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BSI Standards Publication

Fixed firefighting systems — Powder systems

Part 1: Requirements and test methods for components

bsi.

National foreword

This British Standard is the UK implementation of EN 12416-1:2024. It supersedes BS EN 12416-1:2001, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee FSH/18/8, Powder/Media Systems.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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This European Standard was approved by CEN on 24 June 2024.

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Contents

European foreword

This document (EN 12416-1:2024) 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of an identical text or by endorsement, at the latest by January 2025, and conflicting national standards shall be withdrawn at the latest by January 2025.

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 12416-1:2001+A2:2007.

The main changes compared with EN 12416-1:2001+A2:2007 are as follows:

— revision of the normative references;

— revision of Clause 6;

— revision of Annexes D, F, G and N;

— deletion of the former Annexes H and I;

— extension of the bibliography.

This European Standard has the general title "Fixed firefighting systems — Powder systems" and consists of the following two parts:

— Part 1: Requirements and test methods for components;

— Part 2: Design, construction and maintenance.

This document is included in a series of European Standards planned to cover also:

a) gas extinguishing components and systems (the EN 12094 series and the EN 15004 series);

b) sprinkler components and systems (the EN 12259 series and the EN 12845 series);

c) smoke control systems (the EN 12101 series);

d) explosion protection systems;

e) foam systems (the EN 13565 series);

f) hose systems (the EN 671 series);

g) water spray systems (CEN/TS 14816);

h) water mist components and systems (the EN 17450 series and the EN 14972 series).

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Introduction

It has been assumed in the preparation of this document that the execution of its provisions is entrusted to appropriately qualified and experienced people.

1 Scope

This document specifies requirements and test methods for materials, construction and performance of components intended for use in powder firefighting systems complying with EN 12416-2:2001+A1:2007.

The components covered are as follows:

— powder containers;

— expellant gas container assemblies;

— pressure regulators and gauges;

— actuators;

— main isolating valves and selector valves;

— nozzles.

The components are suitable for powder firefighting systems for general use in buildings and other construction works. In areas with a risk of explosion, earthquake zones, extreme environmental conditions, e.g. marine, offshore, mining or aircraft additional considerations apply.

This document covers components for use in powder extinguishing systems complying with EN 12416-2:2001+A1:2007. It does not cover, for example, pipes and fittings which are covered by more general standards for which requirements and recommendations are given in EN 12416-2:2001+A1:2007. Nor does it cover fire detectors or electrical control and indicating equipment.

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.

EN 286-1:1998, *Simple unfired pressure vessels designed to contain air or nitrogen — Part 1: Pressure vessels for general purposes*

EN 1964-3, *Transportable gas cylinders — Specification for the design and construction of refillable transportable seamless steel gas cylinders of water capacities from 0,5 litre up to and including 150 litres — Part 3: Cylinders made of seamless stainless steel with an Rm value of less than 1100 MPa*

EN 12094-4, *Fixed firefighting systems — Components for gas extinguishing systems — Part 4: Requirements and test methods for container valve assemblies and their actuators*

EN 12094-5, *Fixed firefighting systems — Components for gas extinguishing systems — Part 5: Requirements and test methods for high and low pressure selector valves and their actuators*

EN 12094-8, *Fixed firefighting systems — Components for gas extinguishing systems — Part 8: Requirements and test methods for connectors*

EN 12094-13, *Fixed firefighting systems — Components for gas extinguishing systems — Part 13: Requirements and test methods for check valves and non-return valves*

EN 12416-2:2001+A1:2007, *Fixed firefighting systems — Powder systems — Part 2: Design, construction and maintenance*

EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529)*

EN ISO 4126-1, *Safety devices for protection against excessive pressure — Part 1: Safety valves (ISO 4126-1)*

EN ISO 4126-2, *Safety devices for protection against excessive pressure — Part 2: Bursting disc safety devices (ISO 4126-2)*

EN ISO 9809-1, *Gas cylinders — Design, construction and testing of refillable seamless steel gas cylinders and tubes — Part 1: Quenched and tempered steel cylinders and tubes with tensile strength less than 1 100 MPa (ISO 9809-1)*

EN ISO 9809-2, *Gas cylinders — Design, construction and testing of refillable seamless steel gas cylinders and tubes — Part 2: Quenched and tempered steel cylinders and tubes with tensile strength greater than or equal to 1 100 MPa (ISO 9809-2)*

EN ISO 10297, *Gas cylinders — Cylinder valves — Specification and type testing (ISO 10297)*

EN ISO 17871, *Gas cylinders — Quick-release cylinder valves — Specification and type testing (ISO 17871)*

ISO 3864-1, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
actuator
component which when receiving a signal operates another component

