BRITISH STANDARD

BS EN
12094-5:2006

Fixed firefighting systems — Components for gas extinguishing systems —

Part 5: Requirements and test methods for high and low pressure selector valves and their actuators

The European Standard EN 12094-5:2006 has the status of a British Standard

ICS 13.220.20

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 12094-5:2006. It supersedes BS EN 12094-5:2001 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee FSH/18, Fixed firefighting systems, to Subcommittee FSH/18/6, Gaseous extinguishing media and systems, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Additional information

In 4.1.9, Figures ZA.1 and ZA.3 the term 'flow resistance coefficient' is used. This characteristic, which is the friction or resistance that the valve, pipe or fitting presents to the flow of fluid, is also referred to in the UK as 'pressure loss coefficient'.

Subclause 5.9 currently requires tests on selector valves using both gas and water. For the next revision of the European Standard the UK will request that all selector valves are flow tested using only water to determine the flow resistance coefficient. In addition to simplifying the text, this will have the added benefit of avoiding an unnecessary discharge of the extinguishant to the environment. It should be noted that the coefficients used for the pipe fittings in the EN 12094 series were all determined using water.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Summary of pages

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English Version

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

Installations fixes de lutte contre l'incendie - Éléments constitutifs des installations d'extinction à gaz - Partie 5: Exigences et méthodes d'essai pour vannes directionnelles haute et basse pression et leurs déclencheurs

Ortsfeste Brandbekämpfungsanlagen - Bauteile für Löschanlagen mit gasförmigen Löschmitteln - Teil 5: Anforderungen und Prüfverfahren für Hoch- und Niederdruck-Bereichsventile und zugehörige Auslöseeinrichtungen

This European Standard was approved by CEN on 9 March 2006.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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Foreword

This European Standard (EN 12094-5:2006) 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 October 2006, and conflicting national standards shall be withdrawn at the latest by April 2009.

This European Standard supersedes EN 12094-5:2000.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this European Standard.

This European Standard is part of a series concerned with gas extinguishing system components.

The following European Standards are planned to cover:

— gas extinguishing systems (EN 12094),

— sprinkler systems (EN 12259 and EN 12845),

— powder systems (EN 12416),

— explosion protection systems (EN 26184),

— foam systems (EN 13565),

— hose systems (EN 671),

— smoke and heat control systems (EN 12101),

— water spray systems (EN 14816).

This standard has the general title “Fixed firefighting systems – Components for gas extinguishing systems” and will consist of the following parts:

— Part 1: Requirements and test methods for electrical automatic control and delay devices,

— Part 2: Requirements and test methods for non-electrical automatic control and delay devices,

— Part 3: Requirements and test methods for manual triggering and stop devices,

— Part 4: Requirements and test methods for container valve assemblies and their actuators,

— Part 5: Requirements and test methods for high and low pressure selector valves and their actuators,

— Part 6: Requirements and test methods for non-electrical disable devices,

— Part 7: Requirements and test methods for nozzles for CO_2 systems,

— Part 8: Requirements and test methods for connectors,

— Part 9: Requirements and test methods for special fire detectors,

— Part 10: Requirements and test methods for pressure gauges and pressure switches,

— Part 11: Requirements and test methods for mechanical weighing devices,

— Part 12: Requirements and test methods for pneumatic alarm devices,

— Part 13: Requirements and test methods for check valves and non-return valves,

— Part 16: Requirements and test methods for odorizing devices for CO_2 low pressure systems,

— Part 20: Requirements and test methods for the compatibility of components.

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

Introduction

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

All pressure data in this European Standard are given as gauge pressures in bar, unless otherwise stated.

NOTE 1 bar = 10^5 N m^{-2} = 100 kPa.

1 Scope

This European Standard specifies requirements and describes test methods for selector valves and their actuators used in CO_2 -, Inert Gas- or Halocarbon gas fire extinguishing systems.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 60068-2-6:1995, *Environmental testing — Part 2: Tests — Tests Fc: Vibration (sinusoidal) (IEC 60068-2-6:1995 + Corrigendum 1995)*

EN ISO 9001:2000, *Quality management systems — Requirements (ISO 9001:2000)*

3 Terms and definitions

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

3.1
actuator
component which causes a valve to operate

3.2
closing time
time for the sealing device of the valve to move from its fully open position to its fully closed position

3.3
CO_2-high-pressure installation
fire extinguishing installation in which the CO_2 is stored at ambient temperature. For example, the pressure of the CO_2 in storage is p_{abs} = 58,6 bar at 21 °C

3.4
CO_2-low-pressure installation
fire extinguishing installation in which the CO_2 is stored at low temperature, normally -19 °C to -21 °C

3.5
fill ratio
mass of extinguishing medium related to the net capacity of a container expressed as kilograms per litre (kg/l)

3.6
Halocarbon Gas
extinguishing agent that contains as primary components one or more organic compounds containing one or more of the elements fluorine, chlorine, bromine or iodine

3.7
Halocarbon Gas installation
fire extinguishing installation in which the Halocarbon Gas is stored at ambient temperature

3.8
Inert Gas
non liquefied gas or mixture of gases which extinguish the fire mainly by reducing the oxygen-concentration in the protected zone, such as Argon, Nitrogen or mixtures of these gases with CO_2

3.9
Inert Gas installation
fire extinguishing installation in which the Inert Gas is stored at ambient temperature

3.10
opening time
time for the sealing device of the valve to move from its fully closed position to its fully open position

3.11
selector valve
valve which releases the extinguishing media to the pipework for a flooding zone when activated

3.12
resistance coefficient
value for the calculation of the pressure drop in a component under two-phase flow condition

3.13
two-phase flow
partial change of phase of a fluid from liquid to vapour under flowing conditions

3.14
working pressure
pressure at which the component is used in the system

4 Requirements

4.1 General design

4.1.1 The valve body and internal parts except seals shall be made of metal. All mechanical parts of the actuator shall be made of metal. Operating moving parts shall be manufactured of stainless steel, copper, copper alloy or corrosion-protected steel (e.g. galvanised steel).

