Gas Industry Standard

GIS/V7-1:2013

Specification for

Distribution valves

Part 1: Metal-bodied line valves for use at pressures up to 16 bar and construction valves for use at pressures up to 7 bar

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Contents

Foreword

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This standard calls for the use of procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Compliance with this engineering document does not confer immunity from prosecution for breach of statutory or other legal obligations.

Mandatory and non-mandatory requirements

For the purposes of a GIS the following auxiliary verbs have the meanings indicated:

can indicates a physical possibility;

may indicates an option that is not mandatory;

shall indicates a GIS requirement;

should indicates best practice and is the preferred option. If an alternative method is used then a suitable and sufficient risk assessment needs to be completed to show that the alternative method delivers the same, or better, level of protection.

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Brief history

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1 Scope

This Gas Industry Standard specifies the requirements for metal-bodied valves, for gas distribution purposes. The valves shall be suitable for use at temperatures within the range –20 °C to 60 °C. The valves are for use as line valves up to 16 bar MOP (maximum operating pressure) or construction valves up to 7 bar MOP and the MOP of the valve shall be specified in the purchase order.

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.

Formal standards

BS 21, *Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions)*.

BS 4504, *Circular flanges for pipes, valves and fittings (PN designated)*.

BS EN 19*, Industrial valves — Marking of metallic valves*.

BS EN 682, *Elastomeric seals — Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids*.

BS EN 1562, *Specification for malleable cast iron*.

BS EN 1092-1, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Steel flanges*.

BS EN 1092-2, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated— Cast iron flanges*.

BS EN 10028-1, *Specification for flat products made of steels for pressure purposes — Part 1: General requirements*.

BS EN 10028-2, *Specification for flat products made of steels for pressure purposes — Part 2: Non-alloy and alloy steels with specified elevated temperature properties*.

BS EN 10028-3, *Specification for flat products made of steels for pressure purposes — Part 3: Weldable fine grain steels, normalized*.

BS EN 10029, *Specification for tolerances on dimensions, shape and mass for hot rolled steel plates 3 mm thick or above*.

BS EN 10213-1, *Technical delivery conditions for steel castings for pressure purposes — Part 1: General*.

BS EN 10213-2, *Technical delivery conditions for steel castings for pressure purposes — Part 2: Steel grades for use at room temperature and at elevated temperature*.

BS EN 10213-3, *Technical delivery conditions for steel castings for pressure purposes — Part 3: Steels for use at low temperatures*.

BS EN 10213-4, *Technical delivery conditions for steel castings for pressure purposes — Part 4: Austenitic and austenitic-ferritic steel grades*.

BS EN 10222-1, *Steel forgings for pressure purposes — Part 1: General requirements for open die forgings*.

BS EN 10224, *Non-alloy steel tubes and fittings for the conveyance of aqueous liquids including water for human consumption — Technical delivery conditions*.

BS EN 10226-1, *Pipe threads where pressure tight joints are made on the threads — Taper external threads and parallel internal threads — Part 1: Dimensions, tolerances and designation*.

BS EN 12266-1:2003, *Industrial valves — Testing of valves — Pressure tests, test procedures and acceptance criteria — Part 1: Mandatory requirements*.

BS EN 12266-2:2002, *Industrial valves — Testing of valves — Tests, test procedures and acceptance criteria — Part 2: Supplementary requirements*.

Gas Industry Standards

GIS/C5, *Specification for distribution pipe fittings cast in grey cast iron for use up to 7 bar maximum operating pressure.*

GIS/PL2-1, *Specification for polyethylene pipes and fittings for natural gas and suitable manufactured gas — Part 1: Pipes for use at pressures up to 5.5 bar*.

GIS/PL2-8, *Specification for polyethylene pipes and fittings for natural gas and suitable manufactured gas — Part 8: Pipes for use at pressures up to 7 bar*.

