Specification for

Open bottomed taper plug valves for 1st, 2nd and 3rd family gases up to 200 mbar

Confirmed December 2011

BSI STANDARDS

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee GSE/22, Safety and control devices for gas governors and gas burning appliances, upon which the following bodies were represented:

Association of Control Manufacturers (TACMA (BEAMA Ltd.))
British Combustion Equipment Manufacturers' Association
British Gas plc
Department of Trade and Industry (Consumer Safety Unit, CA Division)
Electricity Association
LP Gas Association
Society of British Gas Industries

The following body was also represented in the drafting of the standard, through subcommittees and working groups:

Calor Gas Limited

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Contents

Foreword

This British Standard has been prepared under the direction of the Engineering Sector Board and covers valves outside the scope of prEN 331 which is being prepared by CEN/TC 236.

It supersedes BS 1552 : 1989, which is withdrawn. Its scope differs from that of BS 1552 : 1989, as it covers only open bottomed taper plug valves.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Specification

1 Scope

This British Standard specifies the requirements and methods of test for the design and performance of manually operated open bottomed taper plug valves, operating at a declared working pressure of up to 200 mbar[1)] on 1st, 2nd and 3rd family gases.

Valve sizes covered are up to and including size R2 and a maximum bore of 50 mm or equivalent free area.

2 Normative references

This British Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on the inside back cover. For dated references, only the edition cited applies: any subsequent amendments to or revisions of the cited publication apply to this British Standard only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

3 Definitions

For the purposes of this British Standard the following definitions apply.

3.1 valve

A device which admits or closes the gas flow by movement of a closure member.

NOTE. A valve is termed manually operated if the operation can be directly performed by the user.

3.2 open bottomed taper plug valve

A valve with a taper plug closure member and open bottomed body.

NOTE. Examples of applications are given in annex A and are illustrated in figure A.1.

3.3 closure member

The moving part of the valve that effects opening and closing.

3.4 declared flow rate

The flow rate, at the fully open position, declared by the manufacturer, using air at a pressure differential across the valve of 1.0 mbar.

NOTE 1. Air at standard density and pressure has a relative density of 1.

NOTE 2. A method of calculating the equivalent gas rate is given in annex C.

4 Materials

4.1 Body, closure member and its retaining parts

The body, closure member and its retaining parts shall be made of a metallic material with a melting point in excess of 425 °C.

Zinc alloys shall not be used for these components.

4.2 Zinc alloys

Where zinc alloys are used for components other than those specified in **4.1**, the following conditions shall apply.

a) The alloys shall conform to the specification of alloy A given in BS 1004.

b) The castings shall be manufactured in accordance with BS 5338.

c) The parts shall not be subjected to a temperature higher than 80 °C.

4.3 Corrosion resistance

4.3.1 *General*

For all parts of the valve, corrosion resistance shall be achieved either by the use of corrosion-resistant materials or by means of a protective coating, e.g. paint. Sealing surfaces of the valve shall be made from corrosion-resistant materials. No part of the valve shall corrode to an extent that would affect its safe and correct operation.

Conformity shall be checked in accordance with **4.3.2** and **4.3.3**.

4.3.2 *Scratch resistance*

Those parts of the valve that are coated for protection and not solely for decoration shall be tested as specified in **B.1**, both before and after the humidity tests specified in **B.2**. There shall be no penetration of the protective coating by the ball.

4.3.3 *Resistance to humidity*

Following the test in **B.2** the valve shall conform to the following.

a) No part of the valve shall show signs of undue corrosion, and coated surfaces shall not show signs of bubbling or blistering when viewed with the naked eye.

b) Those parts of the valve, the corrosion of which could adversely affect the continued safe working of the valve, shall not show any signs of corrosion.

[1)] 1 mbar = 100 N/m^2 = 100 Pa.

4.4 Operation at low temperature

Where a valve is declared to operate at a temperature below 0 °C, it shall conform to clause **8** and **10.1** after having been maintained at the declared minimum temperature, with inlet and outlet parts open to atmosphere, for 24 h.

4.5 Accelerated ageing

Following the accelerated ageing test given in **B.3**, the valve shall conform to clause **8** and **10.1** at (20 ± 5) °C.