All materials shall be resistant to media with which they come into contact.

4.1.2 The open and closed position of the selector valve shall be clearly indicated by mechanical means at the valve or the actuator and shall be defined by mechanical limitation of the movement of the valve or the actuator.

4.1.3 Selector valves and actuators shall be designed for a maximum opening time of 3 s.

CO_2-low pressure selector valves and actuators shall be designed for a maximum opening time of 3 s and for a maximum closing time of 3 s.

4.1.4 Selector valves shall be designed such that the closed position may be left only by activation of the actuators or by manual means.

The closed position of CO_2-low pressure selector valves shall not be maintained only by friction.

4.1.5 Selector valves and pneumatic actuators shall be specified by the manufacturer for working pressure according to Table 1.

Selector valves may be specified by the manufacturer for use in systems with reduced and controlled pressure only.

Table 1 — Working pressure

Component	Working pressure in bar			
	CO_2-high-pressure component	CO_2-low-pressure component	Inert Gas component	Halocarbon Gas component
Selector valve	140	25	see NOTE	see NOTE
Pneumatic actuator	As specified by the manufacturer			
NOTE This value is given as the developed pressure in the container at 50 °C with the highest fill ratio/superpressurization, where applicable, or – for components specified for use in systems with reduced and controlled pressure only – as specified by the manufacturer.				

NOTE 1 Actuators may have a different working pressure than selector valves.

NOTE 2 Guidelines for planning and installation may require that a manual emergency operating device, if applicable, at the selector valve does not override pre-warning and time delay.

4.1.6 The pressure of the housing of the selector valve shall not exceed the working pressure in any operating position.

NOTE Cold liquid CO_2 locked in a closed CO_2-low pressure selector valve after flooding may cause pressures exceeding the working pressure when the temperature of the CO_2 and the valve goes up again.

4.1.7 The test samples shall comply with the technical description as specified in 4.12 (drawings, parts lists, description of functions, operating and installation instructions) when checked in accordance with 5.3.

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

4.1.9 The flow characteristics of the valve shall be specified by the manufacturer either as an equivalent length or as a flow-resistance coefficient.

4.1.10 The nominal and the internal diameter of the pipes at the inlet and the outlet of the valve shall be specified by the manufacturer.

4.1.11 The free flow cross sectional area of CO_2 selector valves shall be not less than 80 % of the area given by the inlet pipe internal diameter.

4.1.12 Where the component incorporates a pneumatic actuator, the manufacturer shall specify nominal, maximum and minimum figures for the pressure supply.

4.1.13 Where the component incorporates a gravity powered actuator, the manufacturer shall specify the mass and the drop distance.

4.1.14 Where the component incorporates an electric powered actuator, the manufacturer shall specify nominal, maximum and minimum figures for voltage and current and the electrical data giving 50 % of the force achieved for nominal electrical conditions (voltage and current). Electric powered actuators shall be specified for continuous duty.

4.1.15 The component shall be specified by the manufacturer either for installation on walls only or for installation on both walls and machinery.

4.1.16 For Inert gas and Halocarbon gas selector valves not specified for use in systems with reduced and controlled pressure only the manufacturer shall specify the maximum developed pressure in the container at 20 °C with the highest fill ratio/superpressurization, as applicable.

4.2 Connection threads and flanges

Connections threads shall comply with European Standards or International Standards for threads, e.g. ISO 7-1 or EN ISO 228-1 and for flanges, e.g. EN 1092 or ISO 7005.

Inlet and outlet connections of the valve shall be of the same size in diameter.

4.3 Function and ambient temperatures

The selector valve and actuator shall operate in an ambient temperature range encompassing - 20 °C to + 50 °C, when tested in accordance with 5.4 and 5.8.

NOTE Test temperature for CO_2-low pressure selector valves in accordance with 5.8 is - 30 °C taking into account temperature drop during discharge.

Selector valves and actuators shall have opening times of maximum 3 s, when tested in accordance with 5.4 and 5.8.

CO_2-low pressure selector valves with their actuators shall have times for opening and closing of 3 s maximum, when tested in accordance with 5.4 and 5.8.

After being tested as described in 5.8.1 selector valves shall meet the requirements of 4.4 when tested as described in 5.5.2 at the test temperature defined in 5.8.1.

After being tested as described in 5.8.2 selector valves shall meet the requirements of 4.4 when tested as described in 5.5.2 at the test temperature defined in 5.8.2.

4.4 Resistance to internal pressure and leakage

The valve and, where applicable, the pneumatic actuator, shall not suffer any permanent deformation when tested as described in 5.5.1 at 1,5 times the working pressure. When subsequently tested as described in 5.5.2 the leakage shall not exceed 10 ml in the case of CO_2-low pressure valves and 100 ml in the case of actuators and other valves in (300^{+10}_{0}) s at atmospheric pressure.

4.5 Resistance to bursting

The valve casing, closure mechanism and pressurised actuators shall not burst when subjected to a test pressure of three times the working pressure, when tested in accordance with 5.6.

4.6 Operational reliability

There shall be no deterioration of performance when a selector valve and actuator is tested in accordance with 5.7. During operation no part of the valve or its components shall be ejected outside the confines of the valve or into the discharge pipework.

After the operational reliability test, the components shall meet the requirements of 4.4 when tested as described in 5.5.2.

4.7 Flow characteristics

4.7.1 Except as stated in 4.7.2, the flow characteristic figures of the valves given by the manufacturer shall be in the accuracy range of ± 10 %, when tested in accordance with 5.9.

