



International  
Standard

ISO 7076-6

Second edition  
2024-06

Fire protection — Foam fire  
extinguishing systems —

Part 6:  
Vehicle-mounted compressed air  
foam systems

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 document 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](http://www.iso.org/directives)).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at [www.iso.org/patents](http://www.iso.org/patents). ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 [www.iso.org/iso/foreword.html](http://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 second edition cancels and replaces the first edition (ISO 7076-6:2016), which has been technically revised. It also incorporates the Amendment ISO 7076-6:2016/Amd. 1:2020.

The main changes are as follows:

- in [4.3.2.5](#), the deviation from the set proportioning ratio has been modified;
- the title of [Clause 6](#) has been modified; within the clause, a citation to [Annex B](#) has been added.
- in [Table A.1](#), the rows for [4.2.3.3](#) and [4.2.4.1](#), the descriptions in the “individual assessment” column have been modified;
- [Annex B](#) has been added;
- editorial corrections have been made throughout the document.

A list of all parts in the ISO 7076 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](http://www.iso.org/members.html).

## Introduction

Compressed air foam systems (CAFS) conforming to this document are installed in fire-fighting vehicles, or used in conjunction with fire-fighting vehicles, to improve the efficiency of fire-extinguishing processes. CAFS improve the adhesion, penetration and retention time of the fire-extinguishing agent on the burning material, thereby transferring more energy and improving the cooling effect of the applied foam. This is achieved by adding foam concentrates and compressed air, to be delivered into water under pressure by the fire-fighting pump, to the fire.

CAFS generate homogeneous foam that increases the effective contact area of the foam on the burning material. This improves the adhesion and penetration of the foam to non-horizontal surfaces of the burning material, thereby increasing the period in which heat is effectively transferred.

It is assumed that systems defined in this document are only operated by suitably trained personnel.

For CAFS to be used at a temperature outside the temperature range defined in this document (i.e. from -10 °C to +40 °C), the particular temperature range is specified by the user. The manufacturer should determine any need for additional precautions by means of a risk assessment.

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# Fire protection — Foam fire extinguishing systems —

## Part 6: Vehicle-mounted compressed air foam systems

### 1 Scope

This document specifies requirements for compressed air foam systems (CAFS) in which foam concentrate and compressed air are continuously added to the water being discharged from the fire-fighting pump. This document is applicable to CAFS that can be permanently installed in fire-fighting vehicles, or that are transportable or mobile.

This document specifies requirements for CAFS which are used at ambient temperatures ranging from  $-10^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ .

This document does not apply to stationary CAFS.

This document does not apply to requirements for hazards related to handling foam concentrates, noise generated by CAFS, drives, auxiliary equipment, power sources, or pumps connected to the CAFS.

This document does not specify requirements for special hazards arising from particular conditions under which CAFS are used, for example:

- immunity against electromagnetic fields and electrostatic discharge;
- operation without supervision;
- events specific to the location where the CAFS is set up (e.g. on public roads);
- handling of any equipment, devices, etc. which have to be connected to the CAFS or are joined to it (e.g. branch pipes, nozzles and pressure hoses);
- decommissioning and disposal.

### 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 7000, *Graphical symbols for use on equipment — Registered symbols*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13854, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

ISO 13857, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

ISO 13943, *Fire safety — Vocabulary*

ISO 14120, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

IEC 60068-1, *Environmental testing — Part 1: General and guidance*

IEC 60204-1, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 61310-2, *Safety of machinery — Indication, marking and actuation — Part 2: Requirements for marking*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13943 and the following 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/>

#### 3.1

##### **air delivery rate**

volume of air, in ambient conditions, that is fed into the *compressed air foam systems* (3.5) per unit of time

Note 1 to entry: The measurement unit is l/min.

#### 3.2

##### **compressed air foam**

mixture of water, foam concentrate and compressed air

#### 3.3

##### **compressed air foam delivery pressure**

pressure of *compressed air foam* (3.2) at the delivery outlet of the *compressed air foam systems* (3.5)

Note 1 to entry: The measurement unit is MPa.

#### 3.4

##### **compressed air foam delivery rate**

volume of *compressed air foam* (3.2) at the delivery outlet of the *compressed air foam systems* (3.5), converted at atmospheric pressure, per unit of time

Note 1 to entry: The measurement unit is l/min.