5 Design

5.1 Set positions

When a valve is set to any specific position it shall remain there.

5.2 Handles

Except in the case of nursery union cocks, the handle or lever shall be securely attached. There shall be provision to enable the installer to remove and replace the handle or lever using commercially available tools.

5.3 Wall thickness

The wall thickness from any gasway to atmosphere or to any holes connected to atmosphere shall be not less than 1 mm.

5.4 Dismantling in service

There shall be ready access to the plug for servicing, using tools which are readily available commercially, and the valve shall be so constructed that incorrect assembly is both difficult and obvious when tested in accordance with **B.4**. The valve shall conform to **8.1** following the serviceability test.

5.5 Assembly

5.5.1 Niting washers shall be flat.

5.5.2 The washer seating of the body shall be machined square with the axis of the bore.

NOTE. The moving parts should adjusted to give a smooth action without unevenness.

5.5.3 The screwed portion of the plug which projects beyond the nut securing the niting washer shall not be burred over. The nut shall be a spanner-tight fit over the whole length of the spigot and shall conform to **5.5.5**.

5.5.4 When tested in accordance with **B.5**, the minimum torque to unscrew the niting nut shall be not less than given in table 1.

Table 1. Minimum torque to unscrew niting nuts

Nominal size of valve	Torque N·m
⅛	0.17
¼	0.34
½	0.62
¾	0.90
1	1.25
1 ¼	1.70
1 ½	4.10
2	7.90

5.5.5 It shall not be possible to loosen the fastener without the use of a tool.

5.6 Operation

Meter controls for use in domestic applications shall close from the fully open position in a quarter turn. For 1st and 2nd family gas installations there shall be provision for locking the valve in the OFF position.

For other single outlet valves which are operated by a rotating closure member, the valve shall close in a clockwise direction.

If the rotation from open to close is a quarter turn and if the manual actuator is detachable, the end of the closure member shall have a raised or recessed line to indicate direction of gas flow.

If more than a quarter turn is required to close the valve, the closing direction shall be indicated.

5.7 Open and closed positions

The fully open and closed positions of valves shall be clearly recognizable and the closed position(s) shall be limited by a fixed non-adjustable stop(s).

For valves which are operated by a lever or handle, the lever or handle shall be arranged such that it is:

a) at right angles to the direction of the outlet flow for the closed position; and

b) parallel with the direction of the outlet flow for the open position.

5.8 Compensation for wear

5.8.1 Valves shall be designed to compensate for wear (see figure A.1).

5.8.2 Valves for use with 3rd family gases shall have a means for providing compensation for wear, e.g. spring loading, without the need for manual adjustment.

6 Manufacture

All components of valves shall be of sound manufacture, free from burrs and clean, e.g. free from swarf and core sand. They shall also be free from sharp edges and corners which could cause damage, injury or incorrect operation.

7 Connections

7.1 Only commercially available tools shall be required for making connections.

7.2 Where valves are provided with threaded connections, these connections shall conform to:

a) BS 21;

b) designation G of BS 2779;

c) BS 746 for the outlet of meter control valves.

7.3 Compression fittings shall conform to BS 864 : Part 2 or BS 2051 : Part 2. Non-symmetrical olives shall not be used.

7.4 Flange connections shall conform to the manufacturer's specification.

7.5 Capillary joints shall conform to BS 864 : Part 2 or BS 2051 : Part 2.

8 Leak tightness

8.1 General

The valve shall be leak tight and shall be considered to be so if it meets the requirements of **8.2** and **8.3** at an internal air pressure of 300 mbar.

8.2 External leak tightness

When tested in accordance with **B.6**, the leakage rate shall not exceed 20 cm^3/h.

8.3 Internal leak tightness

When tested in accordance with **B.7**, the leakage rate shall not exceed 20 cm^3/h.

9 Nominal flow rate

When measured in accordance with **B.8**, the corrected flow shall be not less than the declared flow rate, for a differential pressure of 1 mbar.

10 Mechanical performance

10.1 Ease of operation

When tested in accordance with **B.9**, the maximum and minimum torque applied to operate the valve shall be within the limits declared by the manufacturer.