4.7.2 The test in accordance with 5.9 is not necessary when the following conditions are in place:

— the valve is a ball valve, and

— the free flow cross sectional area of the selector valves is not less than 100 % of the area given by the inlet pipe internal diameter, and

— the flow characteristic data of the valves given by the manufacturer represent at least a pipe or a pressure drop of a pipe with the length of the component.

4.8 Resistance to corrosion

After being subjected to the corrosion test as described in 5.10, the valve assemblies shall operate satisfactorily when tested as described in 5.4 and shall meet the requirements of 4.4 when tested as described in 5.5.2.

4.9 Resistance to stress corrosion

Any copper alloy part used in the valve assembly shall be tested in accordance with 5.11 and shall not crack when tested.

4.10 Vibration resistance

The valve assembly including accessories and actuator shall not operate or be damaged when tested in accordance with 5.12. No deterioration or detachment of parts shall occur during the test.

After the vibration test, the valve assemblies shall operate satisfactorily when tested as described in 5.4 and shall meet the requirements of 4.4 when tested as described in 5.5.2.

4.11 Operating force

The effective force of the actuator shall be at least twice the force required to operate the valve, when the valve assembly is tested in accordance with 5.13.

4.12 Documentation

4.12.1 The manufacturer shall prepare and maintain documentation.

4.12.2 The manufacturer shall prepare installation and user documentation, which shall be submitted to the testing authority together with the sample(s). This documentation shall comprise at least the following:

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

b) a technical specification including:

   1) the information mentioned in 4.1;

   2) sufficient information to permit an assessment of the compatibility with other components of the system (if applicable e.g. mechanical, electrical or software compatibility);

c) installation instructions including mounting instructions;

d) operating instructions;

e) maintenance instructions;

f) routine testing instruction, if appropriate.

4.12.3 The manufacturer shall prepare design documentation, which shall be submitted to the testing authority together with the sample(s), except where the conditions of supply to the manufacturer make this impossible. This documentation shall include drawings, parts lists, block diagrams (if applicable), circuit

diagrams (if applicable) and a functional description to such an extent that compliance with this document may be checked and that a general assessment of the design is possible.

5 Type test methods

5.1 Conditions

The components shall be tested assembled as recommended for installation by the manufacturer. The tests shall be carried out at a temperature of (25 ± 10) °C, except when otherwise stated.

The tolerance for all test parameters is 5 %, unless otherwise stated.

5.2 Samples and order of tests

For the tests of one selector valve the manufacturer shall submit two samples.

For the tests of a design series with two sizes of selector valves the manufacturer shall submit one sample of each size.

The order of tests is shown in Table 2 (sample A and B).

For the tests of a design series with more than two selector valves the manufacturer shall submit three samples with three different diameters.

The order of tests is shown in Table 2.

NOTE It is recommended to use the bottom, top and middle of the range of sizes. The individual tests may be done with different test samples and the tests may be done in other sequences than the sequence shown in Table 2, except when a special sequence is explicitly required in this European Standard.

Table 2 — Order of tests

Tests methods	Order of tests for		
	sample A	sample B	sample C
5.3 Compliance	1	1	1
5.4 Test for function	3/9/14	3	3
5.5 Test for resistance to internal pressure	2	2	2
5.5.2 Leakage test	10/12/15	—	—
5.6 Test for resistance to bursting	16	—	—
5.7 Test for operational reliability	11	—	—
5.8 Test for operation under temperature conditions			
5.8.1 Low temperature test (including leakage test)	6	6 [a]	6 [a]
5.8.2 High temperature test (including leakage test)	5	5 [a]	5 [a]
5.9 Test for flow characteristic data	4 [a]	4 [a]	4
5.10 Test for resistance to corrosion	13	—	—
5.11 Test for resistance to stress corrosion	—	8	—
5.12 Vibration test	8	—	—
5.13 Test for operating force	7	7 [a]	7 [a]

A = largest cross section
B = medium cross section
C = smallest cross section

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[a] The need for these tests depends on design, e.g. seal materials, flow way design.

5.3 Compliance

NOTE This test relates to the requirements of 4.1.7.

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).

5.4 Test for function

NOTE This test relates to the requirements of 4.3, 4.8 and 4.10.

5.4.1 The test pressure is

— for CO_2-low-pressure selector valves (20 ± 3) bar;

— for CO_2-high-pressure selector valves (60 ± 5) bar;

— for other than CO_2 selector valves not specified for use in systems with reduced and controlled pressure only the pressure developed in the container at 20 °C;

— for other than CO_2 selector valves specified for use in systems with reduced and controlled pressure only the specified working pressure.

5.4.2 The following cycle shall be carried out five times:

a) Apply the test pressure to the inlet port of the selector valve assembly using gaseous 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 and a nozzle ($3^{+0,5}_{0}$) mm diameter.

b) After 5 s open the selector valve with the appropriate actuator. Check the correct function of the sample and measure the opening time.

c) In the case of CO_2-low pressure selector valve, close the sample after (10 ± 5) s with the appropriate actuator. Check the correct function of the sample and measure the closing time. In the case of other selector valves, after (10 ± 5) s depressurise the sample to a value below 5 bar and close it manually.

d) Allow the test facility and the test sample to cool to the normal test temperature.

During each test cycle the supply pressure to the valve shall not drop below:

— 15 bar for CO_2-low-pressure selector valves,

— 50 bar for CO_2-high-pressure selector valves, and

— 80 % of the test pressure for other selector valves.

5.4.3 Fit replacement parts at the end of each cycle on test samples in which parts are designed to be destroyed on normal operation of the valve.

5.4.4 The relevant characteristics of the test facility shall be as follows:

a) pipework between control valve of the test rig and the test sample shall be as specified and provided by the manufacturer.

   If there are no data provided, the test pipe shall have the following dimensions:

   — nominal size DN 50;

   — length (2 ± 0,1) m;

b) control valve

   — quick opening valve upstream of the test pipe to achieve the test pressure at the test sample within 1 s.