3.2
bursting disc
diaphragm designed to burst at a predetermined pressure difference

3.3
calculation zone
zone for which the design quantity of the extinguishing media required is calculated separately

3.4
diptube
tube through which powder from the lower part of the container is transported into the piping

3.5
equipment fire
fire of three dimensional objects, also subject to leakage, dripping or splashing

3.6
expellant gas container
high pressure container to store the expellant gas

3.7
expellant gas container valve
valve which retains the expellant gas in the expellant gas container, and which releases it when actuated

3.8
fill ratio
mass of an expellant gas relative to the net capacity of the expellant gas container, expressed in kilograms per litre (kg/l)

3.9
flooding zone
zone comprising all calculation zones to be flooded simultaneously with the extinguishing media via one selector valve

3.10
local application system
system to protect separate objects

3.11
maximum working pressure
pressure (at a temperature of 50 °C) at which the system or the component can still work and may be operated

3.12
minimum release energy
energy which is needed for the operation of a component

3.13
minimum working pressure
pressure (at a temperature of –20 °C) at which the system or the component can still be operated

3.14
non-return valve
component permitting flow only in one direction

3.15
nozzle
component to achieve determined performance characteristics and a uniform distribution into or at a protected zone

3.16
pilot container
power source for a pneumatic alarm device and for actuation of the expellant gas container

3.17
(extinguishing) powder
extinguishing medium composed of finely divided solid chemical products consisting of one or more principle components, which are combined with additives to improve its characteristics

EXAMPLE BC powder is designed to extinguish class B (liquids or liquefied solids) and class C (gases) fires; ABC powder is designed to extinguish class A (solids which form glowing members), class B and class C fires.

Note 1 to entry: In North America and some other countries, the term "dry powder" is used to denote special metal fire extinguishing agents and the term "dry chemical extinguishing agent" is used to denote the extinguishing medium specified in this European Standard.

Note 2 to entry: When it is useful to indicate the class of fire for which a powder is designed, capital letters may be added before the term. The letters used in this European Standard are those specified in EN 2.

[SOURCE: EN 615:2009, 3.1]

3.18
protected zone
entire number of flooding zones protected by one system

3.19
selector valve
component which opens or prevents the flow of extinguishing media into a flooding zone

3.20
surface fire
fire spreading across horizontal surfaces. A surface fire may be a fire involving flammable liquids, gases or solids, not subjected to smouldering

3.21
total flooding system
system to protect the entire contents of an enclosed space

3.22
working pressure
pressure at which the component is used in the system

3.23
working temperature range
temperature range at which the system or the component can still work and may be operated

4 General requirements for components

4.1 Working temperature range

The components shall have a working temperature range of –20 °C to +50 °C.

If CO_2 pilot containers or CO_2 expellant gas containers are used the working temperature range shall be 0 °C to 40 °C.

4.2 General test facilities

It shall be ensured that the function of all actuators can be tested without discharging the expellant gas. Depending on the type of the system test connectors for an external test cylinder shall be available.

4.3 Stress corrosion test

If copper alloy parts are used they shall be subjected to the stress corrosion test in Annex I.

5 Powder container

5.1 Capacity

The volume shall be not more than 4000 l.

5.2 Design

The powder container shall be designed in accordance with EN 286-1 and shall be made of steel.

5.3 Maximum working pressure

The maximum working pressure shall not exceed 25 bar.

5.4 Colour

The powder containers shall be coloured red in accordance with ISO 3864-1.

5.5 Container components

5.5.1 Powder filling opening

The powder filling opening of the container shall be not less than DN 100.

Sight-holes, handholes, headholes and manholes may be used for filling in accordance with EN 286-1, if they are located on the top of the powder container.

5.5.2 Drain connection

For inspection of the interior of the container and testing of the powder, a drain connection to empty the powder container should be provided.

Drain connections, if provided, shall be not less than:

— for V up to 1000 l: R 1/2 or R_p1/2 or G 1/2;

— for V above 1000 l : R 1 or R_p1 or G 1.

5.5.3 Pressure relief device

The powder container shall be fitted with a pressure relief device. The set pressure of the pressure relief device is never greater than the maximum working pressure, but after pressure relief has commenced the pressure can exceed the maximum working pressure by 10 % maximum. The gas flow rate through the pressure relief device shall be greater than the maximum rate of expellant gas entering into the powder container.

5.5.4 Connection for the expellant gas tube

The expellant gas tube shall be fitted to the powder container discharging the gas below the powder surface. The system shall be designed to prevent powder entering the expellant gas system.

5.5.5 Powder diptube

The powder container shall be fitted with a powder diptube.

The diptube shall be fixed with sufficient strength to resist damage during operation (filling, emptying of the container or during the discharge of powder).