10.2 Mechanical strength

The valve shall remain functional when tested as specified in **B.10** and **B.11** using the values given in table 2. The leakage rates given in clause **8** shall not be exceeded and there shall be no distortion or cracking.

When a control has provision for mounting, e.g. fixing lugs, tapped holes or pressed steel fixing brackets, this fitting shall be used to hold the control while the mechanical strength tests are carried out. Spanner flats, if provided, shall be used to hold the control when carrying out the test described in **B.10**.

Table 2. Torque and bending moment values

Nominal inlet size			Torque	Bending moment
Pipe thread or maximum bore		Tube outside diameter		
	mm	mm	N·m	N·m
⅛	6	—	15	25
¼	8	6 and 8	20	35
⅜	10	10 and 12	35	70
½	15	15	50	105
¾	20	22	85	225
1	25	28	125	340
1 ¼	32	—	160	475
1 ½	40	—	200	610
2	50	—	250	1100

11 Endurance

11.1 Valves selected for an endurance test shall be in a new condition. They shall be checked for conformity to clauses **8** and **9** and **10.1** before being subjected to the endurance test.

Two valves shall be subjected to an endurance test comprising the cycling test and static test specified in **B.12**, after which they shall still conform to clauses **8** and **9** and **10.1**.

11.2 A valve that is declared to operate below 0 °C shall conform to **4.4** after having successfully completed the endurance test required by **11.1**.

11.3 Following the endurance test required by **11.1** and **11.2**, as appropriate, the valve shall conform to **5.5.4** and **5.5.5**.

12 Fire resistance

Meter controls and other valves which are declared to be fire resistant shall not melt nor show any sign of deformation during the test specified in **B.13**, and the total leakage, i.e. let-by and soundness, from each valve shall not exceed 0.14 m^3/h at an internal air pressure of 50 mbar.

After cooling to room temperature, the total leakage shall remain within this limit. It shall then be possible to close the open valve by use of the handle or a commercially available spanner or wrench, and the total leakage through the closed valve shall not exceed 0.14 m^3/h.

13 Operational data

The manufacturer shall state:

a) the working temperature range of the body for which the valve has been designed;

b) the gas family or families for which the valve is suitable;

c) the declared flow rate and differential pressure;

d) the working life of the valve (minimum 300 cycles);

e) working gas pressure range (in mbar);

f) materials specification including lubricants;

g) operating torque (minimum and maximum);

h) whether the valve is fire resistant;

i) overall dimensions and connections, and, where applicable, details of flanges;

j) direction of flow.

14 Marking

14.1 Each valve shall be marked with the manufacturer's name or trade mark and date code.

14.2 Valves that are designed for uni-directional operation shall be marked with the direction of flow, unless this is obvious.

14.3 All marking shall be easily visible and indelible. Conformity shall be checked by ensuring that the marking remains legible and secure subsequent to the tests specified in **B.3** and **B.12** (accelerated ageing test and endurance).

14.4 Each consignment shall contain the operational data given in **13**a, **13**b, and **13**e.

Annexes

Annex A (informative)
Examples of application

NOTE. The following examples of application are illustrated in figure A.1.

A.1 Meter control cock

A meter control cock is intended for use on the service pipe to a meter. The inlet end is screwed internally with an R_C thread of appropriate size conforming to BS 21. The outlet end embodies a union boss threaded in accordance with BS 746.

The range of sizes is from ½ in to 2 in.

A.2 Main cock

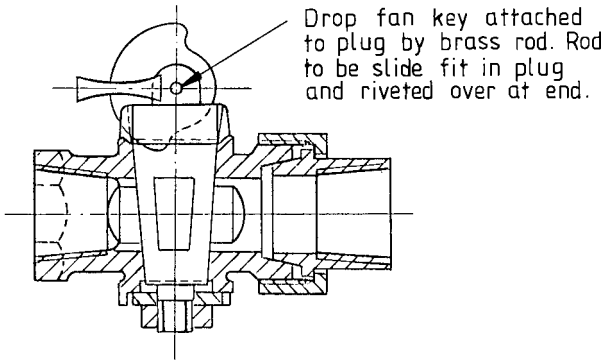
A main cock is intended for use as a control valve on pipe lines. One end is screwed internally and the other end screwed externally, each in accordance with BS 21. The range of sizes is from ½ in to 2 in.

