Draft for Public Comment

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BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000
Fax: +44 (0)20 8996 7400
www.bsigroup.com

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Part 6: Requirements and test methods for check valves

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Responsible Committee Secretary: **Mrs Susan Revell (BSI)**
Direct tel: **020 8996 7195**
E-mail: **susan.revell@bsigroup.com**

Introduction

This draft standard is based on international discussions in which the UK has taken an active part. Your comments on this draft are invited and will assist in the preparation of the consequent standard. Comments submitted will be reviewed by the relevant BSI committee before sending the consensus UK vote and comments to the international secretariat, which will then decide appropriate action on the draft and the comments received.

If the international standard is approved, it is possible the text will be published as an identical British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with reasons) or positive vote on this draft.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: **ISO/DIS xxxx**

1	2	(3)	4	5	(6)	(7)
MB	**Clause No./ Subclause No./Annex** (e.g. 3.1)	**Paragraph/ Figure/ Table/Note**	**Type of comment**	**Commend (justification for change) by the MB**	**Proposed change by the MB**	**Secretariat observations on each comment submitted**
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

DRAFT INTERNATIONAL STANDARD
ISO/DIS 6182-6

ISO/TC **21**/SC **5**

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Fire protection — Automatic sprinkler systems —

Part 6:
Requirements and test methods for check valves

Protection contre l'incendie — Systèmes d'extinction automatiques du type sprinkler —
Partie 6: Exigences et méthodes d'essai des postes de contrôle

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

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

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 6182-6 was prepared by Technical Committee ISO/TC 021, *Equipment for fire protection and fire fighting*, Subcommittee SC 05, *Fixed fire fighting systems using water*.

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

ISO 6182 consists of the following parts, under the general title *Fire Protection — Automatic Sprinkler Systems*:

— *Part 1: Requirements and test methods for sprinklers*

— *Part 2: Requirements and test methods for wet alarm valves, retard chambers and water motor alarms*

— *Part 3: Requirements and test methods for dry pipe valves*

— *Part 4: Requirements and test methods for quick-opening devices*

— *Part 5: Requirements and test methods for deluge valves*

— *Part 6: Requirements and test methods for check valves*

— *Part 7: Requirements and test methods for early suppression fast response (ESFR) sprinklers*

— *Part 8: Requirements and test methods for pre-action dry alarm valves*

— *Part 9: Requirements and test methods for water mist nozzles*

— *Part 10: Requirements and test methods for domestic sprinklers*

— *Part 11: Requirements and test methods for pipe hangers*

— *Part 12: Requirements and test methods for grooved-end couplings*

Introduction

This part of ISO 6182 is one of a number of ISO Standards prepared by ISO/TC 21 covering requirements and test methods for check valves in the main water way to a sprinkler installation. Check valves are used to prevent the backflow of water and may be installed in several locations within a sprinkler system, e.g. if the sprinkler system is fed from multiple pumps or if sprinkler installations are provided with multiple flow switches for better fire localization.

Fire protection — Automatic sprinkler systems —

Part 6:

Requirements and test methods for check valves

1 Scope

This part of ISO 6182 specifies performance, requirements, methods of test and marking requirements, for check valves used to supply water in automatic fire protection systems.

Note: This is not intended to include trim valves.

2 Normative references

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

ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs*

ISO 898-2, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread*

3 Terms and definitions

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

3.1
check valve
valve that permits flow of water into a pipe system, prevents the reverse flow of water

3.2
clapper
type of sealing assembly, which includes rotational movement
NOTE See also 3.8.

3.3
corrosion-resistant material
bronze, brass, Monel 1) metal, austenitic stainless steel, or equivalent metallic or plastic material conforming with the requirements of this document[1)]

3.4
flow velocity
speed of water flow through a valve expressed as the equivalent water velocity through a pipe of the same nominal size as the valve

3.5
rated working pressure
maximum service pressure at which a check valve intended to operate

3.6
reinforced elastomeric element
element of clapper, clapper assembly or seat seals in a composite of an elastomeric compound with one or more other components

3.7
sealing assembly
main movable sealing element (such as a clapper) of the valve which prevents the reverse flow of water

3.8
sealing assembly seat ring
main fixed sealing element of a valve

4 Requirements

4.1 Nominal sizes

The nominal size of a valve shall be the nominal diameter of the inlet and outlet connections, i.e. the pipe size for which the connections are intended. Sizes shall be not less than 25 mm. The diameter of the waterway through the sealing assembly seat ring shall be permitted to be less than the nominal size.