The length and configuration of the diptube shall be such that the volume of powder remaining in the container at the end of the discharge is less than 5 % of the internal volume of the container.

The function of the container including the diptube shall be demonstrated by test as specified in Annex D.

The powder filling opening of the container shall be not less than DN 100.

Sight-holes, handholes, headholes and manholes may be used for filling in accordance with EN 286-1, if they are located on the top of the powder container.

6 Expellant gas container assembly

6.1 Expellant gas containers

Expellant gas containers shall be constructed in accordance with EN ISO 9809-1, EN ISO 9809-2 and EN 1964-3.

To check the contents of the expellant gas container at any time, all individual containers shall be fitted with

a) a weighing device in case of pressure liquefied gases to weigh the contents;

b) in other cases with a working pressure gauge in accordance with Table 1 to indicate the internal pressure of the container.

6.2 Expellant gas valves

If the system has an automatic and a manual release, the expellant gas valve shall be in accordance with EN 12094-4 but without a diptube. If the system has a manual release only, an expellant gas container valve in accordance with EN ISO 10297 may be used, in this case CO_2 as expellant gas is not permitted and there is no need for any safety precautions, such as delay devices.

6.3 Actuators for expellant gas valves

Actuators for expellant gas valves shall comply with requirements for actuators in EN 12094-4.

6.4 Manifolds

Manifolds shall withstand a pressure of 1,5 times the maximum pressure of the gas used at a temperature of 50 °C when tested in accordance with Annex B.

Manifolds shall be designed in accordance with the relevant requirements for the pipework design as specified in EN 12416-2.

6.5 Flexible connectors and non-return valve

Expellant gas containers shall be fitted to the pipework or the manifold by flexible connectors in accordance with EN 12094-8.

When more than one container is used, each flexible connection to a manifold shall be fitted with a non-return valve in accordance with EN 12094-13.

7 Pressure gauges

Pressure gauges shall be in accordance with Table 1.

Table 1 — Pressure gauges

Parameter	Pressure regulators		Expellant gas container
	A downstream	B upstream	
Scale	0 to 1,5 times of the working pressure		
Graduation	1 bar	5 bar	10 bar
Accuracy	> 1,6 %	> 2 %	±5 %
Diameter	> 38 mm		

8 Pressure regulators

8.1 General

Powder containers with a capacity of more than 100 kg shall be fitted with a pressure regulator. A pressure regulator shall be fitted to build-up the necessary expellant gas pressure in the powder container and to maintain the working pressure of the powder system. The minimum setting of the pressure regulator shall be 10 % lower than the maximum working pressure. The pressure gauge of Type A shall be installed before and the pressure gauge of Type B behind the pressure regulator. The pressure gauges shall be in accordance with Table 1.

8.2 Material

All mechanical parts of the pressure regulator for the powder discharge valves and powder selector valves shall be made of metal or other materials which have at least the same performance characteristics.

Non-metallic materials and elastomers used in the pressure regulator shall not alter so that the operation is impaired before or after any of the tests. All materials shall be resistant to the media with which they come into contact.

If copper alloy is used the component shall be tested in accordance with Annex K.

8.3 Corrosion resistance

The pressure regulator shall be tested in accordance with Annex J.

8.4 Resistance to internal pressure

The pressure regulator shall be tested in accordance with Annex B.

8.5 Flow

The pressure regulator shall be designed so that the expellant gas flow ensures the required powder discharge in at least the minimum discharge time.

9 Actuators

9.1 General

9.1.1 Design

Actuators should be designed in accordance with EN 12094-4.

The requirements of this clause shall be met as minimum requirements.

9.1.2 Materials

All mechanical parts of the actuator for the powder discharge valves and powder selector valves shall be made of metal or other materials which have at least the same performance characteristics.

Non-metallic materials and elastomers used in the actuator shall not alter so that the operation is impaired before or after any of the tests. All materials shall be resistant to the media with which they come into contact.

If copper alloy is used the component shall be tested in accordance with Annex K.

9.1.3 Vibration resistance

The valve assembly including accessories and actuator shall not operate or be damaged when tested in accordance with EN ISO 10297 or EN ISO 17871.

9.1.4 Temperature resistance

The actuator shall be tested in accordance with Annex F and G.

9.1.5 Operational reliability

Actuators shall operate together with the associated valve and shall be tested in accordance with EN ISO 10297 or EN ISO 17871.

9.1.6 Corrosion resistance

Actuators shall operate together with the associated valve and shall be tested in accordance with Annex J.

9.1.7 Operating force

Corresponding to an opening time of maximum 1 s the effective force of the actuator shall be at least two times and in the case of pyrotechnic actuators at least three times the force necessary to open the valve under the most severe conditions, when the component is tested as specified in Annex C.