A.3 Union cock

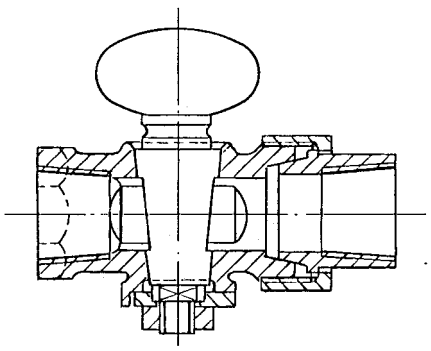
A union cock is intended for use as a control valve on pipe lines. The inlet end is screwed internally and the outlet end embodies a union with either internal or external threads, in each case in accordance with BS 21 . The range of sizes is from ⅛ in to 1 in.

A.4 Nursery union cock

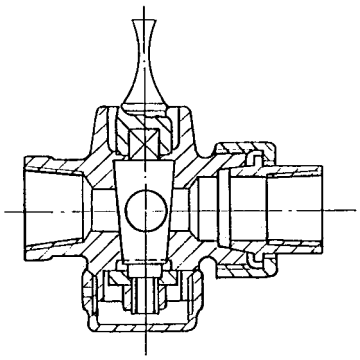
A nursery union cock is the same as a union cock, but with shrouding and a detachable key. The sizes are ¼ in and ½ in.



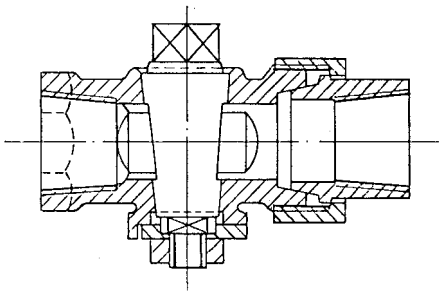
Union cock: drop fan



Union cock: rigid fan

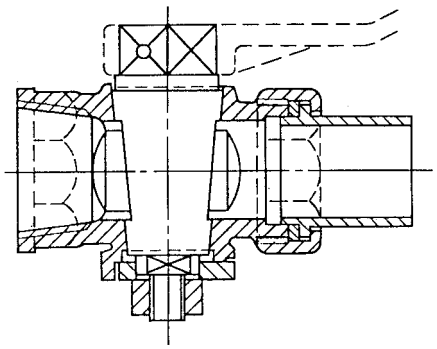


Nursery union cock

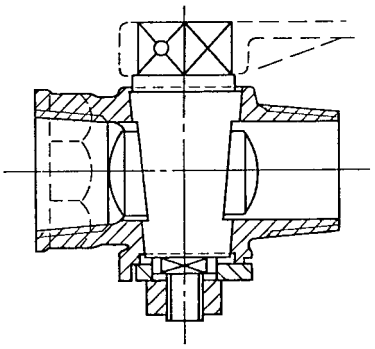


Union cock: diamond head

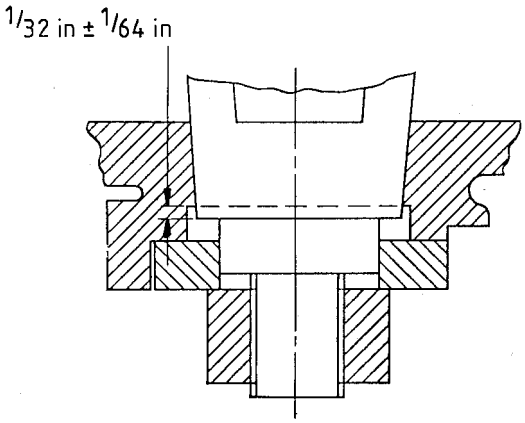
Figure A.1. Typical examples of applications



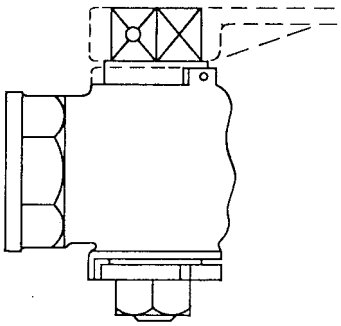
Meter control cock with washered union



Main cock



Enlarged view showing protrusion of plug beyond taper bore in body



Meter control cock or main cock with tapping for locking screw

Figure A.1. Typical examples of applications (*concluded*)

Annex B (normative)
Test methods

B.1 Scratch test method

Draw a 1 mm diameter fixed steel ball across the surface of the valve at a speed of 30 mm/s to 40 mm/s with a contact force of 10 N.