#### 3.5

##### **compressed air foam system**

##### **CAFS**

system in which a foam concentrate and air are continuously added under pressure to the water being discharged from a fire-fighting pump

#### 3.6

##### **dry foam**

*compressed air foam* (3.2) defined by a nominal *foam solution/air volume ratio* (3.9) greater than 1:10, being mixed in the *compressed air foam systems* (3.5)

#### 3.7

##### **flushing procedure**

process to ensure that pipework associated to the foam proportioning system is adequately cleaned of foam concentrate and solution up to the discharge connection to avoid any damage

EXAMPLE Procedure to avoid damage by corrosion.

#### 3.8

##### **foam concentrate delivery rate**

volume of foam concentrate fed into *compressed air foam systems* (3.5), per unit of time

Note 1 to entry: The measurement unit is l/min.

**3.9****foam solution/air volume ratio**

relationship between parts of liquid (foam solution) and air (at atmospheric pressure) being mixed together in a *compressed air foam system* (3.5) mixing device

**3.10****foam solution delivery rate**

volume of foam solution delivered per unit of time by a system

Note 1 to entry: The measurement unit is l/min.

Note 2 to entry: At *proportioning ratios* (3.12) of up to 1 %, the difference between *water delivery rate* (3.13) and foam solution delivery rate can be neglected.

**3.11****operating range**

range (of conditions) specified by the manufacturer of a system and within which the CAFS can be operated without limitations while achieving the intended performance characteristics

**3.12****proportioning ratio**

amount of foam concentrate added to water given as a percentage in the foam solution

**3.13****water delivery rate**

volume of water fed into *compressed air foam systems* (3.5) per unit of time

Note 1 to entry: The measurement unit is l/min.

**3.14****wet foam**

*compressed air foam* (3.2) defined by a nominal *foam solution/air volume ratio* (3.9) between 1:3 and 1:10, being mixed in the *compressed air foam systems* (3.5)

## 4 Requirements

### 4.1 Conformance

#### 4.1.1 Type assessments

In order to conform to this document, the CAFS representative of normal manufacture shall meet the requirements of [Clauses 4, 6 and 7](#). The CAFS shall be verified by visual inspection or engineering assessment. It shall be tested as described in [Clause 5](#) and it shall meet the requirements of the tests (see [Annex A](#) for guidance on conducting the assessments).

It is recognized that minor variations can occur in the design of CAFS (e.g. to ensure compatibility with multiple truck types). Where minor variations occur and in the interests of economy, only one variant of each model need undergo type assessments. The CAFS should undergo new type assessments where a design change is likely to affect a requirement of this document. The extent of the re-assessment can be limited, depending on the type of design change that has been made to the CAFS. In all cases, the manufacturer should maintain appropriate documentation.

#### 4.1.2 Individual assessments

In addition to the requirements of [4.1.1](#), each CAFS produced by the manufacturer shall meet the requirements of the subclauses listed in [Table 1](#), which shall be verified by visual inspection, engineering assessment or test, and shall meet the requirements of the tests (see [Annex A](#) for guidance on conducting the assessments).

**Table 1 — Individual assessment schedule**

Assessment	Subclause number
Installation of the CAFS on the vehicle	<a href="#">4.2.2.1</a>
Moving parts	<a href="#">4.2.2.2</a>
Over-pressurization prevention	<a href="#">4.2.3.3</a>
Accumulated water removal	<a href="#">4.2.4.1</a>
Hot parts safety	<a href="#">4.2.5.1</a>
Hot parts notice	<a href="#">4.2.5.2</a>
Electrical equipment safety	<a href="#">4.2.6.2</a>
Operator controls and indicators	<a href="#">4.2.7</a>
Shutdown control	<a href="#">4.2.9</a>
Maintenance and service	<a href="#">4.2.10</a>
Protection against over-speed	<a href="#">4.2.11</a>
Safety from over-heating	<a href="#">4.2.12</a>
Drainage	<a href="#">4.3.1.3</a>
Proportioning ratio and foam solution/air volume ratio	<a href="#">4.3.2.1</a>
Maintenance of proportioning ratio	<a href="#">4.3.2.5</a>
Maintenance of foam solution/air volume ratio	<a href="#">4.3.2.7</a>
Storage vessels	<a href="#">4.3.3</a>
Nominal performance	<a href="#">5.2</a>
Marking	<a href="#">7.1</a>

## 4.2 Safety and protective measures

### 4.2.1 General

Safety of machinery shall conform to the requirements of ISO 12100.