9.1.8 Electric switch and monitoring equipment

The degree of protection for enclosures of the switch and monitoring equipment as well as solenoid coils shall comply with class IP 54 according to EN 60529.

9.2 Solenoid operated type actuators

9.2.1 The degree of protection for enclosures shall conform to a minimum classification of IP 54 in accordance with EN 60529.

9.2.2 The solenoid operated type actuators shall be tested in accordance with Annexes C, D, E, F, G, H and I.

9.3 Pneumatic powered actuators

Pneumatic actuators of expellant gas containers shall comply with the requirements of EN 12094-4.

Pneumatic actuators of powder container main isolating valves and selector valves shall comply with the requirements of EN 12094-5, but shall operate in a maximum actuating time of 5 s. Pneumatic powered actuators shall be tested in accordance with Annexes C, D, E, F, G, H and I.

9.4 Mechanical operated actuators

The drop distance shall be at least 75 mm greater than the distance required to open the valve.

Springs acting as the prime mover in the release device shall be free to complete their full travel without impedance.

9.5 Pyrotechnic actuators

The actuator shall be tested in accordance with Annex C, D, E, F, G, H and I.

The manufacturer shall specify:

— minimum all-fire current and its minimum duration and the form of the signal; and

— maximum monitoring current; and

— range of voltage; and

— maximum storage time under specified storage conditions; and

— maximum life time under stand-by conditions (50 °C and 70 % relative humidity).

In addition, data shall be provided by the manufacturer to show that:

a) the failure rate of the device in the energy transfer path does not exceed 1 in 100 000 at the recommended firing current; and

b) actuators will achieve the required power output after being subjected to a 90-day ageing test at a test temperature of (90 ± 2) °C; and

c) the power output of the actuator at the end of its service life as recommended by the manufacturer will be not less than three times that required to operate the valve at the most disadvantageous operating conditions.

9.6 Manually released actuators

The manually released actuators shall be protected against unintentional use.

The force required to operate a manually released actuator shall not exceed:

a) 150 N for hand operated controls; or

b) 50 N for finger pull operated controls; or

c) 10 N for finger push operated controls;

The movement of the release shall not exceed 300 mm to achieve actuation. The manual remote release shall be tested together with the actuator in accordance with C.1.5.

9.7 Use in combination

Actuators for use in combination shall comply with the individual requirements of the appropriate clauses when tested as a combined assembly.

10 Main isolating valve and selector valve

10.1 General

The main isolating valves and the selector valve shall have a mechanical indicator to show the open and closed position.

Only ball valves or cavity free valves shall be used.

10.2 Material

All mechanical parts of main isolating valves and selector valves shall be made of metal or other materials which have at least the same performance characteristics.

Non-metallic materials and elastomers used in the main isolating valve and selector valve shall not alter so that the operation is impaired before or after any of the tests. All materials shall be resistant to the media with which they come into contact.

If copper alloy is used the component shall be tested in accordance with Annex K.

10.3 Temperature resistance

Main isolating valves and selector valves shall be tested in accordance with Annex F and G.

10.4 Resistance to pressure

The valve with actuator shall be tested in accordance with Annex B.

10.5 Flow characteristics

The free flow cross section of the valve shall be not less than 95 % of the area given by the inlet pipe nominal diameter.

The flow characteristic of the valve shall be stated by the manufacturer, either as an equivalent length of pipe, equal to the inlet pipe nominal diameter or as a flow resistance coefficient.

The valves shall be designed so that during operation no part of the valve or its components shall be ejected outside of the confines of the valve or into the discharge pipework.

10.6 Corrosion resistance

The main isolating valves and selector valves shall be tested in accordance with Annex J.

10.7 Vibration resistance

The valve assembly including accessories and actuator shall not operate or be damaged when tested in accordance with EN ISO 10297 or EN ISO 17871.

10.8 Operating force

The effective force of the actuator shall - under the most unfavourable conditions - be at least twice the force required to operate the valve.

The valves shall be tested in accordance with Annex C.

11 Nozzles

11.1 Material

The nozzle and internal parts shall be made of metal or material with equivalent properties.

The nozzle protective covers may be made of other materials.

11.2 Resistance to pressure

The nozzle shall be tested in accordance with Annex B.

11.3 Resistance to heat

The nozzle shall be tested in accordance with G.2.

11.4 Corrosion resistance

The nozzles shall be tested in accordance with Annex J and if for nozzles copper alloys are used they shall be tested in addition in accordance with Annex K.

11.5 Orifice diameter

The diameter of each orifice shall be not less than 7 mm.

11.6 Connections

Nozzles shall be either threaded or flanged.