Individual Gas Distribution Network Standards

/SP/DAT 33, Range and typical composition of natural gas being delivered via the gas transportation system*.

*/SP/DAT 45, *Specification for spheroidal graphite or nodular graphite castings to BS 2789*.

*/SP/Pl6, *Notes for guidance on the dimensions and applications of standard weld end preparations for steel pipe, fittings and valves*.

*/SP/V6-1, *Technical specification for steel valves for use with natural gas at normal operating pressures above 7 bar — Part 1: 100 mm nominal size and above*.

*/SP/V6-2, *Technical specification for steel valves for use with natural gas at normal operating pressures above 7 bar — Part 2: 80 mm nominal size and below*.

* = Denotes each gas distribution network reference

3 Terms and definitions

For the purposes of this standard the following terms and definitions apply.

3.1
mean temperature
20 °C ± 5 °C

3.2
MOP
maximum operating pressure. The pressure within the pipework under normal operating conditions

4 Shell materials

4.1 All materials used for the components of the valves shall be suitable for use with natural gas conforming to the requirements of */SP/DAT 33 or equivalent manufactured gas and shall not be adversely affected by any of its constituents or additives.

4.2 For MOP up to 7 bar and sizes up to 300 mm, grey cast iron conforming to GIS/C5 in Grade 220 or spheroidal graphite cast iron conforming to BS 2789 in Grade 420/12 may be used.

4.3 Spheroidal graphite cast iron shall conform to the requirements of */SP/DAT 45, Grade 400/18/L20. Malleable cast iron shall conform to the requirements of BS EN 1562, Grade W38-12 or B32-10.

4.4 Carbon steel castings shall conform to the requirements of BS EN 10213-1, BS EN 10213-2, BS EN 10213-3 and BS EN 10213-4. Carbon steel forgings shall conform to the requirements of BS EN 10222-1. Carbon steel plates shall conform to the requirements of BS EN 10028-1, BS EN 10028-2, BS EN 10028-3 and BS EN 10029.

4.5 ASTM, ISO or EN materials of equivalent grades may be proposed for consideration by the gas transporter as variants.

5 Elastomeric materials

All elastomeric materials shall conform to BS EN 682 and in addition shall be tested at –25 °C in accordance with BS 903, A39 using the pass/fail criteria defined for the –5 °C compression set test.

6 Design requirements

6.1 General design requirements

6.1.1 Valves shall be designed to meet the specified performance requirements with ambient and gas temperatures in the range –20 °C to +60 °C.

6.1.2 The manufacturer shall ensure there is no possibility of chemical or electrochemical reaction between the materials used. The design of the stem shall be resistant to external corrosion.

6.1.3 Foreign material or corrosion products, external to the valve body, which could impair the operation of the valve shall be effectively excluded by the design of the valve.

6.1.4 The valve shall be designed in such a way that the stem is anti-blow-out. The gland flange fasteners shall not be considered as the sole anti-blow-out method.

Where pressure retaining parts or assemblies are held together by means of screwed components, the valve shall be designed to prevent accidental disassembly under pressure. If replacement of internal parts is possible, the parts shall be designed so as to prevent mis-assembly.

6.1.5 Valves that rely on support from mating flanges to contain internal components shall not be used.

6.1.6 The paint finish shall be zinc phosphate primer of minimum thickness 65 µm but variants may be proposed for consideration by the gas transporter.

6.2 Design requirements for line valves

6.2.1 Line valves shall be of wedge, parallel slide or conduit design, multi-turn in operation and utilize a gate-like disk and two seats for closure. Line valves shall be capable of operation and sealing against gas flowing from either direction.

Line valves shall be full bore. Valves up to PN10 pressure rating shall have a minimum clear bore equal to the nominal diameter of the valve. Valves of pressure rating greater than PN10 shall have a minimum clear bore in accordance with */SP/V6.