5.5 Test for resistance to internal pressure and leakage

NOTE This test relates to the requirements of 4.3, 4.4, 4.6, 4.8 and 4.10.

5.5.1 The valve in its closed position shall be connected via the inlet to a suitable hydraulic pressure supply. Provision for venting shall be available.

The system shall be vented of air and the pressure shall be increased at (2 ± 1) bar/s up to the test pressure ($^{+5}_{0}$) %.

This pressure shall be maintained for a period of (5^{+1}_{0}) min. At the end of this period the hydraulic pressure shall be released.

5.5.2 The valve shall be pressurized with air or nitrogen to the working pressure. With the component maintained at the required test temperature, the leakage shall be measured using a water bath.

5.6 Test for resistance to bursting

NOTE This test relates to the requirements of 4.5.

The valve in its open position with blocked outlet shall be connected via the inlet to a suitable hydraulic pressure supply. Provision for venting shall be available.

The system of air shall be vented and the pressure shall be increased at (2 ± 1) bar/s up to the test pressure $(^{+5}_{0})$ %.

This pressure shall be maintained for a period of $(5\ ^{+1}_{0})$ min. At the end of this period the hydraulic pressure shall be released.

5.7 Test for operational reliability

NOTE This test relates to the requirements of 4.6.

The test cycle described in 5.4 shall be carried out 100 times, but without measuring the opening/closing time.

5.8 Test for operation under temperature conditions

NOTE This test relates to the requirements of 4.3.

5.8.1 Low temperature

The test assembly shall be cooled to $(-20^{\ 0}_{-2})$ °C, in the case of CO_2-low pressure valves to $(-30^{\ 0}_{-2})$ °C, and shall be maintained at this temperature for $(2 \pm 0{,}5)$ h.

It shall be ensured that no water is in the test sample. The valve shall be closed carefully before cooling.

The test procedure described in 5.4.1 to 5.4.3 (excluding the requirements of 5.4.4) shall be carried out five times.

Subsequently a leakage test shall be carried out in accordance with 5.5.2 with the test sample at test temperature.

5.8.2 High temperature

The test assembly shall be heated to $(50\ ^{+2}_{0})$ °C and shall be maintained at this temperature for $(2 \pm 0{,}5)$ h.

The test procedure described in 5.4.1 to 5.4.3 (excluding the requirements of 5.4.4) shall be carried out five times.

Subsequently a leakage test shall be carried out in accordance with 5.5.2 with the test sample at test temperature.

5.9 Test for flow characteristic data

NOTE This test relates to the requirements of 4.7.

5.9.1 Except as stated in 5.9.2, the test shall be done using:

— CO_2 as test medium for CO_2-high and CO_2-low-pressure selector valves,

— a permanent gas as test medium for Inert Gas selector valves,

— the extinguishant (including superpressurization, if applicable) as test medium for Halocarbon Gas selector valves.

5.9.2 In case of a design series, tests with test samples > DN 65 may be done using water provided tests with at least two test samples ≤ DN 65 have been conducted with the test medium required by 5.9.1 and with water and the results show, that the flow characteristics determined can be recalculated to the test medium required by 5.9.1.

5.9.3 The test set-up is shown in Figure 1.

The supply container shall be kept for at least ten hours at a pressure of:

— (56,3 ± 1,5) bar in the case of CO_2-high pressure selector valves,

— (19,5 ± 1) bar in the case of CO_2-low pressure selector valves,

— the pressure developed in the container at 20°C for other than CO_2 selector valves not specified for use in systems with reduced and controlled pressure only, and

— the specified working pressure for other than CO_2 selector valves specified for use in systems with reduced and controlled pressure only.

The sample shall be connected to the supply container. A straight pipe shall be connected to the samples outlet. To this pipe in a distance of at least 10 times the internal diameter of the pipe the pressure measuring point p_3 shall be attached. At the end of the measuring line one or more nozzle(s) shall be fitted.

It may be necessary to carry out several measurements with different flow rates.

The following measuring points with continuous measurement recording are necessary:

a) pressure in the supply container [p_1] (CO_2 and Halocarbon Gas selector valves);

b) temperature in the supply container [t_1] (Halocarbon Gas selector valves);

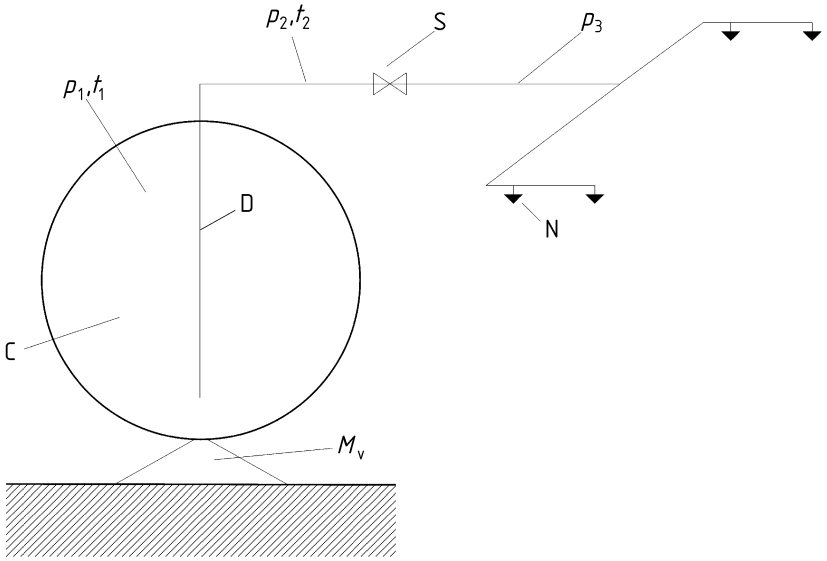
c) pressure upstream of the sample [p_2] (all selector valves);

d) temperature upstream of the sample [t_2] (Inert Gas and Halocarbon Gas selector valves);

e) pressure downstream of the sample [p_3] (all selector valves);

f) mass of the supply container [M_V];

g) discharge time [t_f].