11.7 Nozzle covers

The nozzle covers shall be tested in accordance with C.4. Provisions shall be made to prevent the cover causing injury or damage when it is blown off.

11.8 Discharge characteristics

11.8.1 Total flooding nozzle

The manufacturer shall state the flow rate, maximum area and volume coverage from a single nozzle type and whether it is of a central location type (360 °) or wall mounting type (180 °). The manufacturer shall state the following:

a) the recommended minimum mounting height;

b) the recommended maximum mounting height.

The nozzle shall be tested in accordance with Annex J.

11.8.2 Local application nozzle

The manufacturer shall state the flow rate and maximum area of coverage relative to vertical height and angles if relevant, and also the minimum distance to prevent splashing of liquid hazards.

The nozzle shall be tested in accordance with Annex K.

12 Documentation

12.1 The manufacturer shall prepare and maintain documentation which specifies the installation, operation, routine testing and maintenance of the component.

12.2 The documentation shall be submitted to the testing authority and shall comprise at least the following:

a) a general description of the component, including a list of the features and functions;

b) a technical specification including:

1) the minimum and maximum working pressure,

2) minimum and maximum operating force,

3) the bursting pressure,

4) power supply,

5) temperature range,

6) the suitability for use in various environments,

7) mounting instructions;

c) maintenance instructions.

12.3 The manufacturer shall also prepare, maintain and submit the following detailed description of the overall design:

a) the main parts of the component and their tasks;

b) part list;

c) layouts;

d) design drawings.

This documentation shall also comprise details of any components specific to the manufacturer.

12.4 All documentation specified by the manufacturer for use by the end user shall be normally supplied with the device and constitute part of supply as well as a list of spare parts.

13 Marking

13.1 General

All components shall be marked with the following:

a) the manufacturer's name or identifying mark;

b) the part number or identification code;

c) the number of this European standard (i.e. EN 12416-1).

13.2 Powder containers

Containers shall be marked in accordance with EN 286-1:1998, Clause 12.

13.3 Expellant gas containers and pilot containers

Expellant gas containers and pilot containers shall be marked with the following:

a) the markings specified in 13.1;

b) gas indication;

c) maximum working pressure, in bar;

d) net and gross mass for CO_2, in kilograms;

e) filling pressure, in bar;

f) type and serial or batch identification of the container and year of manufacture;

g) the words “No diptube”, in case of using CO_2.

13.4 Actuators

Actuators shall be marked with the following:

a) the markings specified in 13.1;

b) model designation;

c) serial or batch number;

d) nominal voltage and current for electrical types;

e) working pressure for pneumatic types;

f) manufacturing date for pyrotechnic types.

13.5 Expellant gas valves and container valves

Expellant gas valves and container valves shall be marked with the following:

a) nominal diameter or model designation;

b) working pressure;

c) serial or batch number;

d) in the case of rigid curved diptubes the mounting position of the diptube inlet.

13.6 Main isolating valves and selector valves

Main isolating valves and selector valves shall be marked with the following:

a) the markings specified in 13.1;

b) the direction of flow;

c) maximum working pressure;

d) nominal diameter;

e) mounting position, if the component is not intended for all mounting positions.

13.7 Nozzles

Nozzles shall be marked with the following:

a) the markings specified in 13.1;

b) the orifice sizes (diameter, square section or by reference to a code number).

14 Type test methods

14.1 Conditions

Assemble the components in accordance with the manufacturer's instructions and recommendations. The test shall be carried out at (23 ± 10) °C, except when otherwise specified for a particular test.

14.2 Samples and order of tests

The components shall be tested in accordance with Table 2.

Table 2 — Test methods for components

Components	**Tests in accordance with**
Powder container	EN 286-1 and Annex A and D
Pressure relief device	EN ISO 4126-1 and EN ISO 4126-2
Main isolating valves and selector valves	Clause 14, Table 3
Expellant gas container	Annex B and K; EN ISO 9809-1, EN ISO 9809-2, EN 1964-3
Expellant gas valves	EN 12094-4
Manifold of expellant gas container	Annex B
Flexible connectors	EN 12094-8
Non-return valves	EN 12094-13
Pressure regulator	Clause 14, Table 3
Valves and actuators	Clause 14, Table 3
Manual remote release	C.1.5
Nozzles	Annex B, C.4, G.2, Annexes J, K and L

The order of tests shall be carried out in accordance with Table 3.