NOTE. An example of a suitable test instrument is shown in figure B.1.

B.2 Humidity test

B.2.1 Place the open valve in a climatic cabinet at an ambient temperature of (40 ± 2) °C with a relative humidity in excess of 95 %. After 48 h remove the valve from the climatic cabinet and examine it for conformity to **4.3.2** and **4.3.3**a.

B.2.2 Leave the valve at room temperature for 24 h and re-examine it for conformity to **4.3.2** and **4.3.3**.

B.3 Accelerated ageing test

Maintain the valve at a temperature of 10 °C above the maximum permitted body temperature, with the inlet and outlet ports open to atmosphere, for a period of 4 weeks.

B.4 Serviceability test

Dismantle and re-assemble the valve twice, ensuring that lubrication is in accordance with the manufacturer's instructions, and then check for gas tightness in accordance with **8.1**.

B.5 Niting nut torque test

Slacken off the nut a half turn. Measure the torque to start the nut moving.

Re-tighten and slacken off the nut twice and measure the torque.

B.6 Closure parts, external leak tightness

The inlet and outlet of the half open valve are pressurized to the test pressure given in **8.1**, and the leakage rate is measured.

B.7 Internal leak tightness

The test is carried out in the flow direction of the valve.

Mount the valve on the test equipment with the closure member in the closed position. Pressurize the inlet of the valve to the test pressure given in **8.1** and measure the leakage rate.

For valves with no specified direction of gas flow, repeat the test with the test pressure on the other connection of the valve.

B.8 Flow rate test

Supply air at a constant pressure to a positive displacement or inferential meter of suitable range and having an error not greater than 5 % of the rate to be measured. Pass the air, at a pressure of 20 mbar, through a straight length of pipe connected directly to the inlet of the valve. The pipe is to have the same size as the inlet connection of the valve, and is to be at least 10 pipe diameters in length, with a pressure tapping five diameters upstream of the valve. Position another pressure tapping five pipe diameters downstream of the control on a similar pipe of at least 10 diameters in length. Connect, across these tappings, a differential pressure gauge capable of being read directly to 0.05 mbar or less.

Adjust the air flow rate by means of a control valve on the outlet of the pipe to give the required differential pressure across the valve, and maintain the air temperature to ± 5 °C. Record the flow rate and correct the measured values to standard conditions.

B.9 Operation test

With the sample under its nominal working pressure and at a temperature of (20 ± 5) °C, measure the operating torque continuously over the full cycle of the actuator between the open and closed positions.

Apply the torque to the spindle at a rotational speed of 5 r/min and measure the torque with a torque meter. Repeat the test three times and determine the average values.

The test is undertaken with the valve in an as-delivered condition after one preliminary cycle has been carried out, and the valve has been left for 24 h at (20 ± 5) °C.

B.10 Torque test

B.10.1 *Threaded connections*

Take pipes that are at least 300 mm in length and threaded in accordance with BS 21 taper, screw them hand tight to the inlet and outlet of the control and clamp the inlet pipe. Apply the test torque given in table 2 to the outlet pipe for approximately 10 s.

Check the valve for deformation and leakage.

For valves where the inlet and outlet connections are not on the same axis, repeat this test by clamping the outlet pipe, and applying the test torque to the inlet pipe for approximately 10 s.

B.10.2 *Olive compression connections*

Using a steel rod with a new brass olive of the recommended size, apply the torque specified in table 2 to the nut and proceed as described in **B.10.1**. Discount any deformation of the olive seating or mating surfaces that is consistent with the torque applied.