Key

C gas container
D diptube
N nozzle
S test sample

M_V container mass, in kilograms

p_1 Pressure in the container, in Pascal
p_2 Pressure upstream of the test sample, in Pascal
p_3 Pressure downstream of the test sample, in Pascal
t Temperature in the container, degrees Celsius

NOTE For testing Inert Gas selector valves the dip-tube is not necessary.

Figure 1 — Test set-up for measuring resistance coefficient

5.9.4 The resistance coefficient shall be determined as follows:

a) the mass flow shall be calculated as a function of loss in mass of the container and the discharge period with the following equation:

$$M^* = \frac{d_{MV}}{d_{tF}}$$

b) three sets of figures (for each of pressure, temperature and mass flow) shall be recorded at the chosen time;

c) the density ρ_H and the velocity w_H of the homogeneous mixture in the tube upstream the sample shall be calculated:

$$\frac{1}{\rho_H} = \frac{x_G}{\rho_G} + \frac{x_L}{\rho_L} + \frac{x_N}{\rho_N}$$

$$\omega_H = \frac{M^*}{A\,\rho_H}$$

NOTE The calculation of ρ_H depends on the extinguishant:

— for Inert Gases: $x_N = 0$, $x_L = 0$, $x_G = 1$;

— for CO_2: $x_N = 0$, x_L and x_G depend on the pressure drop between the measuring points p_1 and p_2 and are determined by means of the vapour pressure curve;

— for Halocarbon Gases: x_N, x_L and x_G depend on the extinguishant and the superpressurization and are determined by means of the relevant physical data;

d) the resistance coefficient shall be calculated with the following equation:

$$\psi = \frac{2 \times dp}{\rho_H \times w_H^2}$$

where

dp is the pressure drop $p_3 - p_2$, in Pascal;

ψ is the resistance coefficient;

ρ_H is the density of homogeneous mixture, in kilograms per cubic metre;

ρ_G is the density of the gas phase, in kilograms per cubic metre;

ρ_L is the density of the liquid phase, in kilograms per cubic metre;

ρ_N is the density of the Nitrogen (superpressurization), in kilograms per cubic metre;

w_H is the homogeneous velocity, in metres per second;

M^* is the total mass flow, in kilograms per second;

A is the free flow cross section, in square metres;

x_G is the vapour (gas) mass fraction;

x_L is the liquid phase mass fraction;

x_N Nitrogen (superpressurization) mass fraction.

5.10 Test for resistance to corrosion

NOTE This test relates to the requirements of 4.8.

The sample shall be exposed to a salt spray within a fog chamber. The inlet of the valve 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 components and properties of the reagents and the test specifications are:

— solution consists of NaCl 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 to 2 ml/h on an area of 80 cm^2;

— temperature in the test cabinet: $(35\ ^{+1,0}_{-1,7})$ °C;

— position of the sample: 15° to the vertical axis;

— spray time: (96 ± 2) h;

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

5.11 Test for resistance to stress corrosion

NOTE The test relates to the requirements of 4.9.

A suitable container of known capacity in litres fitted with a capillary tube vent shall be used. The aqueous ammonia solution shall have a specific weight of (0,94 ± 0,2) kg/l. The container shall be filled with (10 ± 0,5) ml of the solution for each litre of container volume.

The sample for test and exposure shall be degreased for $(10\ ^{+1}_{0})$ d to the moist atmosphere of ammonia and air, at a temperature of (34 ± 2) °C. The samples shall be positioned (40 ± 5) mm above the level of the liquid.

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

5.12 Vibration test

NOTE The test relates to the requirements of 4.10.

The sample shall be attached to a vibration table using fixing materials provided by the manufacturer.

The test apparatus and procedure shall be as described in EN 60068-2-6:1995, Test Fc.

— Frequency range: 10 Hz to 150 Hz;

— acceleration amplitude for components which are intended to be attached to machinery:

  — 10 Hz to 50 Hz: 1,0 g_n;

  — 50 Hz to 150 Hz: 3,0 g_n;

— acceleration amplitude for components which are intended to be attached to walls:

  — 10 Hz to 50 Hz: 0,2 g_n;

  — 50 Hz to 150 Hz: 0,5 g_n;

— sweep rate: 1 octave per 30 min;

— number of sweeps: 0,5 per axis;

— number of axes: 3 mutually perpendicular.

5.13 Test for operating force

NOTE The test relates to the requirements of 4.11.

5.13.1 The selector valve and actuator shall be fitted to a test set-up pressurised with air or nitrogen to a pressure which gives the most severe conditions.

5.13.2 For components with pneumatic actuator, connect the pneumatic actuator to a pressure supply at the specified minimum, nominal and maximum pressure. 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.

5.13.3 For components with an electrical powered actuator, connect the actuator to a power supply at the specified minimum, nominal and maximum 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.

5.13.4 For components with a gravity powered actuator 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.

6 Marking

6.1 Valves shall be marked with the following information:

a) manufacturer's or supplier's name or trademark;

a) nominal diameter or model designation;

b) working pressure;

c) some mark(s) or code(s) (e.g. serial number or batch code), by which, at least, the date or batch and place of manufacture (if several places of manufacture) can be identified by the manufacturer;

d) mounting position, if necessary;

e) direction of flow, if necessary.

6.2 Actuators shall be marked with the following information:

a) if the actuator is produced as separate part, manufacturer's or supplier's name or trademark;

b) if the actuator is produced as separate part, model designation;

c) if the actuator is produced as separate part, some mark(s) or code(s) (e.g. serial number or batch code), by which, at least, the date or batch and place of manufacture (if several places of manufacture) can be identified by the manufacturer;

d) nominal voltage and current for electrical types;

e) working pressure and triggering pressure (range) for pneumatic types.