4.2 Connections

4.2.1 All connections shall be designed for use at the rated working pressure of the valve.

4.2.2 The dimensions of all connections shall conform with the applicable requirements of International Standards. If International Standards are not applicable, national standards shall be permitted to be used.

4.3 Rated working pressure

4.3.1 The rated working pressure shall be not less than 1,2 MPa (12 bar).

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1) Monel is an example of a suitable product available commercially. This information is given for the convenience of users of this part of ISO 6182 and does not constitute an endorsement by ISO of this product.

4.3.2 The rated working pressure shall be specified by the manufacturer.

4.3.3 Inlet and outlet connections shall be permitted to be machined for lower working pressures to match installation equipment provided the valve is marked with the lower working pressure.

4.4 Bodies and covers

4.4.1 Bodies and covers shall be made of a material having corrosion resistance at least equivalent to cast iron.

4.4.2 Cover fasteners shall be made of steel, stainless steel, titanium, or other materials with equivalent physical and mechanical properties.

4.4.3 Non-metallic materials other than gaskets, diaphragms and seals or metals with a melting point less than 800 °C shall not form part of the valve body or cover.

4.4.4 For valves with a cover plate, it shall not be possible to assemble the valve with the cover plate in a position which either improperly indicates flow direction or prevents proper operation of the valve.

4.5 Strength (see 6.3)

4.5.1 An assembled valve, with the sealing assembly blocked open, shall withstand, without rupture, an internal hydrostatic pressure of four times the rated working pressure for a period of 5 min, when tested as specified in 6.7.

4.5.2 If the test in accordance with 6.7 is not done with standard production fasteners, the supplier shall provide documentation showing that the calculated design load of any standard production fastener, neglecting the force required to compress the gasket, does not exceed the minimum tensile strength specified in ISO 898-1 and ISO 898-2 when the valve is pressurized to four times the rated working pressure. The area of the application of pressure shall be calculated as follows.

a) If a full-face gasket is used, the area of application of pressure is that extending out to a line defined by the inner edge of the bolts.

b) If an “O”-ring seal or ring gasket is used, the area of application of force is that extending out to the centre line of the “O”-ring or gasket.

4.6 Access for maintenance

Means shall be provided to permit access to working parts and removal of the sealing assembly.

4.7 Components

4.7.1 Any component which is normally disassembled during servicing shall be designed so that it cannot be reassembled improperly without providing an external visual indication, when the valve is returned to service.

4.7.2 With the exception of valve seats, all parts intended for field replacement shall be capable of being disassembled and reassembled using tools normally employed by the trade.

4.7.3 All components shall be non-detachable during normal operation of the valve.

4.7.4 Failure of the sealing assembly diaphragms or seals shall not prevent the valve from opening.

4.7.5 Sealing surfaces of sealing assemblies, including the sealing assembly seat ring, shall have corrosion resistance equivalent to brass or bronze and have sufficient width of surface contact to withstand ordinary wear and tear, rough usage, compression stresses and damage due to pipe scale or foreign matter carried by the water.

4.7.6 Springs and diaphragms shall not fracture or rupture, when tested in accordance with 6.2.

4.7.7 There shall be no sign, on visual examination, of damage to the sealing assembly after testing for the operational requirements in accordance with 6.10.

4.7.8 When wide open, the sealing assembly shall bear against a definite stop. The point of contact shall be located so that impact or reaction of the water flow will not permanently twist, bend or fracture valve parts.

4.7.9 Where rotation or sliding motion is required, the part or its bearing shall be made of a corrosion resistant material. Materials lacking corrosion resistance shall be fitted with bushings, inserts or other parts made of corrosion resistant materials at those points where freedom of movement is required.