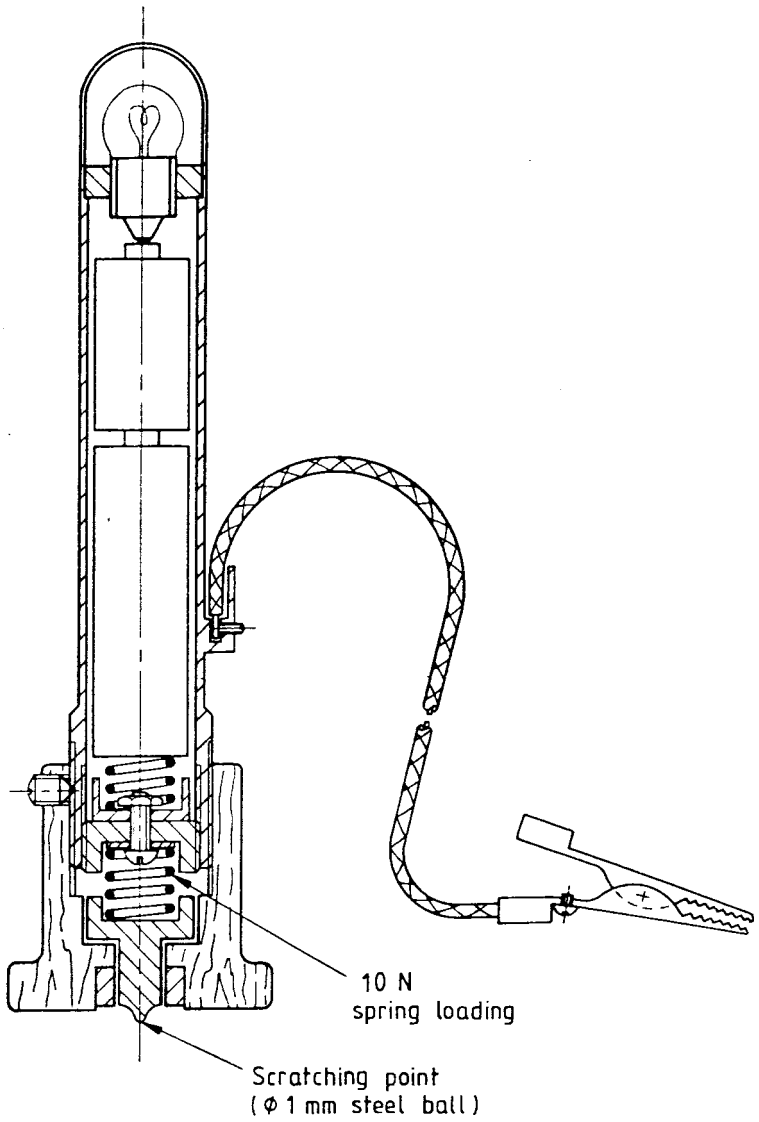


Figure B.1. Paint scratch test apparatus

B.10.3 ***Flared compression connections***

Using a short length of steel tube with a flared end, apply the torque specified in table 2 according to the largest tube that can be used with the nut and proceed as described in **B.10.1**. Discount any deformation of the cone seating or mating surfaces that is consistent with the torque applied.

B.10.4 ***Flanged connections***

Connect the appropriate mating flange, with the test pipe attached, to the valve inlet and/or outlet as applicable. Apply the test torque as described in **B.10.1**.

B.10.5 ***Union connections***

Replace the nut and liner with a one-piece test connection and replace any non-metallic seal with a soft copper seal. Screw the test piece onto the valve and proceed as described in **B.10.1**.

B.11 Bending moment test

Following the torque test given in **B.10.1**, either clamp the inlet pipe within five pipe diameters of the connection boss, or clamp the flanged connection in the normal manner.

Apply a force, equivalent to the test bending moment given in table 2, either to the outlet pipe used in **B.10.1** or to a suitable flanged pipe which is clamped to the flanged outlet connection in the normal manner.

Apply the force for approximately 10 s in each of four directions perpendicular to each other and to the axis of the pipe. Choose the direction to include the direction of minimum strength of the device and to exclude any torque on angled connections.