6.2.2 Line valves with adjustable glands/stem seals shall not be used.

6.2.3 Line valves shall not be of the rising spindle type.

6.2.4 All line valves shall incorporate a double block and bleed facility. Vents shall be internally threaded in accordance with BS 21 and BS EN 10226-1, $R_p\ ½$ or $R_c\ ½$ for valve sizes up to and including 100 mm and $R_p\ ¾$ or $R_c\ ¾$ for sizes above 100 mm, as a minimum. All vents shall be plugged in a gas-tight manner when delivered.

The positioning of a vent on the valve body shall be such that it is easily accessible for the connection of a vent pipe. The vent plug shall incorporate a safety feature to enable valve body pressure to be vented prior to the complete removal of the plug. The plug material shall satisfy the requirements of **6.1.2**.

6.2.5 The weld ends of weld end valves shall be of sufficient length to allow welding without damage of the valve internals.

The valve weld end shall be manufactured from a material which is suitable for welding into the pipeline system. The pipeline material shall be specified in the purchase order. All weld end preparations shall be machine-cut in accordance with */SP/P16.

6.2.6 For valves fitted with pipe pups, the pups shall be of a material suitable for the pressure rating of the valve with weld end preparation machine-cut in accordance with */SP/P16.

6.2.7 Where the valve body weld ends are thicker than the pups to which they are to be welded, they shall be reduced to the same thickness at their ends. The reduction shall be by a 1 in 4 taper on the outer, inner or both walls as appropriate.

6.2.8 Flanged line valves shall conform to BS EN 1092-1 for steel flanges and BS EN 1092-2 for cast iron flanges, Class PNl6 for MOP of ≤7 bar and BS EN 1092-1 for steel flanges and BS EN 1092-2 for cast iron flanges, Class PN25 for MOP above 7 bar. Sufficient clearance between the back of the flange and the body to allow standard bolts to be used shall be incorporated into the design.

6.2.9 Line valves with polyethylene pups shall be suitable for welding to polyethylene pipe manufactured to GIS/PL2-1 and GIS/PL2-8.

6.3 Design requirements for construction valves

6.3.1 Construction valves are used for under pressure drilling or flow-stopping applications and are operated either by a push/pull action or by an operating lever.

6.3.2 Construction valves that incorporate only one seat on the sliding member shall be marked “live side” on the live side of the valve.

Where an obturator is provided that operates in a circular motion, the fully open or fully closed position of the slide shall be clearly indicated by the activator.

6.3.3 Means shall be provided to lock the valve in the open position to prevent unintentional closing of the valve.

6.3.4 Construction valves shall be capable of operation and locking in the open position under all conditions.

6.3.5 Construction valves shall be suitable for flange connections conforming to BS EN 1092-1 for steel flanges and BS EN 1092-2 for cast iron flanges, Class PN16 and the maximum distance between flanges shall be in accordance with Table 1.

6.3.6 Construction valves shall have a minimum clear bore in accordance with Table 1.

Table 1 — Minimum clear bore distances for construction valves

Nominal bore mm	Clear bore mm	Maximum (face to face) distance between flanges mm
80	85	90
100	105	90
150	155	120
200	205	120
250	255	140
300	310	140

6.3.7 Construction valves rated above 2 bar shall have a pressure equalizing facility to equalize the pressure across the obturator incorporated into the design.

6.4 General operational requirements

6.4.1 Line and rotary construction valve operation shall be in a clockwise direction to close.

6.4.2 The breaking torque (the torque to initiate movement of the obturator) and the running torque shall be kept to a minimum and shall not exceed 150 N·m. This shall apply in both the opening and closing direction and may be achieved by the provision of suitable gearing. This may be achieved by the use of a gearbox which may be integral or externally fixed and shall be non-pressurized. Where the breakdown of any seal could lead to leakage into the gearbox, the design shall incorporate a relief so as to prevent the build up of pressure. The design of the relief shall not permit the ingress of foreign material, e.g. dirt or moisture.