4.7.10 The sealing assembly shall close towards the seat when water flow ceases. Springs shall be permitted to ensure full and proper seating.

4.8 Leakage (see 6.4)

4.8.1 There shall be no leakage, permanent distortion or rupture of a valve when an internal pressure of twice the rated working pressure is applied for 5 min with the sealing assembly open in accordance with 6.6.1.

4.8.2 There shall be no leakage, permanent distortion or rupture of a valve at an internal pressure of twice the rated working pressure applied to the downstream side of the sealing assembly for 5 min with the upstream end vented in accordance with 6.6.

4.8.3 A valve shall not leak while being subjected to an internal hydrostatic pressure equivalent to a column of water 1,5 m high for 16 h in accordance with 6.6.2.2.

4.9 Non-metallic components (excluding gaskets, seals and other elastomeric parts) (see 6.5 & 6.6)

Non-metallic valve parts that may affect proper valve function as defined in this standard shall be subjected to the applicable aging of its non-metallic parts, as described in 6.4 and 6.5, using separate sets of samples, as applicable. After aging, a valve shall meet the requirements of 4.8 and 4.11 when tested in accordance with the applicable tests described in 6.6, 6.8 and 6.9.

4.10 Sealing assembly elements (see 6.7)

A seal made of elastomeric or other resilient materials shall not adhere to the mating surface when tested in accordance with 6.3.1. Where the same design of seat is used for more than one size of valve, it shall be permitted to only test the size with the highest stress on the seating surface.

4.11 Clearances

4.11.1 The radial clearance between a sealing assembly and the inside walls in every position, except wide open, shall not be less than 12 mm for cast iron bodies and shall not be less than 6 mm if the body and sealing assembly are of cast iron or steel with corrosion protective coatings tested in accordance with 6.13, non-ferrous material, stainless steel or materials having equivalent physical, mechanical and corrosion resistant properties. See Figure 1 a).

4.11.2 Any space in which the sealing assembly can trap debris beyond the seat shall be not less than 3 mm deep.

4.11.3 Sealing assembly guide bushings or bearings shall project a sufficient axial distance to maintain not less than 1,5 mm (Bushing Projection) clearance between ferrous metal parts. See Figure 1. Clearance less than 1,5 mm shall be permitted where adjacent parts are of bronze, brass, Monel 1) metal, austenitic stainless steel, titanium, or similar corrosion resistant materials. When corrosion resistance of steel parts is provided by a protective coating, the parts shall show no visible signs of deterioration of the coating such as blistering, delamination, flaking or increased resistance to movement when tested in accordance with 6.13.

4.11.4 Requirements for clapper type check valves

a) There shall be a diametrical clearance of not less than 3 mm between the inner edges of a seat ring and the metal parts of a hinged sealing assembly when the valve is in the closed position. See Figure 1 b).

b) The diametrical clearance between hinge pins and their bearings shall be not less than 0,125 mm.