6.3 The marking shall be non-detachable, non-flammable, permanent and legible.

6.4 Where the requirements of ZA.3 give the same information as in 6.1 and 6.2, the requirements of this clause have been met.

7 Evaluation of conformity

7.1 General

The compliance of the component with the requirements of this European Standard shall be demonstrated by:

— initial type testing;

— factory production control by the manufacturer.

NOTE The manufacturer is a natural or legal person, who places the component on the market under his own name. Normally, the manufacturer designs and manufactures the component himself. As a first alternative, he may have it designed, manufactured, assembled, packed, processed or labelled by subcontracting. As a second alternative he may assemble, pack, process, or label ready-made products.

The manufacturer shall ensure:

— that the initial type testing in accordance with this European Standard is initiated and carried out (where relevant, under the control of a product certification body), and

— that the component continuously complies with the initial type testing samples, for which compliance with this European Standard has been verified.

He shall always retain the overall control and shall have the necessary competence to take the responsibility for the component.

The manufacturer shall be fully responsible for the conformity of that component to all relevant regulatory requirements. However, where the manufacturer uses components already shown to conform to those requirements relevant for that component (e.g. by CE marking), the manufacturer is not required to repeat the evaluation which led to such conformity. Where the manufacturer uses components not already shown to conform, it is his responsibility to undertake the necessary evaluation to show conformity.

7.2 Initial type testing

7.2.1 Initial type testing shall be performed to demonstrate conformity with this European Standard.

All characteristics given in Clause 4 (except 4.12) shall be subject to this initial type testing, except as described in 7.2.3 to 7.2.4.

7.2.2 In the case of modification of the component or of the method of production (where these may affect the stated properties), initial type testing shall be performed. All characteristics given in Clause 4 (except 4.12), which may be changed by the modification, shall be subject to this initial type testing, except as described in 7.2.3 to 7.2.4.

7.2.3 Tests previously performed in accordance with the provisions of this European Standard may be taken into account providing that they were made to the same or a more rigorous test method under the same system of attestation of conformity on the same component or components of similar design, construction and functionality, such that the results are applicable to the component in question.

NOTE Same system of attestation of conformity means testing by an independent third party under the responsibility of a product certification body which is now a notified product certification body.

7.2.4 Components may be grouped into families where one or more characteristics are the same for all components within that family or the test results are representative of all components within that family. In this case not all components of the family have to be tested for the purposes of the initial type testing.

7.2.5 Test samples shall be representative of the normal production. If the test samples are prototypes, they shall be representative of the intended future production and shall be selected by the manufacturer.

NOTE In the case of prototypes and product certification body certification, this means that it is the manufacturer not the product certification body who is responsible for selecting the samples. During the initial inspection of the factory and of the factory production control (see 7.3), it is verified that the component continuously complies with the initial type testing samples.

7.2.6 If the technical documentation of the test samples does not give a sufficient basis for later compliance checks, a reference sample (identified and marked) shall remain available for this purpose.

7.2.7 All initial type testing and its results shall be documented in a test report.

7.3 Factory production control (FPC)

7.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the components placed on the market conform to the stated performance characteristics.

If the manufacturer has the component designed, manufactured, assembled, packed, processed and labelled by subcontracting, FPC of the subcontractor may be taken into account. Where subcontracting takes place, the manufacturer shall retain the overall control of the component and ensure that he receives all the information that is necessary to fulfil his responsibilities according to this European Standard. The manufacturer who subcontracts all of his activities may in no circumstances discharge himself of his responsibilities to a subcontractor.

FPC is the permanent internal control of production exercised by the manufacturer.

All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures. This production control system documentation shall ensure a common understanding of conformity evaluation and enable the achievement of the required component characteristics and the effective operation of the production control system to be checked.

Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the conformity of the component with technical specifications. Its implementation may be achieved by controls and tests on measuring equipment, raw materials and constituents, processes, machines and manufacturing equipment and finished components, including material properties in components, and by making use of the results thus obtained.

7.3.2 General requirements

The FPC system shall fulfil the requirements as described in the following clauses of EN ISO 9001:2000:

- 4.2 except 4.2.1 a);
- 5.1 e), 5.5.1, 5.5.2;
- Clause 6;
- 7.1 except 7.1 a), 7.2.3 c), 7.4, 7.5, 7.6;
- 8.2.3, 8.2.4, 8.3, 8.5.2.

The FPC system may be part of a Quality Management system, e.g. in accordance with EN ISO 9001:2000.

7.3.3 Component specific requirements

7.3.3.1 The FPC system shall

— address this European Standard, and

— ensure that the components placed on the market conform with the stated performance characteristics.

7.3.3.2 The FPC system shall include a component specific FPC- or Quality-plan, which identifies procedures to demonstrate conformity of the component at appropriate stages, i.e.:

a) the controls and tests to be carried out prior to and/or during manufacture according to a frequency laid down, and/or

b) the verifications and tests to be carried out on finished components according to a frequency laid down.

If the manufacturer uses finished components, the operations under b) shall lead to an equivalent level of conformity of the component as if normal FPC had been carried out during the production.

If the manufacturer carries out parts of the production himself, the operations under b) may be reduced and partly replaced by operations under a). Generally, the more parts of the production are carried out by the manufacturer, the more operations under b) may be replaced by operations under a). In any case the operation shall lead to an equivalent level of conformity of the component as if normal FPC had been carried out during the production.

NOTE Depending on the specific case, it may be necessary to carry out the operations referred to under a) and b), only the operations under a) or only those under b).

The operations under a) centre as much on the intermediate states of the component as on manufacturing machines and their adjustment, and measuring equipment etc. These controls and tests and their frequency are chosen based on component type and composition, the manufacturing process and its complexity, the sensitivity of component features to variations in manufacturing parameters etc.