### 4.2.2 Mechanical equipment

#### 4.2.2.1 Installation of CAFS on the vehicle

CAFS shall be so designed and constructed as to be installed on the vehicle, in such a way as to prevent malfunction, disconnection or damage caused by vibration during the operation of the vehicle.

#### 4.2.2.2 Moving parts

**4.2.2.2.1** Personnel shall be protected from injury by moving parts during inspection, operation and service. Where applicable, the following shall be provided:

- fixed guards in accordance with ISO 14120, conforming to the safety distances defined in ISO 13857;
- minimum clearance at the end of a motion sequence in accordance with ISO 13854.

**4.2.2.2.2** A cautionary notice shall be fitted to, or adjacent to moving parts that are accessed during inspection, operation and service and may cause injury.

### 4.2.3 Components under pressure

**4.2.3.1** The maximum operation pressure while using CAFS from the designated delivery outlets shall not exceed 1,0 MPa.

NOTE Higher pressures for specific applications can be agreed between users and a manufacturer.

**4.2.3.2** A device shall be provided to relieve the internal pressure of the CAFS after operation.

**4.2.3.3** Prevention of over-pressurization shall be ensured.

#### **4.2.4 Material, parts and components**

**4.2.4.1** If water can accumulate in the air system, a means of removing it shall be provided.

**4.2.4.2** Material, parts and components shall be resistant to corrosion by the foam concentrate, foam solution and compressed air foam.

#### **4.2.5 Hot parts**

**4.2.5.1** Personnel shall be protected from injury by hot parts during inspection, operation and service.

For further information, see ISO 13732-1.

**4.2.5.2** A cautionary notice shall be fitted to, or adjacent to hot parts that are accessed during inspection, operation and service and may cause injury.

#### **4.2.6 Electrical equipment**

**4.2.6.1** Electrical equipment shall meet the requirements of IEC 60204-1.

**4.2.6.2** Design measures shall be taken to protect electrical equipment from damage by water, foam concentrate, and foam solution during filling of storage vessels and operation.

#### **4.2.7 Operator controls and indicators**

**4.2.7.1** Controls and indicators used by the operator during fire-fighting actions shall be adequately arranged and operated for the purpose of safety, visibility and easier operation. See the IEC 61310 series.

**4.2.7.2** Manual operating equipment and other control elements shall be easy to reach and to operate when wearing protective gloves for fire-fighters, without having to apply excessive force.

**4.2.7.3** The number of switching operations shall be kept to a minimum. Control elements shall be arranged according to the operating sequence, in such a manner that operating errors are minimized.

#### **4.2.8 System failure and continuation of on-going fire-fighting operation**

**4.2.8.1** Safety-relevant failures in the CAFS shall be clearly indicated.

EXAMPLE Visual indicators on the fire-fighting pump's operating panel, supervision of control valves.

**4.2.8.2** Even in case of failure regarding the injection of foam concentrate or compressed air or both, the CAFS and the associated installation shall remain in a safe condition to ensure that the further extinguishing operation with water is maintained.

#### **4.2.9 Shutdown control**

The operating control station shall be equipped with a control that serves to switch off the system with a single operating step.

#### 4.2.10 Maintenance and service

4.2.10.1 Each part of CAFS shall be easily maintained and serviced.

4.2.10.2 Each part of CAFS which requires lubrication, such as bearings or moving parts shall be easily lubricated.

#### 4.2.11 Protection against over-speed

If necessary, the CAFS shall have a means of preventing maximum speed being exceeded. When the system is switched off, the fire-fighting pump shall be usable without restrictions and with no user intervention.

#### 4.2.12 Safety from over-heating

A visual or audible alarm shall activate when the temperature of air compressor oil or temperature of compressed air rises above a safe level. The safe level is determined by the manufacturer.

### 4.3 Performance

#### 4.3.1 Operation

4.3.1.1 The CAFS shall be capable of 6 h continuous operation at the nominal compressed air foam delivery rate specified by the manufacturer.

4.3.1.2 Adding foam concentrate while the CAFS is operating shall not cause an interruption in compressed air foam delivery.

4.3.1.3 It shall be possible to drain the CAFS of water and foam concentrate.

4.3.1.4 The CAFS shall operate at ambient temperature ranging from  $-10^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ .

#### 4.3.2 Proportioning ratio and foam solution/air volume ratio

4.3.2.1 The proportioning ratio and foam solution/air volume ratio may be continuously or incrementally adjustable.

4.3.2.2 The method of setting and selecting the proportioning ratio and foam solution/air volume ratio shall be agreed between the user and the manufacturer.

4.3.2.3 At nominal foam solution delivery rate, the achievable proportioning ratio shall be not less than 1 %.

4.3.2.4 Across the range of water delivery rates, the proportioning ratio shall be adjustable at least within the range of 0,5 % to 1,0 %.

4.3.2.5 Within the operating range, the deviation from the set proportioning ratio shall not exceed:

- 0 % to  $+30\%$  deviation from the set proportioning ratios of 1 % or greater;
- 0 % to  $+40\%$  deviation from the set proportioning ratios of less than 1 %.

4.3.2.6 At the nominal proportioning ratio, the CAFS shall produce wet foam within the compressed air foam delivery rate limits specified by the manufacturer.

NOTE Another specific requirement can be agreed between the user and the manufacturer.

**4.3.2.7** The foam solution/air volume ratio shall be automatically maintained or easily manually controlled within  $\pm 20$  % of the designated value as given in the CAFS description [see [7.2.3 c](#)].

### 4.3.3 Storage vessels

**4.3.3.1** Storage vessels shall not leak or become deformed during transport, use, or when being refilled.

**4.3.3.2** The quantity of foam concentrate in the storage vessel shall be available to the operator.

## 5 Tests

### 5.1 General

#### 5.1.1 Atmospheric conditions for tests

**5.1.1.1** Unless otherwise stated in a test procedure, conduct the testing after the test specimen has been allowed to stabilize in the standard atmospheric conditions for testing as specified in IEC 60068-1 as follows:

- temperature: (15 to 35) °C;
- relative humidity: (25 to 75) %;
- air pressure: (86 to 106) kPa.

**5.1.1.2** The temperature and humidity shall be substantially constant for each environmental test where the standard atmospheric conditions are applied.

#### 5.1.2 Mounting arrangements

The specimen shall be mounted by its normal means of attachment in accordance with the manufacturer's instructions. If these instructions describe more than one method of mounting, then the method considered to be most unfavourable shall be chosen for each test.

#### 5.1.3 Operating conditions for tests

**5.1.3.1** If a test method requires that a specimen be operational, then the specimen shall be connected to suitable supply and monitoring equipment with characteristics as required by the manufacturer's data. Unless otherwise specified in the test method, the supply parameters applied to the specimen shall be set within the manufacturer's specified range(s) and shall remain substantially constant throughout the tests. The value chosen for each parameter shall normally be the nominal value or the mean of the specified range.

**5.1.3.2** The details of the supply and monitoring equipment used shall be given in the test report; see [Clause 8](#).

**5.1.3.3** With the exception of foam expansion ratio test, and in the interests of environmental considerations and economy, water may be used as a substitute for foam concentrate during tests.

#### 5.1.4 Tolerances

**5.1.4.1** Unless otherwise stated, the tolerances for the environmental test parameters shall be as given in the basic reference standards for the test, e.g. IEC 60068-1.

**5.1.4.2** If a requirement or test procedure does not specify a tolerance or deviation limits, then deviation limits of  $\pm 5$  % shall be applied.

### 5.1.5 Provision for tests

5.1.5.1 The specimen is required to conduct the tests as indicated in the test schedule (see [5.1.6](#)).

5.1.5.2 The specimen submitted shall be representative of the manufacturer's normal production with regard to their construction.

### 5.1.6 Test schedule

The specimen shall be tested in the order shown and according to the test schedule in [Table 2](#).

**Table 2 — Test schedule for CAFS**

Test	Subclause number
Nominal performance	<a href="#">5.2</a>
Endurance	<a href="#">5.3</a>

The CAFS shall still be in a working condition and in accordance with this document after completion of the tests.

## 5.2 Nominal performance

### 5.2.1 Objective

To demonstrate that the CAFS has the performance designated in [Clause 6](#).

### 5.2.2 Procedure

5.2.2.1 Mount the specimen as described in [5.1.2](#) and connect it to supply and monitoring equipment as described in [5.1.3](#).

5.2.2.2 Operate the specimen in accordance with the manufacturer's specification at the maximum discharge volume and proportioning ratio of 1 %.