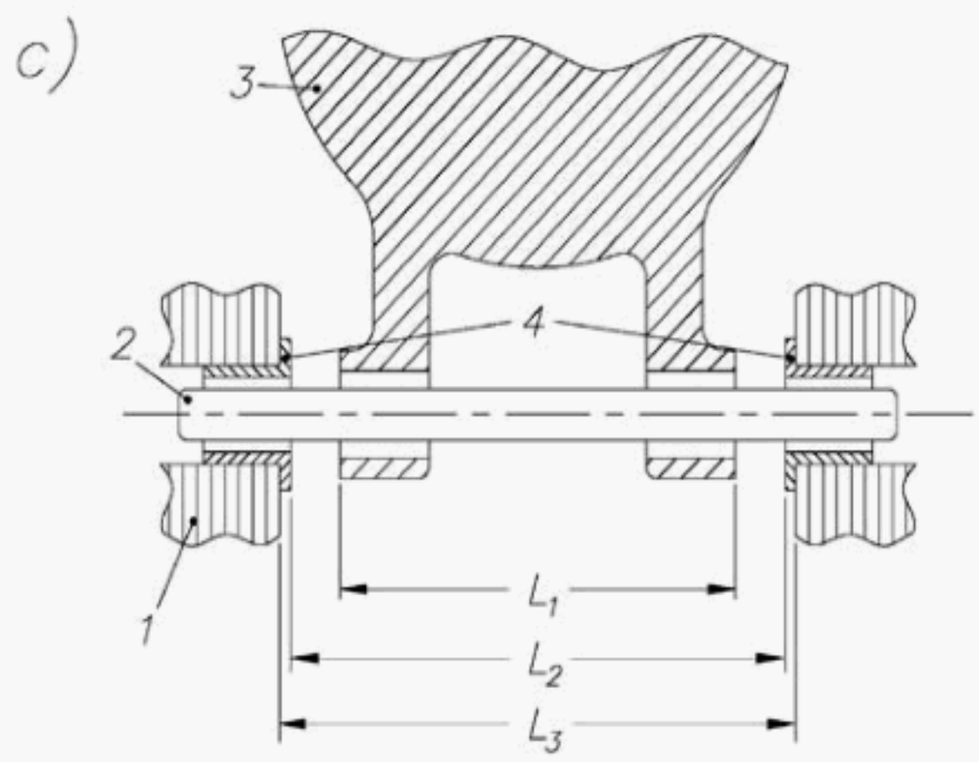
c) The total axial clearance between the clapper hinge and adjacent valve body bearing surfaces shall be not less than 0,25 mm. See Figure 1 c) or Figure 1 d).