The breaking torque shall not be less than 6 N·m.

6.4.3 A torque of 150 N·m or 1.5 times the breaking torque, whichever is the greater, applied via the stem at the fully open and closed position shall not result in damage likely to affect the operation of the valve.

6.5 Operational requirements for line valves

For line valves, the stem termination shall be a 25 mm square section and between 28 mm to 35 mm long. This may be achieved using an adaptor which shall be secured to the stem by mechanical means.

6.6 Operational requirements of construction valves

Where a construction valve is operated in a straight pull/push motion, the breaking force (the force to initiate movement of the obturator) and the running force shall be kept to a minimum but within the range 50 N to 350 N.

7 Type testing

7.1 Selection of sizes for type testing

For valves with DN $\leq$ 500, qualification of the range shall be achieved by testing the smallest and the largest valves and one chosen in the middle of the range. This applies only where the materials, design and construction do not change within the range.

For valves with DN > 500, qualification shall be achieved by agreement between manufacturer and the gas transporter on the size(s) of the valve(s) to be tested.

All the tests detailed in the annexes shall be carried out for type approval testing and in the sequence given, i.e. Annex A, Annex B, etc.

7.2 Conformity with the manufacturer's specification

The valve test reports submitted shall ensure that the valve conforms to the description given by the manufacturer and proof supplied of carrying out tests as stated in the test annexes of these documents as follows:

- shell strength (Annex A);
- obturator strength (Annex B);
- external leak tightness (Annex C);
- internal leak tightness (Annex D);
- operability (Annex E);
- bending test (Annex F);
- resistance to liquids (Annex G);
- wear test (Annex H);
- strength of stops (Annex I);
- resistance to bending moment via spindle head (Annex J);
- double block and bleed test (Annex K).

Please note: the wear test and double block and bleed test do not apply to construction type valves.

7.3 Final examination

The examination shall be performed on each valve to assess the condition after testing and compared with the original condition given in the descriptive study. A written report shall be prepared. Dismantling, or in the case of welded body valves, destructive testing followed by visual and dimensional tests to verify the condition of the valve shall be carried out.

8 Production testing (all valves)

Production testing shall be in accordance with BS EN 12266 and BS EN 10226. The valves used for the production tests shall conform to the description given by the manufacturer and specification conforming to the type approval tests passed by the gas transporter. The tests shall be carried out in the following order following the requirements in the test annexes:

- shell strength test;
- obturator strength test;
- external leak tightness;
- internal leak tightness;
- operability test;
- double block and bleed test (line valves only).

9 Marking

9.1 Marking shall be carried out in accordance with the requirements given in BS EN 19.

9.2 Products conforming to GIS/V/7-1 shall be permanently marked with the following information:

a) the number and date of this standard, i.e. GIS/V7-1:2013 [1)];

b) the name or trademark of the manufacturer or their appointed agent;

c) the manufacturer's contact details;

d) where authorized, the product conformity mark of a third party certification body, e.g. BSI Kitemark.

NOTE Attention is drawn to the advantages of using third party certification of conformance to a standard.

9.3 For all valves, the valve body shall be marked with the following items:

a) DN;

b) PN;

c) material designation for pressure containing parts (with EN or ISO reference).

9.4 In addition, the following information shall be marked on a securely attached tag or nameplate:

a) weight;

b) tightness class A or B;

c) rating (MOP);

d) number of turns from fully open to fully closed.

10 Packaging

10.1 Valves shall be clean and dry and all the relevant production test requirements for both individual valves and random samples shall have been achieved for that batch before packaging.

10.2 All valve openings shall be protected using an appropriate method immediately after the production tests have been completed. Such protection shall keep out both dirt and moisture.

10.3 Packaging shall be such that each valve is protected against damage or corrosion.

11 Documentation

Certified records relating to the materials used and inspection and testing of all valves shall be kept by the contractor. Such records shall be available for inspection for 5 years from manufacture.