### 5.2.3 Measurements

5.2.3.1 Measure the foam solution delivery rate for 1 min.

NOTE The foam solution delivery rate can be calculated as the sum of the water delivery rate and the foam concentrate delivery rate.

5.2.3.2 Measure the air delivery rate for 1 min.

### 5.2.4 Requirements

5.2.4.1 The measured value of foam solution delivery rate shall not be less than the designated nominal foam solution delivery rate.

5.2.4.2 The measured value of air delivery rate shall not be less than the designated nominal air delivery rate.

## 5.3 Endurance

### 5.3.1 Objective

To demonstrate the ability of the CAFS to operate correctly for an extended period of time.

### 5.3.2 Procedure

5.3.2.1 Mount the specimen as described in [5.1.2](#) and connect it to supply and monitoring equipment as described in [5.1.3](#).

5.3.2.2 Set the proportioning ratio to 1 % or a higher value as nominated by the manufacturer.

5.3.2.3 Operate the CAFS at the maximum discharge volume for 6 h.

5.3.2.4 Do not make any adjustments to the CAFS during the test, except to refill foam concentrate (if used) and fuel.

### 5.3.3 Measurements

5.3.3.1 Measure the compressed air foam delivery pressure and compressed air foam delivery rate in intervals not exceeding 30 min.

NOTE The compressed air foam delivery rate can be calculated as the sum of the water delivery rate, the foam concentrate delivery rate and the air delivery rate.

5.3.3.2 Measure the water delivery rate through 1 min in intervals not exceeding 30 min.

5.3.3.3 Measure the foam concentrate delivery rate through 1 min in intervals not exceeding 30 min.

5.3.3.4 Measure the air delivery rate through 1 min in intervals not exceeding 30 min.

5.3.3.5 Designate the greater of the compressed air foam delivery pressure measured in this test as  $P_{\max}$  and the lesser as  $P_{\min}$ .

5.3.3.6 Designate the greater of the compressed air foam delivery rate measured in this test as  $V_{\max}$  and the lesser as  $V_{\min}$ .

### 5.3.4 Requirements

5.3.4.1 No interruption to operation shall occur.

5.3.4.2 No leakage of foam concentrate, water or compressed air shall occur.

5.3.4.3 The ratio of the compressed air foam delivery pressure values  $P_{\max}:P_{\min}$  shall not exceed 1,2.

5.3.4.4 The ratio of the compressed air foam delivery rate values  $V_{\max}:V_{\min}$  shall not exceed 1,2.

5.3.4.5 The variation of the proportioning ratio shall be within the range -0 % to +30 % of the ratio set at the start of the test.

5.3.4.6 The variation of the foam solution/air volume ratio shall not exceed  $\pm 20$  % of the ratio set at the start of the test.

## 6 Classification and designation

CAFS conforming to this document shall be classified in accordance with [Annex B](#).

CAFS conforming to this document shall be designated as follows with reference to [Figure 1](#):

- a) long designation;
- b) number of this document (i.e. ISO 7076-6:2024);
- c) short designation CAFS;
- d) nominal foam solution delivery rate/nominal air delivery rate.

NOTE 1 Nominal foam solution delivery rate means foam solution delivery rate at the nominal delivery pressure of the CAFS and nominal proportioning ratio of 1 %.

NOTE 2 Nominal air delivery rate means air delivery rate in normal conditions.

Compressed air foam system ISO 7076-6 CAFS-800/2400

Designation	_____
Number of this document	_____
Short designation of CAFS	_____
Nominal foam solution delivery rate/nominal air delivery rate	_____

**Figure 1 — Example designation of a compressed air foam system (CAFS)**

## 7 Marking and data

### 7.1 Marking

**7.1.1** The following information shall be permanently marked on the system:

- a) the registered name and the full address of the manufacturer and where applicable, of the authorized agent/representative;
- b) type, type test number;
- c) reference to this document and the designation;
- d) serial number of the CAFS and year of manufacture;
- e) at the operating panel/operator's position:
  - a diagram showing the system operating range;
  - a short-form of the operating instructions.

**7.1.2** Marking of control elements and filling devices shall be durable and legible at all times.

**7.1.3** Lubrication and servicing points, draining devices, etc. shall be identified by appropriate colours.

### 7.2 Operator instructions

#### 7.2.1 General

**7.2.1.1** Information for users shall be compiled in accordance with ISO 12100:2010, 6.4.5 and supplied with each CAFS.