a) Radial clearance, $C_R = R_2 - R_1$

b) Diametrical clearance, $C_D = D_2 - D_1$

Key

1 valve body
2 pin
3 sealing assembly
4 bushings

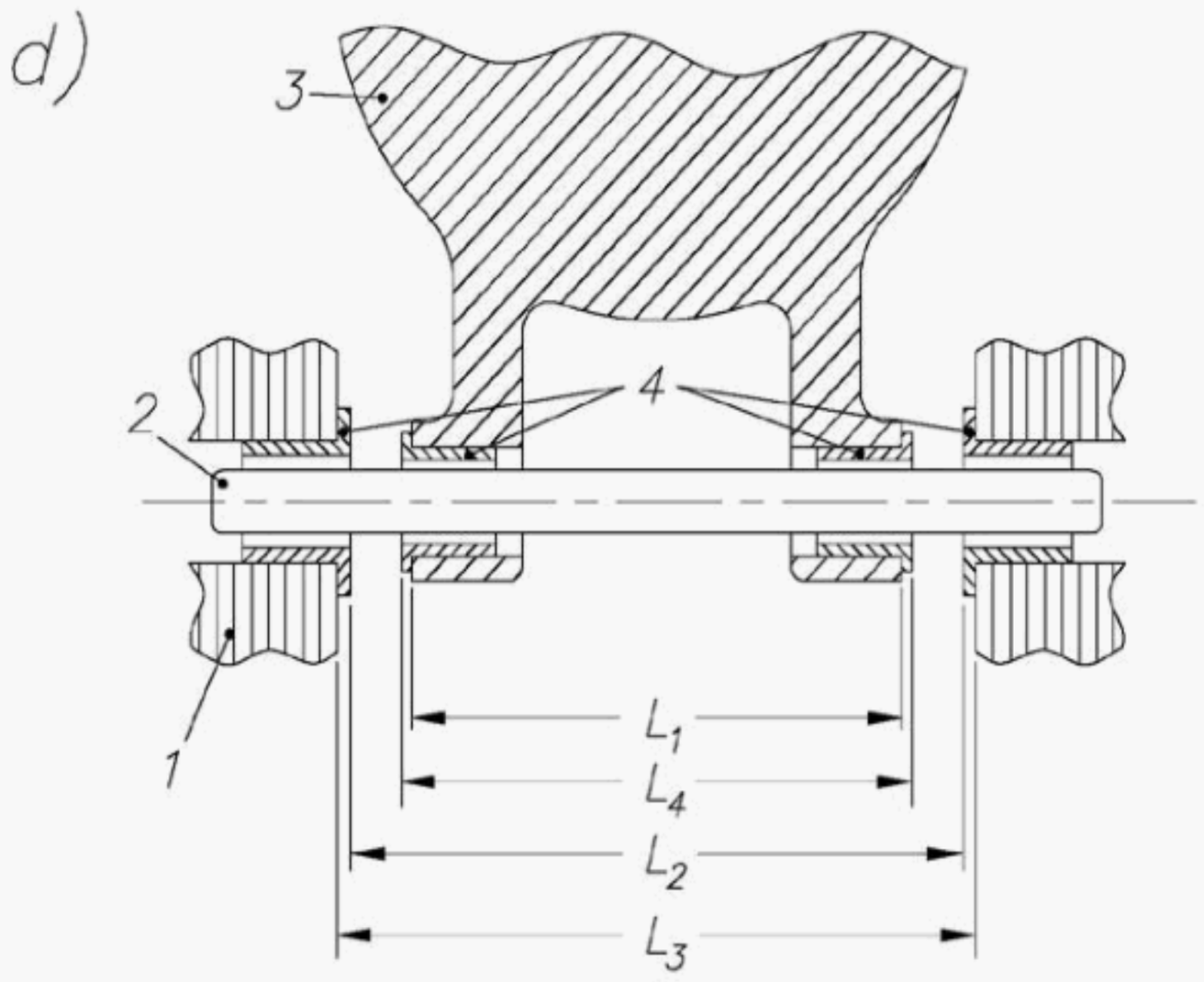


c) Total axial clearance, C_{TA}

$C_{TA} = L_2 - L_1$; **Bushing Projection** = $(L_3 - L_2)/2$

Key

1 valve body
2 pin
3 sealing assembly
4 bushings



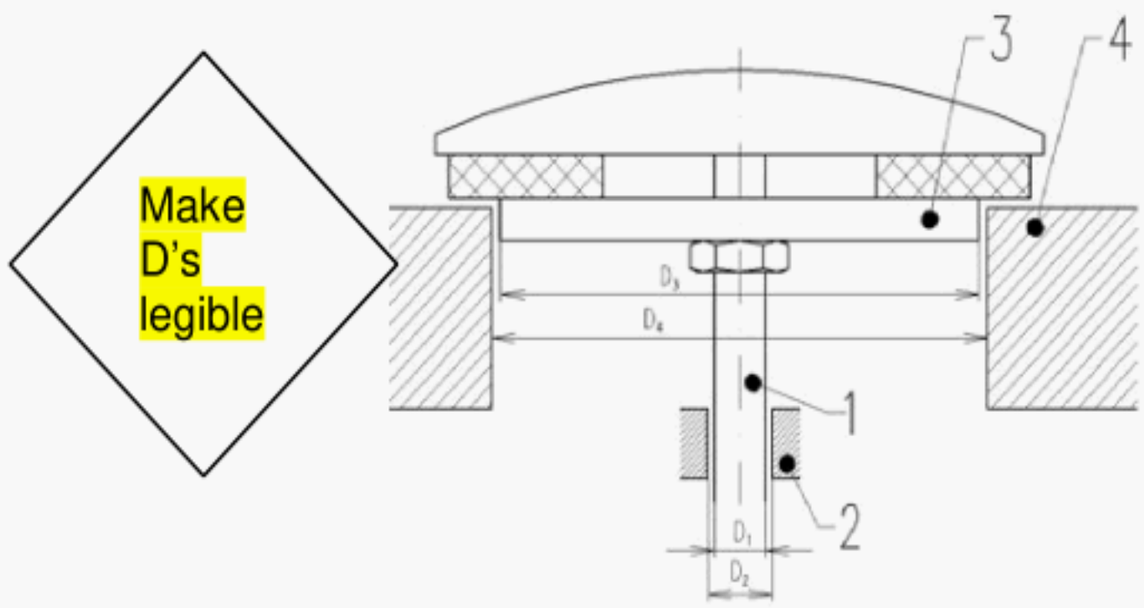
d) Total axial clearance, C_{TA}

$C_{TA} = L_2 - L_4$

Figure 1 — Types of clearances (continued)

4.11.5 Requirements for non clapper type check valves

a) Any reciprocating guide components, which are essential to allow a valve to open, shall have a minimum diametrical clearance of not less than 0,7 mm in that portion over which the moving component enters the fixed component and of not less than 0,05 mm in that portion of the moving component continuously in contact with the fixed component in the ready (set) position. (see Figure 2.