[1)] Marking GIS/V/7-1:2013 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

Annex A (normative)
Test 1 – Shell strength test

A.1 Principle

The purpose of this test is to confirm the pressure containing capability of the shell against internal pressure.

A.2 Apparatus

Apparatus shall be in accordance with Clause **A.1** of BS EN 12266-1:2003.

A.3 Procedure

A.3.1 Carry out this test before any other pressure test.

A.3.2 Carry out production and type tests in accordance with BS EN 12266-1:2003.

A.3.3 Subject the shell of the valve to a minimum internal hydrostatic pressure of 2.25 times the MOP value at mean temperature for a duration of at least 10 min for the type test and in accordance with Table A.2 in BS EN 12266-1:2003 for the production test.

A.4 Results

This test shall be carried out before any other pressure test and the acceptance criteria shall be in accordance with **A.2.3** of BS EN 12266-1:2003.

Table A.1 — Test durations for double block and bleed tests

Valve size	Duration (minutes)
Up to DN 250	5
DN 300 to DN 450	10
DN 500 and above	15

Annex B (normative)
Test 2 – Obturator strength test

B.1 Principle

The purpose of this test is to confirm the allowable differential pressure containing capability of the obturator in the closed position.

B.2 Apparatus

Apparatus shall be in accordance with Clause **A.2** of BS EN 12266-2:2002.

B.3 Procedure

B.3.1 Follow the test procedure and duration given in Clause **A.2** of BS EN 12266-2:2002.

B.3.2 Subject the obturator of the valve to a minimum internal hydrostatic pressure of 1.5 times the MOP value at mean temperature applied to each end in turn for a duration of at least 10 min for the type test and in accordance with Table A.3 of BS EN 12266-2:2002 for the production test.

B.4 Results

The acceptance criteria shall be in accordance with Clause **A.2** of BS EN 12266-2:2002.

Annex C (normative)
Test 3 – External leak test

C.1 Principle

The purpose of this test is to confirm the leak tightness of the shell including the operating mechanism sealing against internal pressure.

C.2 Apparatus

Apparatus shall be in accordance with that used in the shell tightness test P11 in BS EN 12266-1:2003 plus the individual requirements listed in Tables C.1 and C.2 but not using a test fluid.

C.3 Procedure

C.3.1 Follow the procedure for the shell tightness test P11 in BS EN 12266-1:2003 plus the individual requirements listed in Tables C.1 and C.2 but not using a test fluid.

C.3.2 Apply the external leakage test using air or inert gas to each test pressure specified for the leakage class (see Tables C.1 and C.2) with the obturator successively in the intermediate (i.e. half-open), open, and closed positions at mean temperature, 60 °C and –20 °C.

C.3.3 When tested at temperatures above 7 °C, test the valve in general accordance with BS EN 12266-1.

C.3.4 Operate the valve through two complete opening/closing cycles prior to each test and then place the obturator in the required position.

C.3.5 Apply the internal test pressure to the entire shell at the required level for the duration specified (see Tables C.1 and C.2).

C.3.6 Do not commence the test period until the pressure and temperature have stabilized to the required test conditions. Ensure the test temperature holds to within ±2 °C for the test duration.

C.3.7 When testing at 6 mbar below water, ensure the actual test pressure is 6 mbar above the pressure created by the head of water down to the deepest point on the pressurized shell.

C.3.8 For valves tested at –20 °C, pressurize the valve with clean/dry nitrogen and coat the external surface of the valve with a low temperature leakage detection fluid.

C.3.9 Alternatively, at –20 °C, the valve may be pressurized using a 90 % nitrogen / 10 % helium mixture and leakage checked using a helium leakage detection device.