**7.2.1.2** Pictograms shall conform to IEC 61310-2. Pictograms which are not included in IEC 61310-2 shall conform to ISO 7000.

### **7.2.2 CAFS information**

The operating instructions shall contain the following general CAFS information:

- a) application range and limits of use as intended (e.g. note that the system is not intended for use in potentially explosive atmospheres), including specification of all ambient conditions at the place of deployment;
- b) details on the CAFS, including:
  - 1) manufacturer's name or name of their authorized representative,
  - 2) designation, type, size,
  - 3) revision number and/or revision date of the operating instructions,
  - 4) warnings to prevent foreseeable misuse;
- c) necessary personal protective equipment (e.g. the need to wear protective gloves).

### **7.2.3 Description**

The operating instructions shall contain the following descriptions:

- a) general description of the system;
- b) ambient temperature range for system operation;
- c) design, mode of operation and system performance, including main specifications;
- d) the following information about the properties that the foam concentrate is required to have in order to be used with the system:
  - 1) proportioning ratio;
  - 2) viscosity;
- e) information concerning the hoses (e.g. diameter, length) and the nozzles to be used;
- f) maximum operating pressure;
- g) information on operating elements, indicators and displays;
- h) design, operating principle and use of protective devices;
- i) additional description of accessories;
- j) cutaway or exploded view drawings of the system as required by the party ordering the system;
- k) information on the electrical equipment.

### **7.2.4 Commissioning, operating and decommissioning**

The operating instructions shall include the following instructions for commissioning, operating and decommissioning the system:

- a) technical documents, including:
  - 1) measuring points and piping diagram (e.g. piping and instrumentation flow diagram);

- 2) overview of recommended lubricants;
- b) settings of control and monitoring equipment, including:
  - 1) function tests;
  - 2) setting values;
- c) instructions for putting the system into operation, including:
  - 1) commissioning;
  - 2) putting system into operation after interruptions;
  - 3) switching the system on/number of switching cycles;
  - 4) operation and starting-up with closed valve;
  - 5) operating characteristics with increased inlet pressure;
  - 6) special information (e.g. readiness for operation, disturbances);
- d) decommissioning, including:
  - 1) switching off the system;
  - 2) emptying and draining;
  - 3) flushing procedures (time, volume, pressure, etc.);
  - 4) preservation;
- e) other measures determined by the manufacturer, which are required for the safe and complete operation of the CAFS.

#### **7.2.5 Servicing and maintenance**

The operating instructions shall include the following system servicing and maintenance instructions:

- a) maintenance intervals and extent of maintenance work;
- b) maintenance and inspection tasks including:
  - 1) consumables including a list of replacement parts and special tools;
  - 2) monitoring during operation;
  - 3) preventive measures (e.g. for parts subject to wear, lubrication, sealing medium);
  - 4) warning against risks arising from incorrectly set safety devices;
- c) tightening torques for connecting elements;
- d) criteria for selecting parts needing replacement;
- e) durability of markings and warning notices.

#### **7.2.6 Fault causes and corrections**

The operating instructions shall include the following instructions on determining causes and corrective measures in case of faults:

- a) type of fault, including:
  - 1) hydrodynamic faults;

- 2) mechanical faults;
- 3) electrical faults;
- 4) faults in measuring instruments and their connections;
- b) correction of faults and elimination of faults on the basis of a product-specific checklist.

#### 7.2.7 Other technical documents

Where agreed by the manufacturer or authorized representative and the party ordering the CAFS, other technical documents shall be supplied.

#### 7.2.8 Short-form operating instructions

Short-form operating instructions with the following information shall be provided in a weather-resistant form (legibly and indelibly) that can be readily used by operators on site. These instructions shall include information about:

- a) commissioning;
- b) settings/operation without supervision;
- c) decommissioning; and
- d) operating range.

### 8 Test report

The report of type approval tests of CAFS shall contain at least following information:

- a) manufacturer's name or trademark;
- b) reference to this document, i.e. ISO 7076-6:2024;
- c) designation of the CAFS;
- d) identification of the CAFS assessed;
- e) details of the supply and monitoring equipment;
- f) results of assessments and tests;
- g) date of test;
- h) name and function of the person(s) conducting the tests;
- i) any deviations from the test procedure;
- j) any unusual features observed.