Diametrical clearance of parts not continuously in contact, C_{NC}
C_{NC}= D4 - D3

Diametrical clearance of parts continuously in contact, C_{CC}
C_{CC} = D2 - D1

Key:
1 shaft
2 bearing or bushing
3 seal retaining washer

4 seat

Figure 2 — Clearance of reciprocating guides

4.12 Hydraulic friction loss (see 6.8)

The pressure loss across the valve shall be determined using a flow of 4,5 m/s, when tested by the method of 6.5 shall not exceed the pressure loss published in the manufacturer's installation instructions. See 8.1.

4.13 Endurance (see 6.9)

The valve and its moving parts shall show no sign of distortion, cracks, loosening, separation or other sign of failure, following 30 min of water flow in accordance with 6.9

5 Production testing and quality control

5.1 It shall be the responsibility of the manufacturer to implement and maintain a quality control program to ensure that production continuously meets the requirements of this part of ISO 6182 in the same manner as the originally tested samples.

5.2 Every manufactured valve shall pass a hydrostatic body test for a period not less than 1 min at twice the rated working pressure without leakage.

5.3 Every manufactured valve shall withstand, without leakage at the valve seat, an internal hydrostatic pressure of twice the rated working pressure applied downstream of the clapper for a period of not less than 1 min.

6 Tests

6.1 Samples

A representative sample of each size of valve shall be subjected to the following tests.

6.2 Spring test

Subject the spring in the normal mounting to 50 000 cycles of normal operation in water. The components shall not be operated at a rate exceeding 6 cycles per minute.

For springs of clapper type check valves, the sealing assembly shall be rotated off the seat to a 45° angle and slowly returned to the closed position.

For other type valves the sealing assembly shall be moved to the 50% open position and slowly returned to the closed position.

6.3 Body strength test (see 4.5)

For the purpose of this test, standard production bolts, gaskets and seals may be replaced by components capable of withstanding the test pressure. The valve inlet and outlet connections and all other openings shall be sealed.

There shall be a connection for hydrostatically pressurizing the assembled sample valve at the inlet connection and a means of venting air and pressurizing fluid at the outlet connection. With the sealing assembly blocked open, the sample valve assembly shall be internally hydrostatically pressurized at 4 times the rated working pressure, but not less than 4,8 MPa (48 bar), for a period of 5 min. The valve shall conform to the requirements of 4.5.1.

6.4 Valve leakage and deformation tests (see 4.8)

6.4.1 Body leakage test

Install the valve in a pressure test apparatus with the sealing assembly in the open position. Seal all openings in the valve body. Apply hydrostatic pressure of twice the rated working pressure for a period of 5 min and inspect the valve during this time for signs of leakage. The valve shall conform to the requirements of 4.8.1.

6.4.2 Valve leakage and deformation test

Install the valve under test, including any external compensator and seal the downstream outlet connection.

6.4.2.1 Install a connector and bleed valve to enable the downstream portion of the valve to be hydrostatically pressurized. Seal all other connections on the portion of the valve downstream of the sealing assembly. Apply an internal hydrostatic pressure of twice the rated working pressure downstream of the closed sealing assembly for a period of 5 min. Place a sheet of paper under the valve. Leakage past the sealing assembly will be indicated by wetting of the paper.

6.4.2.2 Fit the valve outlet connection with an open-ended rise pipe which includes an external compensator. With the clapper assembly in the closed position, fill the rise pipe with water to a level 1,5 m above the sealing assembly centre. Place a sheet of paper under the valve assembly. Leakage past the sealing assembly will be indicated by wetting of the paper. Test the valve in its intended position or positions of use and check for leakage after testing for 16 h.

6.4.2.3 Install the valve with a connector on the inlet side of the sealing assembly and a bleed valve on the outlet side. Seal all other openings. Apply a hydrostatic pressure of twice the rated working pressure. Examine the valve for leakage for a period of 5 min. Release the pressure and examine the internal component for leakage, permanent distortion or rupture.