C.4 Results

The results of the test shall conform to the requirements given in Tables C.1 and C.2 and the maximum allowable leakage shall be 5 ppm of helium. No leakage shall be observed during the test period when tested in accordance with BS EN 12266-1 at the pneumatic pressures required for the tightness class given in Table C.2 for the durations specified in BS EN 12266-1.

Acceptance criteria shall be in accordance with **A.3.3** of BS EN 12266-1:2003.

Table C.1 — Test periods for internal leakage tests

Valve size	**Duration of test** min
Up to DN 250	5
DN 300 to DN 450	10
DN 500 and above	15

Table C.2 — Table of leakage test pressures

Class	**High pressure test**	**Low pressure test**
A	No less than 1.1 × MOP	No more than 6 mbar No less than 4 mbar
B	No less than 1.1 × MOP	No more than 0.5 bar No less than 0.3 bar
NOTE A valve qualified class A is automatically classified class B but not vice versa.		

Annex D (normative)
Test 4 – Internal leak test

D.1 Principle

This test assesses the sealing capability of the valve seat(s) at high and low pressure. It confirms the capability of the seat(s) to conform to the specified leakage rate both at time of manufacture and in the direction(s) for which the valve is designed.

D.2 Apparatus

D.2.1 *Air or inert gas supply method*.

D.2.2 *Pneumatic test equipment*.

D.2.3 *Temperature measuring equipment*.

D.3 Procedure

D.3.1 Follow the guidelines in Tables A.3 and A.4 of BS EN 12266-1:2003 relating to the test procedure and test durations to the type of valve in conjunction with **D.3.2** to **D.3.10**.

D.3.2 Apply the internal leakage test using air or inert gas at each test pressure specified for the tightness class in Tables D.1 and D.2, with the obturator in the closed position at mean temperature, +60 °C and –20 °C.

D.3.3 When tested at temperatures above 7 °C, test the valve in general accordance with BS EN 12266-1.

D.3.4 Operate the valve through two complete opening/closing cycles prior to each test and then place the obturator in the closed position using forces/torques not in excess of the requirements. (That is, ensure that breaking and running torque do not exceed 150 N·m in both opening and closing directions and that breaking torque is not less than 6 N·m). (See **6.4.2** and **6.4.3** for further detail.)

NOTE Breaking torque is that required to initiate movement of the obturator.

D.3.5 Apply the required internal test pressure to each side of the valve in turn with the other side at atmospheric pressure for the duration specified in Table D.2.

D.3.6 Ensure that construction valves designed to seal in one direction only are tested from that direction.

D.3.7 Do not commence the test period until the pressure and temperature have stabilized to the required test conditions.

D.3.8 Ensure the test temperature holds to within ±2 °C for the test duration.

D.3.9 Monitor leakage using a “bubble” tube in water placed not more than 3 mm below the surface.

D.3.10 For valves tested at –20 °C, pressurize the valve with clean/dry nitrogen.

D.4 Results

Compare the results of the test with acceptance criteria in **A.4.3** and Table A.5 of BS EN 12266-1:2003.

The obturator shall be leak tight at the pneumatic pressures in the required tightness class range indicated in Table D.2 when tested in accordance with BS EN 12266-1 with the valve in the closed position. No leakage shall be observed during the test period when tested in accordance with the leakage test pressure range given in Tables D.1 and D.2.

Table D.1 — Table of leakage test pressures

Class	**High pressure test**	**Low pressure test**
A	No less than 1.1 × MOP	No more than 6 mbar No less than 4 mbar
B	No less than 1.1 × MOP	No more than 0.5 bar No less than 0.3 bar
NOTE A valve qualified class A is automatically classified class B but not vice versa.		

Table D.2 — Test periods for internal leakage tests

Valve size	**Duration of test** min
Up to DN 250	5
DN 300 to DN 450	10
DN 500 and above	15

Annex E (normative)
Test 5 – Operability test

E.1 Principle

The purpose of this test is to check the functioning of the valve during various internal pressure conditions at mean temperature, +60 °C and –20 °C and after cyclic operation at mean temperature.