Table 3 — Order of tests for components

Tests	Components	Annex	Order of test sample		
			largest component	medium component	smallest component
Compliance test	all components	Annex A	1	1	1
Pressure test	- Pressure regulators - manifolds - nozzles	Annex B	2	2	2
Operating force and function test	Valve and actuators	C.1	3	3	3
	Manual remote release	C.1.5			
	Main isolating and selector valve	C.2			
	Pressure regulator [a]	C.3			
	Protected cover of nozzle	C.4			
Determination of the remaining media in the container after discharge	Powder container	Annex D	6	6	6
Opening and closing time test	Valve and actuator	Annex E	4		
Low temperature test [b]	Valve and actuator	Annex F	5	5	5
High temperature test [b]	Valve and actuator	G.1	7	7	7
	Nozzle	G.2			
Salt spray corrosion test	- Valve and actuator - Main isolating and selector valve - Nozzle	Annex H	8 8 8	—	—
Stress corrosion test	all components made of copper alloy	Annex I	9	—	—
Strength test	- Expellant gas container - Main isolating and selector valve	Annex J	10	—	—
Jet velocity test	Nozzle	Annex K	11	—	—

Flow rate test	Nozzle	Annex L	12	12	12

[a] The operating force test is not applicable for pressure regulators.

[b] The need for these tests depends on construction.

15 Evaluation of conformity

15.1 General

The compliance of powder components with the requirements of this standard shall be demonstrated by:

— initial type testing,

— factory production control by the manufacturer.

15.2 Initial type testing

Initial type testing shall be performed on first application of this standard. Tests previously performed in accordance with the provisions of this standard (e.g. same product, same characteristic(s), test method, sampling procedure, system of evaluation of conformity) may be taken into account. In addition, initial type testing shall be performed at the beginning of the production of a product type or at the beginning of a new method of production (where these may affect the stated properties).

Initial type testing shall be carried out as stated in Clause 14.

15.3 Factory production control (FPC)

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market conform with the stated performance characteristics. The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product, and shall be sufficiently detailed to ensure that the conformity of the product is apparent.

The results of inspections, tests or assessments requiring action shall be recorded, as shall any action taken. The action to be taken when control values or criteria are not met shall be recorded.

NOTE A suitable method of the FPC system is specified in EN ISO 9001.

Annex A
(normative)

Compliance test

A visual and measurement check shall be made to determine whether the test samples correspond to the description in the technical literature (drawings, parts lists, description of functions, operating and installation instructions), and whether the samples comply with this document.

Annex B
(normative)

Internal pressure test

Connect the test specimen inlet to a suitable hydraulic pressure supply and block off all other ports, if any, but make provision for venting.

Ensure that the test specimen is in the open position; in the case of multi-port test specimens, carry out the test in each open position.

Vent the system of air and increase the pressure at approximately 2 bar/s up to the test pressure.

Apply a hydrostatic pressure of not less than 1,5 times and not more than 1,55 times the maximum working pressure for a period of $\left(5\ ^{+1}_{0}\right)$ min.

At the end of this period examine the test specimen for leakage then release the pressure and examine for permanent deformation and distortion.

In the case of nozzles, the deflector may be removed.

Annex C
(normative)

Operating force and function test

C.1 Actuators

C.1.1 Solenoid operated actuators

For an electrical powered actuator connect the actuator to a power supply at the specified minimum (85 %), nominal and maximum (115 %) voltage. Trigger the actuator, measure the current and check the valve for correct operation three times at each voltage.

Verify by a suitable method that the minimum force given by the actuator is not less than twice the maximum force necessary to open the valve.

C.1.2 Pneumatic operated actuators

C.1.2.1 Operation

Carry out five operating cycles at (20 ± 5) °C using the minimum, nominal and maximum working pressure. Carry out five operating cycles at the minimum stated working temperature $^{+5}_{0}$ °C.

Trigger the actuator and check the valve for correct operation three times at each pressure.

Connect the pneumatic actuator to a pressure supply at 50 % of the specified minimum pressure. Trigger the actuator and check the valve for correct operation three times.

C.1.2.2 Energy supply

Connect in series the maximum number of pneumatic operated actuators recommended by the manufacturer. Use a total length of tubing 25 % ± 10 mm longer than the maximum recommended by the manufacturer, and fit a pressure gauge to one end, the other end being for connection of the energy supply container fitted with a quick opening valve.

Condition the energy supply container, whether a pilot container or a master container of extinguishing medium, for $\left(24^{+0,5}_{0}\right)$ h at the lowest temperature recommended for storage. Connect the supply container to the tubing. Open the quick opening valve and record the pressure gauge reading. Check that the pressurized gas containers have discharged.

C.1.3 Mechanical operated actuators

For gravity powered actuators connect the component with specified weights and drop distance to a suitable test rig. Trigger the actuator and check the valve for correct operation three times.

Reduce the drop weight to 50 % of the specified drop weight. Trigger the actuator and check the valve for correct operation three times.