6.5 Warm water aging test for non-metallic components (excluding gaskets and seals and other elastomeric parts) (see 4.9)

Four untested samples of each component shall be immersed in tap water at 87 ± 2 °C for 180 days.

If a material cannot withstand the temperature indicated without excessive softening, distortion, or deterioration, a water aging test shall be conducted at a lower temperature, but not less than 70 °C, for a longer period of time.

The duration of exposure shall be calculated from Equation (1):

$t = 74\ 857\ e^{-0,069\ 3T}$ (1)

where

t is the exposure duration, expressed in days;

e is the base of natural logarithms (= 2,718 3);

T is the test temperature, expressed in degrees centigrade.

NOTE This equation is based on the 10 °C rule, i.e. for every 10 °C rise, the rate of a chemical reaction is approximately doubled. When applied to plastic aging, it is assumed that the life at a temperature, t, in °C is half the life at ($t \pm 10$) °C. The samples shall be removed from the water and allowed to cool to room temperature for examination for a minimum of 24 h.

The components shall be examined for cracking, warping, creep, or other signs of deterioration which would preclude the proper operation of the device. The parts are then to be assembled into valves and shall comply with the requirements of 4.8.1, when tested in accordance with 6.6.

6.6 Air aging test for non-metallic components (excluding gaskets and seals and other elastomeric parts) (see 4.9)

Four untested samples of each component shall be aged in an air oven at 120 ± 2 °C for 180 days. The samples shall be tested in contact with the mating materials under stresses comparable to the intended use at rated working pressure. The components shall be supported so that they do not touch each other or the sides of the oven.

If a material cannot withstand the temperature indicated without excessive softening, distortion, or deterioration, a water aging test shall be conducted at a lower temperature, but not less than 70 °C, for a longer period of time.

The duration of exposure shall be calculated from Equation (2):

$t = 737\ 000\ e^{-0,069\ 3T}$ (2)

where

t is the exposure duration, expressed in days;

e is the base of natural logarithms (= 2,718 3);

T is the test temperature, expressed in degrees centigrade.

NOTE This equation is based on the 10 °C rule, i.e. for every 10 °C rise, the rate of a chemical reaction is approximately doubled. When applied to plastic aging, it is assumed that the life at a temperature, t, in °C is half the life at (t ±10) °C.

The samples shall be removed from the oven and shall be allowed to cool to room temperature for at least 24 h. All post-exposure tests shall be conducted within 72 h. The components shall be examined for cracking, warping, creep, or other signs of deterioration which would preclude the proper operation of the device. The parts are then to be assembled into valves and comply with the requirements of 4.8.1, when tested in accordance with 6.4.1.

6.7 Sealing element tests (see 4.10)

6.7.1 Release test

Prior to conducting this test the minimum opening pressure of the valve needs to be determined.
With the valve in a normal working position and the sealing assembly in the closed position, a hydrostatic pressure of 0,35 MPa (3,5 bar) shall be applied to the outlet end of the valve for a period of 90 days. During this period, the water temperature shall be maintained at 87 ± 2 °C by an immersion heater or other suitable heating device. Provisions shall be made to maintain the water in the inlet end of the valve at atmospheric pressure.

Upon completion of this period of exposure, the water shall be drained from the valve and the valve shall be allowed to cool to ambient temperature for at least 24 h. With the outlet end of the valve at atmospheric pressure, a hydrostatic pressure of 0,035 MPa (0,35 bar) above the minimum opening pressure shall be gradually applied to the inlet end of the valve. The sealing assembly shall move off the seat and no piece of the seal, other than colour shall adhere to the mating surface.

Where the same design of a seal is used for more than one size of valve, only a sample of the size with the highest stress on the seating surface shall be tested.

6.8 Hydraulic friction loss test (see 4.12)

Install the valve in a test apparatus using piping of the same nominal diameter. Use a differential pressure-measuring device accurate to ± 2 % of value.