## Annex A

### (informative)

## Guidance on the inspection and testing of CAFS

### A.1 General

**A.1.1** This annex provides guidance for the inspection and testing of CAFS. The guidance shown in [Table A.1](#) includes the assessment items listed in [Table 1](#) and may be applied to both the type assessments, as required in [4.1.1](#), and individual assessments, as required in [4.1.2](#).

**A.1.2** When tests are conducted, appropriate, calibrated test equipment should be used. The calibration and use of test equipment should be controlled in accordance with a recognized quality system.

**A.1.3** This document does not include a requirement for third-party assessment of CAFS. The assessment can be undertaken by the manufacturer. However, first-party assessment can be unsatisfactory for the requirements of local regulations or specific customers.

**Table A.1 — Guidance for individual requirements**

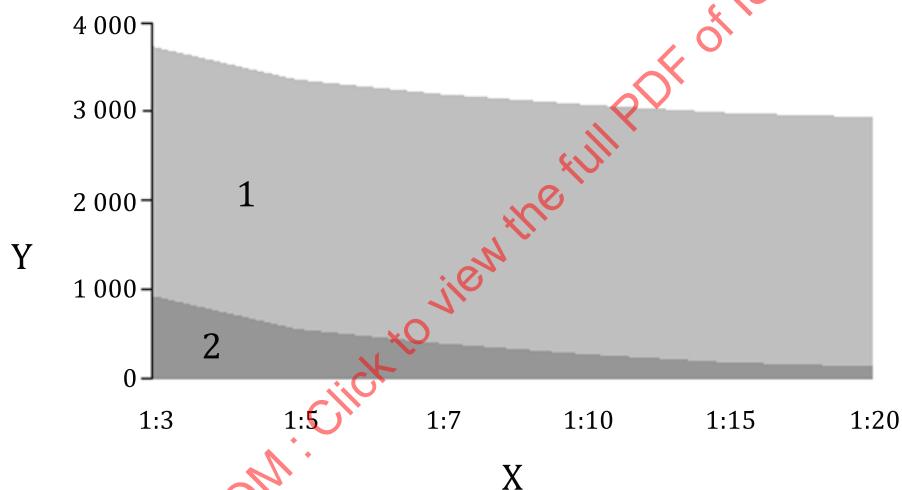
Subclause number	Type assessment	Individual assessment	Comments
<a href="#">4.2.2.1</a>	Inspection of design documentation and visual inspection of the installed CAFS.	Visual inspection of the installed CAFS.	A test run can assist in checking for unusual vibrations.
<a href="#">4.2.2.2</a>	Inspection of design documentation and visual inspection of the installed CAFS.	Visual inspection of installed CAFS and installed safety devices.	When not yet installed in a vehicle, additional data can be required to confirm compliance.
<a href="#">4.2.3.3</a>	Inspection of design documentation and installed CAFS.	Visual inspection of installed CAFS and installed safety devices.	For example, check that properly rated relief valves are installed. Run CAFS to see if hazardous situations can be avoided by other means.
<a href="#">4.2.4.1</a>	Inspection of design documentation and installed CAFS.	Inspection of documentation and visual inspection of installed CAFS.	CAFS shall avoid water accumulation as part of the design or with the provision of automatic means to release accumulated water.
<a href="#">4.2.5.1</a>	Inspection of documentation, design and installed CAFS.	Visual inspection of installed CAFS and inspection of parts ratings in the data.	The surface temperatures can be measured if required.
<a href="#">4.2.6.2</a>	Inspection of documentation, design and installed CAFS.	Visual inspection of installed CAFS.	Splash testing, if undertaken, shall be representative of what can happen in use.
<a href="#">4.2.7</a>	Inspection of design and installed CAFS.	Functional test.	A typical operation test can be sufficient for the individual assessment.
<a href="#">4.2.9</a>	Inspection of documentation. Inspection of design and installed CAFS.	Functional test.	—

Table A.1 (continued)

