.2 and G.4, or G.2 and G.3 plus G.4, as appropriate.

Table 1 — Maximum extinction times and minimum burn-back times

Durations expressed in minutes

Extinguishing performance class	Burn-back resistance level	Gentle application test (See G.4)		Forceful application test (See G.3)	
		Extinction time not more than	25 % burn-back time not less than	Extinction time not more than	25 % burn-back time not less than
I	A	Not applicable		3	10
	B	Not applicable	15	3	Not applicable
	C		10	3	
	D		5	3	
II	A	Not applicable		4	10
	B	Not applicable	15	4	Not applicable
	C		10	4	

	D		5	4	
III	B	5	15	Not applicable	
	C	5	10		
	D	5	5		
NOTE 1 There is no burn-back resistance Level A for Class III.					
NOTE 2 Typical extinguishing performance classes and burn-back resistance levels for different types of foam concentrate are given in Annex J.					
NOTE 3 NOTE 2 Extinction time is the period from the start of foam application until the time when all flames are extinguished					
NOTE 4 25 % burn-back time is the period from the ignition of the burn-back pot fuel until 25 % of the tray is covered by sustained flames or by “flare up” flames.					

14 Marking, packaging and specification sheet

14.1 Marking

14.1.1 The following information shall be marked on the shipping container:

- designation (identifying name) of the concentrate and the words "low-expansion foam concentrate";
- Class (I, II or III) and Level (A, B, C or D) of the foam concentrate and, if the concentrate complies with Clause 11, the words "aqueous film-forming";
- recommended concentration for use (most commonly 1 %, 3 %, or 6 %);
- any tendency of the foam concentrate to cause harmful physical effects, the methods required to avoid them and the first aid treatment if they occur;
- recommended storage temperature and temperature of use;
- if the concentrate complies with Clause 5, it shall be marked with the words; "Not affected by freezing and thawing"; or, if the foam concentrate does not comply with Clause 5, the words "Do not freeze";
- nominal quantity in the container;
- supplier's name and address;
- batch number;
- it shall be marked with the words "Not suitable for use with sea water" or "Suitable for use with sea water", as appropriate.

WARNING — It is extremely important that the foam concentrate, after dilution with water to the recommended concentration, shall not, in normal usage, present a significant toxic hazard to life in relation to the environment.

The recommended storage temperature and temperature of use are the same if the product is marked "Do not freeze".

14.1.2 Markings on shipping containers shall be permanent and legible.

14.1.3 It is recommended that non-Newtonian concentrates be appropriately identified.

14.1.4 Foam concentrates in accordance with ISO 7203-2 shall also be marked "medium-expansion" or "high-expansion" or both.