The test shall also confirm the ability of the assembled valve to open and close fully and, as applicable, the correct operation of the position indicators and/or other auxiliary devices.

E.2 Apparatus

E.2.1 *Pneumatic pressure testing equipment*.

E.2.2 *Temperature measurement equipment*.

E.3 Procedure

E.3.1 Ensure the test period is in accordance with Tables E.1 and E.2 with the valve in the closed position and follow the guidelines in Clause **B.1** of BS EN 12266-2:2002.

E.3.2 With the valve at the required temperature, open and close it with zero internal pressure and record the valve break, running and re-seat torque/force for the opening and closing cycle.

E.3.3 Repeat **E.3.2** five times.

NOTE For construction valves, it is permissible to for this test may be carried out with the pressure equalized on either side of the obturator.

E.3.4 Close the valve using the maximum allowable force-torque according to **6.4.2** or **6.4.3** and a differential pressure applied to one side of the valve, using air or inert gas, equal to the MOP.

E.3.5 Open the valve and record the break, running and re-seat torque/force for the opening cycle.

E.3.6 Repeat with differential pressure applied from the other side. Repeat five times.

E.3.7 Prior to each differential pressure operation test, stabilize the valve temperature to within ±2 °C of the required temperature. During the test, the temperature will fluctuate due to gas release.

E.3.8 Ensure that construction valves designed to seal in one direction only are tested from that direction.

E.3.9 Subject line valves to a 50 cycle operation (open/closed) test at a shell pressure of MOP and at mean temperature. For construction valves, limit this to a five cycle operation.

E.3.10 Ensure that valves designed to seal in one direction are tested from that direction (i.e. construction valves).

E.3.11 After all tests, subject the valve to an external and internal leak test in accordance with Annex C and Annex D, respectively.

E.3.12 Measure the operating torque/force to an accuracy of ±1 % of the requirements of Annex E.

E.4 Results

E.4.1 Compare the results with the requirements of Annexes C, D and E and the acceptance criteria given in **B.1.3** of BS EN 12266-2:2002.

E.4.2 The operational force/torque shall not exceed the values given in **6.4.2** and **6.4.3**, as applicable, when the valve is opened from the closed position with a pressure of MOP on one side of the obturator and with the other side open to atmosphere.

E.4.3 The pressurization shall be carried out in accordance with BS EN 12266-2:2002.

E.4.4 No leakage shall be observed during the test period when tested in accordance with the leakage test pressure range given in Tables E.1 and E.2.

Table E.1 — Table of leakage test pressures

Class	**High pressure test**	**Low pressure test**
A	No less than 1.1 × MOP	No more than 6 mbar No less than 4 mbar
B	No less than 1.1 × MOP	No more than 0.5 bar No less than 0.3 bar
NOTE A valve qualified class A is automatically classified class B but not vice versa.		

Table E.2 — Test periods for internal leakage tests

Valve size	**Duration of test** min
Up to DN 250	5
DN 300 to DN 450	10
DN 500 and above	15