Subclause number	Type assessment	Individual assessment	Comments
<a href="#">4.2.10</a>	Inspection of documentation and design. Inspection of installed CAFS.	Inspection of documentation. Visual inspection of installed CAFS.	Maintenance and service points shall be identified in the manual.
<a href="#">4.2.11</a>	Inspection of documentation and design. Inspection of installed CAFS.	Inspection of documentation. Inspection of installed CAFS.	Precautions shall be necessary if a component (for example compressor) exceeds critical speeds during operation.
<a href="#">4.2.12</a>	Inspection of documentation. Inspection of installed CAFS. Endurance test within type test program.	Check documentation. Check installed CAFS.	While operating under normal conditions, no overheat situation shall occur, so simulating the alarms shall be necessary.
<a href="#">4.3.1.3</a>	Check design. Inspection of installed CAFS.	Visual inspection of installed CAFS.	Access to drain controls and drain outlets shall be reasonable for users.
<a href="#">4.3.2.1</a>	<p>The manufacturer declares the operating range of the CAFS in terms of intended:</p> <ul style="list-style-type: none"> <li>— water delivery rates;</li> <li>— air delivery rates;</li> <li>— foam concentrate delivery rates;</li> <li>— foam solution/air volume ratios to be achieved.</li> </ul> <p>The confirmed data can be shown in a chart (see <a href="#">Figure A.1</a>).</p> <p>The accuracy of proportioning ratio is tested over the operating range (foam solution delivery rate) identified by the manufacturer, which includes the nominal performance point. The proportioning ratio during these tests shall be the nominal proportioning ratio (1 %) and half of the nominal proportioning ratio.</p> <p>If the CAFS comprises flow meters, their calibration and accuracy shall be checked at the nominal performance point and at half the nominal performance point.</p>	<p>Confidence points shall be checked and shall include the following:</p> <ul style="list-style-type: none"> <li>— accuracy of proportioning ratio;</li> <li>— at nominal delivery rate and nominal proportioning ratio;</li> <li>— At half the nominal delivery rate and half the nominal proportioning ratio;</li> <li>— delivery rates and achieved expansion ratio;</li> <li>— at nominal delivery rate (for wet foam);</li> <li>— at the lowest delivery rate (for dry foam).</li> </ul> <p>A typical assessment can be to first check the calibration and the accuracy of the flow measurement. Test points shall be nominal delivery and half of the nominal delivery rates. Test nozzles or other recognized test procedures shall be used.</p>	<p>The accuracy of proportioning ratio can be tested for example by pumping water or simulating water flow and pumping the foam concentrate into a calibrated container over a defined period of time.</p> <p>Data on the expansion ratio shall be documented.</p> <p>The proportioning ratio during the expansion tests shall be adjusted according to data from the foam concentrate manufacturer. These data shall be recorded with the test results.</p> <p>The results of individual CAFS assessments can be usefully compared to the results from the type assessment.</p> <p>If the CAFS recognizes actual foam solution/air volume ratio during operation, foam expansion ratio test can be omitted in individual assessment.</p>
<a href="#">4.3.2.5</a>	<p>The procedure in general is the same as for <a href="#">4.3.2.1</a>. Data shall be recorded before the endurance test.</p> <p>After the endurance test, the confidence points required for the individual assessment shall be checked.</p>	Same as for <a href="#">4.3.2.1</a> .	During the endurance test, foam agent can be recirculated into the CAFS tank or substituted by water.

**Table A.1 (continued)**

Subclause number	Type assessment	Individual assessment	Comments
<a href="#">4.3.2.7</a>	The test can be conducted before the endurance test. Confidence points for the individual assessment shall be checked during the endurance test.	Same as for <a href="#">4.3.2.1</a> .	If foam injection is simulated during the endurance test, test hoses can show severe reaction from air pockets being transported along the hose. Suitable test hoses, securely connected to fixed pipes in the test well shall be used.
<a href="#">4.3.3</a>	Inspect of documentation and installation.	Inspect documentation and visual inspection of installed CAFS.	The operator instructions shall include certification or recertification procedures if required for pressure vessels.
<a href="#">5.2</a>	CAFS shall be operated at no less than the nominal duty point for the duration test.	Check confidence points. Nominal performance is one confidence point.	—
<a href="#">7.1</a>	Inspection of documentation and installation.	Inspection of documentation and installation.	—

**Key**

- X foam solution/air volume ratio
- Y compressed air foam delivery rate (l/min)
- 1 air
- 2 foam solution

**Figure A.1 — Example of operating range of CAFS**

## A.2 Foam expansion ratio determination procedure

### A.2.1 Confirmation of conformance with [4.3.2.1](#) should include recording the following data:

- ambient conditions (including temperature, barometric pressure, air speed, humidity);
- foam concentrate and proportioning ratio;
- foam solution and air delivery rate (air delivery rate may be obtained from compressor documentation);