C.1.4 Pyrotechnic operated actuators

Place five pyrotechnic devices in an oven set at the maximum system temperature plus (20 ± 2) °C for (90 ± 2) d.

For pyrotechnic elements connect the actuator to a suitable power supply giving the specified signal at the specified minimum all-fire current. Trigger the actuator and check the valve for correct operation 10 times.

Verify by a suitable method, that the minimum force given by the actuator is not less than three times the maximum force necessary to open the valve.

C.1.5 Manual remote release

For components with manual remote release measure the force and movement of the handle at the centre of the area provided for this purpose with suitable instrumentation.

C.2 Main isolating valve and selector valve

Fit the valve and actuator to a test rig pressurized with nitrogen or air to a pressure that gives the most severe conditions.

Connect a force gauge, so that the centre of the force applied will be at the centre of the area provided for the purpose. Operate the valve and record the maximum force observed and the displacement of the point at which the force is applied to achieve actuation.

The figures for the maximum operating force under the most severe conditions and the point at which the force is applied shall be as given by the manufacturer.

The following cycle has to be carried out five times:

a) Apply a pressure of (20 ± 3) bar to the inlet port of a valve assembly using CO_2, air or nitrogen. The outlet shall be connected to a pipe with a length of (0,5 ± 0,1) m of the nominal diameter of the valve and to a nozzle.

b) Open the valve with the appropriate actuator. Check the correct function of the sample.

c) After (10 ± 5) s depressurise to a value below 5 bar and close the sample manually.

The supply pressure to the valve shall not drop below 15 bar.

Fit replacement parts at the end of each cycle on valves or actuators in those parts which are designed to be destroyed on normal operation of the valve.

C.3 Pressure regulators

C.3.1 Calibrate the pressure regulators in accordance with the instructions of the manufacturer and the design

— inlet pressure;

— outlet pressure.

C.3.2 By carrying out a flow test with compressed air for example, check the calibrated pressure.

C.3.3 After carrying out the test procedure in accordance with Table 3, check the calibrated

— inlet pressure;

— outlet pressure.

C.4 Protective cover of nozzles

The nozzle with cover shall be mounted on the pipe equipped with a pressure gauge.

Check that the protected cover is correctly fitted. Apply gas pressure increasing at 0,1 bar/s up to 1 bar. The cover shall be blown off at maximum 1 bar.

Annex D
(normative)

Determination of the remaining media in the container after discharge

NOTE This test relates to the requirements of 5.5.5.

The container is fitted with the container valve and diptube. The container shall be mounted on the test rig in the attitude specified by the manufacturer. The outlet of the valve shall not be reduced.

Open the valve to its fully open position and determine by mass, with the same uncertainty of measurement as before, the remaining volume of the media at the end of the discharge.

The mass of the set shall be measured with a maximum uncertainty of measurement of ±0,1 kg.

The test shall be carried out as a real discharge test with the powder.

Annex E
(normative)

Opening and closing times

The valves with actuators shall have opening and closing times of 3 s maximum when tested in accordance with C.1.

Annex F
(normative)

Low temperature test for actuators and valves

Cool the test assembly to $\left(-20\ ^{0}_{-2}\right)$ °C or the lowest service temperature recommended by the manufacturer with the same tolerances, whichever is the lower.

Carry out the following test cycle 10 times:

a) Apply a pressure of (20 ± 3) bar to the inlet port of a valve assembly using CO_2, air or nitrogen. The outlet shall be connected to a pipe with a length of (0,5 ± 0,1) m of the nominal diameter of the valve and to smallest, medium and largest nozzle.

b) Operate the valve with the appropriate actuator. Close the inlet pressure source and depressurize to a value below 5 bar.

The pilot pressure to the valve shall not drop below 5 bar during each test cycle.

Annex G
(normative)

High temperature test for actuators and valves

G.1 Actuators and valves

Heat the test assembly to $\left(+50\ ^{+2}_{0}\right)$ °C or the highest service temperature recommended by the manufacturer with the same tolerances, whichever is the higher.

Carry out the following test cycle 10 times:

a) Apply a pressure of (20 ± 3) bar to the inlet port of a valve assembly using CO_2, air or nitrogen. The outlet shall be connected to a pipe with a length of (0,5 ± 0,1) m of the nominal diameter of the valve and to smallest, medium and largest nozzle.

b) Operate the valve with the appropriate actuator. Close the inlet pressure source and depressurize to a value of 5 bar.

The working pressure to the valve shall not drop below 5 bar during each test cycle.

G.2 Nozzles

A nozzle is connected to the test vessel. The nozzle is connected to a pressure source and is subjected to a temperature of (600 ± 30) °C for a period of $\left(10\ ^{+3}_{0}\right)$ min. Then the gaseous test medium, e.g. CO_2, nitrogen or air shall flow with (60 ± 3) bar through the heated nozzle body for at least 10 s. The pressure shall be measured at a distance of (1 ± 0,1) m from the nozzle.