Measure and record the differential pressure across the valve at a range of flows above and below the flows as specified in 4.12. Replace the valve in the test apparatus by a section of pipe of the same nominal size and measure the differential pressure over the same range of flows. Using graphical methods, determine the pressure drops at the flows. Record the hydraulic friction loss as the difference between the pressure drop across the valve and the pressure drop across the replacement pipe.

Equivalent length of the valve (provided in meters of pipe) shall be calculated based on the nominal size of the valve and pipe specification referenced in the manufacturer's installation instructions.

6.9 Endurance test (see 4.13)

Using the test apparatus described in 6.11, adjust the flow rate to 125 % of the maximum permitted flowing velocity specified by the manufacturer but in no case less than 4,5 m/s, with a tolerance of $^{+5}_{0}$ %.

Sustain a water flow through the valve at this rate for (30^{+5}_{0}) min. Examine the valve for compliance with the requirements of 4.13.

6.10 Salt mist corrosion test

6.10.1 Reagents

Sodium chloride solution, consisting of (20 ± 1) % by weight sodium chloride in distilled water, pH between 6,5 and 7,2 and having a density between 1,126 g/ml and 1,157 g/ml at (35 ± 2) °C.

6.10.2 Apparatus

Fog chamber, of minimum volume 0,43 m^3, fitted with a recirculating reservoir and aspirating nozzles to deliver a salt spray, and means for sampling and controlling the atmosphere in the chamber.

6.10.3 Procedure

Remove the cover (if fitted) from the check valve. Support the check valve and check valve cover in the fog chamber in such a way that solution does not collect in any cavities and expose them to a salt spray by supplying the sodium chloride solution through the nozzles at a pressure of between 0,07 MPa and 0,17 MPa (0,7 bar and 1,7 bar), while maintaining the temperature in the exposure zone at (35 ± 2) °C. Ensure that solution running off the component parts under test is collected and not returned to the reservoir for recirculation. The cover may be omitted from the test if none of the sealing assembly bushings, bearings or their clearances are associated with the cover. Collect salt mist from at least two points in the exposure zone and measure the rate of application and the salt concentration. Ensure, for each 80 cm^2 of collection area, a collection rate of 1 ml/h to 2 ml/h over a period of $(16^{+0,25}_{0})$ h.

Expose the component parts for a period of $(10^{+0,25}_{0})$ days. After exposure, remove the check valve and cover (if under test) from the fog chamber and allow to dry for $(7^{+0,25}_{0})$ days at a temperature not exceeding 35 °C and at a relative humidity not greater than 70 %. After the drying period, examine the corrosion protected steel parts for visible signs of deterioration of the coating such as blistering, delamination, flaking or increased resistance to movement.

7 Marking, labelling and packaging

7.1 Check valves, shall be marked either directly on the body with raised or depressed cast letters or on a permanent metal label attached mechanically (such as with rivets or screws). Metal labels shall be made of corrosion resistant material.

7.2 Cast body markings shall be in letters and figures at least 9,5 mm high. The height of the marking may be reduced to 5 mm for 50 mm and smaller valves. Cast body letters and figures shall be raised or depressed by at least 0,75 mm.

Letters on an etched or stamped permanent label shall be a minimum of 2mm high.

7.3 Check valves shall be marked with the following:

a) name or trade mark of the manufacturer or vendor;

b) distinctive model number, catalogue designation or an equivalent marking;

c) name of the device, such as “check valve”;

d) an indication of flow direction;

e) nominal size;

f) maximum working pressure in MPa (or bar, PSI); if inlet and/or outlet connections are machined for lower working pressures as in 4.3.2, the lower pressure limit shall be marked;

g) serial number or year of manufacture; check valves produced in the last three months of a calendar year may be marked with the following year as the date of manufacture; check valves produced in the first six months of a calendar year may be marked with the previous year as the date of manufacture;

h) mounting position, if limited to vertical or horizontal position;

i) factory of origin, if manufactured at two or more factories;

8 Manufacturer's installation instructions

NOTE A copy of the manufacturer's installation instructions should be supplied with each check valve.

8.1 The instructions shall include an illustration showing the valve operation, friction loss value (e.g. in the form of the equivalent lengths of pipe), and the maximum permitted flow velocity.

8.2 The instructions shall include recommendations for care and maintenance.