The manufacturer shall establish and maintain records which provide evidence that the production has been sampled and tested. These records shall show clearly whether the production has satisfied the defined acceptance criteria and shall be available at least for ten years. Where the component fails to satisfy the acceptance measures, the provisions for non-conforming products shall apply, the necessary corrective action shall immediately be taken and the components or batches not conforming shall be isolated and properly identified. Once the fault has been corrected, the test or verification in question shall be repeated.

The results of controls and tests shall be properly recorded. The component description, date of manufacture, test method adopted, test results and acceptance criteria shall be entered in the records under the signature of the person responsible for the control/test. With regard to any control result not meeting the requirements of this European Standard, the corrective measures taken to rectify the situation (e.g. a further test carried out, modification of manufacturing process, throwing away or putting right of component) shall be indicated in the records.

7.3.3.3 Individual components or batches of components and the related manufacturing documentation shall be completely identifiable and retraceable.

7.3.4 Initial inspection of factory and FPC

7.3.4.1 Initial inspection of factory and FPC shall generally be carried out when the production is already running and the FPC is already in practice. It is however possible, that the initial inspection of factory and FPC is carried out before the production is already running and/or before the FPC is already in practice.

7.3.4.2 The following shall be assessed to verify that the requirements of 7.3.2 and 7.3.3 are fulfilled:

— the FPC-documentation, and

— the factory.

In the assessment of the factory it shall be verified:

a) that all resources necessary for the achievement of the component characteristics required by this European Standard are or will be (see 7.3.4.1) available, and

b) that the FPC-procedures in accordance with the FPC-documentation are or will be (see 7.3.4.1) implemented and followed in practice, and

c) that the component complies or will comply (see 7.3.4.1) with the initial type testing samples, for which compliance with this European Standard has been verified, and

d) whether the FPC system is part of a Quality Management system in accordance with EN ISO 9001 (see 7.3.2) and as part of this Quality Management system is certified and has yearly surveillance by a certification body.

7.3.4.3 All factories of the manufacturer, where for the relevant component final assembling or at least final testing is performed, shall be assessed to verify that the conditions of 7.3.4.2 a) to c) are in place. One assessment may cover one or more components, production lines and/or production processes. If the FPC system covers more than one component, production line or production process, and if it is verified that the general requirements are fulfilled, the assessment of these general requirements does not need to be repeated when assessing the product-specific requirements for another product.

7.3.4.4 Assessments previously performed in accordance with the provisions of this European Standard may be taken into account providing that they were made to the same system of attestation of conformity on the same component or components of similar design, construction and functionality, such that the results may be considered applicable to the component in question.

NOTE Same system of attestation of conformity means testing by an independent third party under the responsibility of a product certification body which is now a notified product certification body.

7.3.4.5 Any assessment and its results shall be documented in a report.

7.3.5 Continuous surveillance of FPC

7.3.5.1 All factories which have been assessed according to 7.3.4 shall be re-assessed once a year, except as stated in 7.3.5.2.

In this case each FPC assessment shall verify a different component or production process, where applicable.

7.3.5.2 If the manufacturer provides proof of continuing satisfactory operation of his FPC system the frequency of the re-assessment may be reduced to once every four years.

NOTE 1 Sufficient proof can be the report of a certification body, see 7.3.4.2 d).

NOTE 2 If the overall Quality Management system in accordance with EN ISO 9001 is well implemented (verified in the initial assessment of factory and FPC) and continuously practised (verified in QM-audits), it can be assumed that the integrated FPC-relevant part is well covered. On this basis, the work of the manufacturer is well controlled, so that the frequency of special FPC-surveillance-assessments can be reduced.

7.3.5.3 All assessment and its results shall be documented in a report.

7.3.6 Procedure for modifications

In the case of modification of the component, the method of production or the FPC system (where these may affect the stated properties), a re-assessment of the factory and of the FPC system shall be performed for those aspects which may be affected by the modification.

Any assessment and its results shall be documented in a report.

Annex ZA
(informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Directive

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M/109 given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard shown in this annex meet the requirements of the Mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the Selector valves and their actuators covered by this annex for the intended use indicated herein; reference shall be made to the information accompanying the CE marking.

WARNING — Other requirements and other EU Directives, not affecting the fitness for intended use can be applicable to Selector valves and their actuators falling within the scope of this European Standard.

NOTE 1 In addition to any specific clauses relating to dangerous substances contained in this standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

NOTE 2 An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (accessed through http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangmain.htm).

This annex establishes the conditions for the CE marking of the Selector valves and their actuators intended for the uses indicated in Table ZA.1 and shows the relevant clauses applicable.

This annex has the same scope as Clause 1 of this standard and is defined by Table ZA.1.

Table ZA.1 — Relevant clauses

Product:	Selector valves and their actuators
Intended use:	Components for use in gas extinguishing system installed in buildings as a part of a complete operating system

Essential characteristics	Clauses in this European Standard	Mandated levels and/or classes	Notes
Operational reliability	4.1, 4.3, 4.4, 4.5, 4.6, 4.11	—	
Distribution of extinguishing media	4.7	—	
Durability of operational reliability	4.8, 4.9, 4.10	—	

ZA.2 Procedure for the attestation of conformity of selector valves and their actuators

ZA.2.1 Systems of attestation of conformity

The system of attestation of conformity of selector valves and their actuators indicated in Table ZA.1, in accordance with the Decisions of the Commission 96/577/EC of 1996-06-24 and 2002/592/EC of 2002-07-15 as given in Annex III of the Mandate M/109, is shown in Table ZA.2 for the indicated intended use.