After the nozzles have been subjected to the test the diameter of the orifices shall conform to the drill tolerance (20 ± 3) °C.

Annex H
(normative)

Salt spray corrosion test

The sample shall be exposed to a salt spray within a fog chamber. The inlet of the valve or, if applicable, of the diptube and the inlet of pneumatic actuators shall be sealed. An open bend shall be fitted to the outlet to prevent direct influence of the salt spray to the valve's interior.

The essential components and properties of the reagents and the test configuration are:

— Solution consists of Na Cl in distilled water

— pH Value: 6,5 to 7,5

— Concentration of the solution: (5 ± 1) %

— Spray pressure: 0,6 bar to 1,5 bar

— Spray volume: 1 ml h^{-1} to 2 ml h^{-1} on an area of 80 cm^2

— Temperature in test cabinet: $\left(35\ ^{+1,0}_{-1,7}\right)$ °C

— Position of the sample: 15° to the vertical axis

— Spray time: (240 ± 2) h

— Drying time: (168 ± 5) h at a humidity of maximum 70 %.

Annex I
(normative)

Stress corrosion test

Use a suitable container of known capacity fitted with a capillary tube vent. The aqueous ammonia solution shall have a specific mass of 0,94 kg l^{-1} ± 2 %. The container is filled with (10 ± 0,5) ml of the solution for each litre of container volume.

Degrease the sample for test and expose for $\left(10 \frac{+1}{0}\right)$ days to the moist atmosphere of ammonia and air, at a temperature of (34 ± 2) °C. The samples are positioned (40 ± 5) mm above the level of the liquid.

After testing, the sample is cleaned and dried and subjected to careful visual examination. To make cracking clearly visible, the liquid penetration method shall be used.

Annex J
(normative)

Strength test for pressure regulators, main isolating valves and selector valves

Remove any internal components which may inhibit the application of pressure to any part of the valve prior to the test. Test multiport valves in each mode to ensure that the complete body is tested.

Connect the valve inlet to a suitable hydraulic pressure supply and block off all other ports including the pressure relief port but make provision for venting air.

Vent the system of air, and apply pressure at an increasing rate of approximately (2 ± 1) bar/s to a hydrostatic pressure of not less than 3 times and not more than 3,05 times the maximum working pressure for a period of $\left(5\ ^{+1}_{0}\right)$ min.

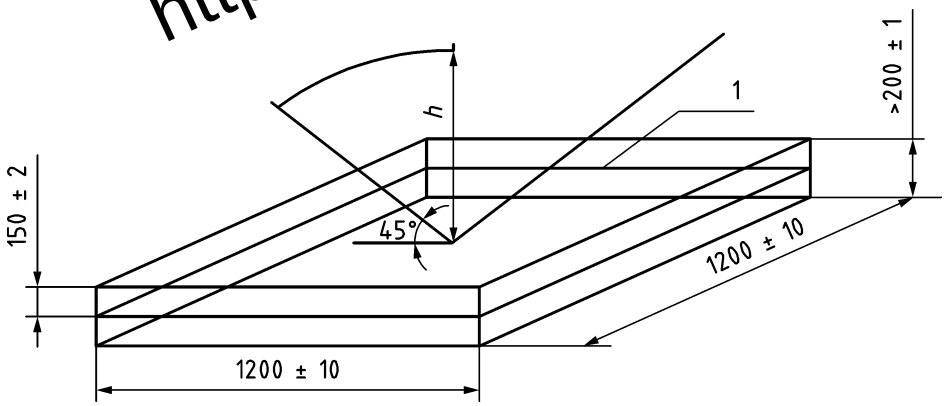
At the end of this period release the pressure and examine for permanent deformation, distortion or damage.

Annex K
(normative)

Jet velocity test

The local application nozzle shall be mounted above a basin partially filled with water, as shown in Figure K.1, at a distance (h) as specified by the manufacturer. The start pressure in the high-pressure container shall be more than (120 ± 5) bar. The pressure at the nozzle shall be (16 ± 1) bar. The nozzle shall not splash any water out of the test tray when directed at the water surface at an angle of 90° ± 1 and 45° ± 1to the surface of the liquid.

Dimensions in millimetres



Key

1 Water level

h Height above water level

Figure K.1 — Test tray for distribution tests for local application nozzles

Annex L
(normative)

Flow rate test

Checks shall be made to determine whether the smallest, medium and largest cross section of the nozzles comply with the flow rate indicated by the manufacturer. Deviations shall not exceed ±10 %.

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