For valves where the inlet and outlet connections are not on the same axis, repeat this test by clamping the outlet pipe, and applying the test torque to the inlet pipe for approximately 10 s.

Check the valve for deformation and leakage in accordance with **8.1**.

B.12 Endurance test

B.12.1 ***General***

The controls shall be tested in a chamber which can be heated and cooled to the required temperatures over a period of 15 min to 45 min. The valves shall not be regreased during the tests.

B.12.2 ***Cycling test***

B.12.2.1 *Cycle*

For the purpose of these tests, a cycle consists of OFF-ON-OFF operation, i.e. starting from the closed position (but unlocked), whereby the control is turned at a specific rate of movement to the end of its travel and back at the same rate of movement to the closed position without locking or retaining a pressure against the stop.

B.12.2.2 *Conditions*

The rate of movement of the operating member shall be 5 cycles per minute irrespective of the total angular movement.

B.12.2.3 *Procedure*

Carry out the tests for alternate periods with the body of the control at the maximum declared working temperature, and then at the minimum declared working temperature, starting at the maximum working temperature. Each period consists of a number of cycles as follows:

– for a declared life of 300 cycles, the period shall comprise 75 cycles;

– for a declared life of more than 300 cycles, the period shall comprise one-fifth of the declared life.

Continue the test until completion of the total number of cycles required.

B.12.3 ***Static test***

On completion of the cycling test, maintain the valve for 2 h at its maximum working temperature, in the ON position.

B.13 Fire resistance test

Two valves shall be tested as follows.

Ensure that the initial operating torque for each valve to be tested conforms to that declared by the manufacturer. Mount the test valves in a furnace using connections that are similar to those likely to be used in practice. For example, a meter control is mounted with a semi-rigid stainless steel meter connector at its downstream end.

At an internal air pressure of 50 mbar, subject one open valve and one closed valve to a fire resistance test for a period of 30 min, in accordance with the standard time-temperature relationship given in **A.2.2** of BS 476 : Part 20 : 1987. Measure the furnace temperature with thermocouples placed symmetrically about and (25 ± 2) mm from the surface of the valve. Ensure that the final temperature does not exceed 850 °C.

Monitor the leakage during the test and, after cooling to room temperature, measure the total leakage at an internal air pressure of 50 mbar.

After cooling to room temperature, close the open valve and measure the total leakage of each valve at an internal air pressure of 50 mbar.

Annex C (informative)
Equivalent gas rate

The equivalent gas rate Q_g is calculated as follows:

$$Q_g = F \times Q_a \sqrt{\frac{P_g}{P_a}}$$

where

Q_a is the measured air rate;

P_g is the gas pressure differential across the valve;

P_a is the air pressure differential across the valve;

F is a non-dimensional density correction factor with the following values:

1.41 for 1st family gas (assumed relative density 0.5);

1.29 for 2nd family gas (assumed relative density 0.6);

0.71 for butane (assumed relative density 2.0);

0.82 for propane (assumed relative density 1.5).

NOTE. In the particular case of the pressure differential being measured in mbar and P_g being 1.0 mbar, the above equation may be conveniently expressed as follows:

$$Q_g = \frac{F \times Q_a}{\sqrt{P_a}}$$

List of references

Normative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS 21 : 1985	*Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions)*
BS 476 :	*Fire tests on building materials and structures*
BS 476 : Part 20 : 1987	*Method for determination of the fire resistance of elements of construction (general principles)*
BS 746 : 1987	*Specification for gas meter unions and adaptors*
BS 864 :	*Capillary and compression tube fittings of copper and copper alloy*
BS 864 : Part 2 : 1983	*Specification for capillary and compression fittings for copper tubes*
BS 1004 : 1972	*Specification for zinc alloys for die casting and zinc alloy die castings*
BS 2051 :	*Tube and pipe fittings for engineering purposes*
BS 2051 : Part 2 : 1984	*Specification for olive type copper alloy compression tube fittings*
BS 2779 : 1986	*Specification for pipe threads for tubes and fittings where pressure-tight joints are not made on the threads (metric dimensions)*
BS 5338 : 1976	*Code of practice for zinc alloy pressure die casting for engineering*

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