Table ZA.2 — System of attestation of conformity

Product	Intended use	Level(s) or class(es)	Attestation of conformity system
Selector valves and their actuators	Fire safety	—	1
System 1: See Directive 89/106/EEC (CPD) Annex III.2.(i), without audit testing of samples			

The product certification body shall certify the initial type testing of all relevant characteristics given in Table ZA.1 in accordance with the provisions of 7.2, and for the initial inspection of the factory and of the factory production control, and for the continuous surveillance, assessment and approval of the factory production control, all characteristics shall be of interest to the approved body. The manufacturer shall operate a factory production control system in accordance with the provisions of 7.3.

ZA.2.2 Certificate and Declaration of conformity

When compliance with the conditions of this annex is achieved, the certification body shall draw up a certificate of conformity (EC Certificate of conformity), which entitles the manufacturer to affix the CE marking. The certificate shall include:

— name, address and identification number of the certification body;

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

NOTE 1 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

— description of the product (type, identification, use);

— provisions to which the product conforms (i.e. Annex ZA of this EN);

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions);

— the number of the certificate;

— conditions and period of validity of the certificate, where applicable;

— name of, and position held by, the person empowered to sign the certificate.

In addition, the manufacturer shall draw up a declaration of conformity (EC Declaration of conformity) including the following:

— name and address of the manufacturer, or his authorised representative established in the EEA, and the place of production;

— name, address and identification number of the certification body;

— description of the product (type, identification, use), and a copy of the information accompanying the CE marking;

NOTE 2 Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

— provisions to which the product conforms (i.e. Annex ZA of this EN);

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions);

— number of the accompanying EC Certificate of conformity;

— name of and position held by the person empowered to sign the declaration on behalf of the manufacturer or of his authorised representative.

The declaration and certificate shall be presented in the language or languages accepted in the Member State of the use of the product.

ZA.3 CE Marking and labelling

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with Directive 93/68/EC and shall be shown on the component, or a label attached to the component, together with the marking as specified in Clause 6, except 6.1 d) and 6.2 c). In addition, the CE marking symbol shall appear on the packaging and/or on the accompanying commercial documents, together with the following information:

— identification number of the certification body,

— the name or identifying mark of the producer/supplier, and

— the last two digits of the year in which the marking was affixed, and

— the appropriate number of the EC-certificate of conformity, and

— the number of this standard (EN 12094-5), and

— type of product (selector valve and actuator), and

— type of system (e.g. CO_2-high-pressure fire extinguishing system, CO_2-low-pressure fire extinguishing), and

— nominal diameter, and

— flow characteristics (flow resistance coefficient or equivalent length), and

— type of actuator (e.g. pneumatic, electrical), and

— performance data of actuator (e.g. nominal pressure, nominal voltage and current)

— the wording "Wall mounting only"[1)], if subjected to limited vibration testing.

1) A list with equivalent words in all languages accepted by each CEN member is under preparation.

For actuators sold separately:

— type of actuator (e.g. pneumatic, electrical), and

— performance data of actuator (e.g. nominal pressure, nominal voltage and current).

Figure ZA.1 gives an example of the information to be given on the packaging and/or commercial documents.

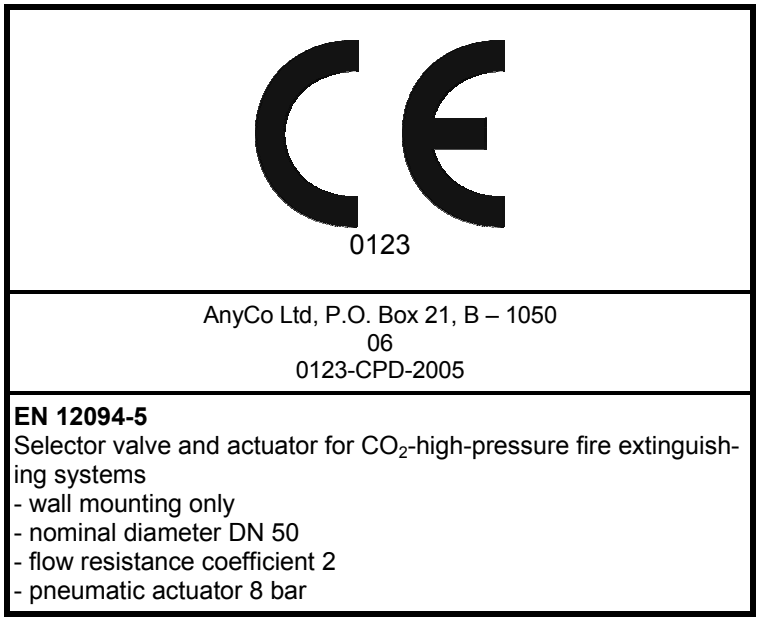


Figure ZA.1 – Example CE marking information

In addition to any specific information relating to dangerous substances shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

NOTE European legislation without national derogation need not be mentioned.

Bibliography

[1] prEN 12094-20, *Fixed firefighting systems — Components for gas extinguishing systems — Part 20: Requirements and test methods for the compatibility of components*[2)]

[2] EN 45011, *General requirements for bodies operating product certification systems (ISO/IEC Guide 65:1996)*

[3] EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2005)*

[4] EU Directive 93/68/EEC, COUNCIL DIRECTIVE 93/68/EEC of 22 July 1993 amending Directives 87/404/EEC (simple pressure vessels), 88/378/EEC (safety of toys), 89/106/EEC (construction products), 89/336/EEC (electromagnetic compatibility), 89/392/EEC (machinery), 89/686/EEC (personal protective equipment), 90/384/EEC (non-automatic weighing instruments), 90/385/EEC (active implantable medicinal devices), 90/396/EEC (appliances burning gaseous fuels), 91/263/EEC (telecommunications terminal equipment), 92/42/EEC (new hot-water boilers fired with liquid or gaseous fuels) and 73/23/EEC (electrical equipment designed for use within certain voltage limits)

[5] EN 1092 (all parts), *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated*

[6] EN ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

[7] ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

[8] ISO 7005 (all parts), *Metallic flanges*

2) Under preparation.

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