Annex F (normative)
Test 6 – Bending test

F.1 Principle

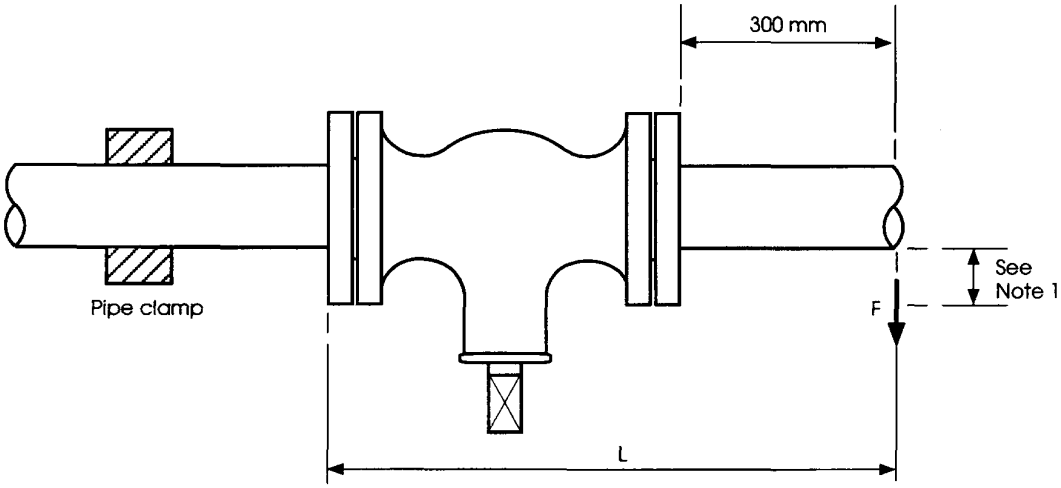
To establish that the valve will resist the stresses transmitted by the installation components to which it is rigidly secured without unacceptable change in the performance of the valve at mean temperature, 60 °C and –20 °C.

F.2 Apparatus

Cantilever bending test apparatus, capable of applying the bending moment to an accuracy of ±2 %.

F.3 Test procedure

F.3.1 Set up the valve for a cantilever bending test in accordance with Figure A.1.



The maximum deflection shall be defined.

NOTE Bending moment = $F \times L$

Figure F.1 — Bending strength test

F.3.2 Subject the valve to the required test temperature and then a bending moment applied as specified in Table F.1 for a period of 10 min.

F.3.3 Check the operability of the valve in accordance with Annex E excluding the 50 cycle operation test, then subject the valve to the internal leakage tests given in Annex D.

F.3.4 Do not commence the test period until the pressure and temperature have stabilized to the required test conditions.

F.3.5 Ensure the test temperature holds to within ±1 °C for the test duration.

Table F.1 — Table of bending moments

Nominal size mm	**Bending moment** N·m
25	500
50	1 000
80	1 500
100	2 200
125	3 200
150	4 800
200	7 200
250	11 000
300	15 000
350	19 000
400	24 000
450	32 000
500	40 000

F.4 Results

The valve leak rate in the closed position shall not exceed the leakage rate “Rate B” in Table A.5 of BS EN 12266-1:2003 and operation shall be in accordance with either **6.4.2** or **6.4.3**, as applicable, when subjected to the bending test specified.

Annex G (normative)
Test 7 – Resistance to liquid agents test

G.1 Principle

The purpose of this test is to subject the elastomeric components in a valve to the fluids present in natural gas distribution networks to ensure the elastomers are fit for purpose.

G.2 Apparatus

G.2.1 *Valve*, with a bleed hole in the lower part of the valve.

G.2.2 *Test fluid*, either:

a) methanol; or

b) a condensate mixture of 2/3 petrol plus 1/3 toluene; or

c) BS 903-A16, liquid B.

G.2.3 *Hydrostatic pressure test equipment*.

G.2.4 *Temperature measuring equipment*.

G.3 Procedure

G.3.1 With the obturator in the mid-position, fill the valve with test fluid and pressurize to the MOP.

G.3.2 Hold this pressure for 1 week.

G.3.3 Depressurize the valve, drain it of test fluid and immediately test it in accordance with the requirements of Annexes C, D, E and F at mean temperature.

G.3.4 Repeat these tests after drying for 1 week in atmospheric conditions at mean temperature.

G.4 Results

The valve shall be tested as above and meet the requirements of Annexes C, D, E and F with no leakage or any adverse valve working operation or visible damage.

Annex H (normative)
Test 8 – Wear test (line valves only)

H.1 Principle

The purpose of the wear test is to subject all line valves intended to be used in natural gas distribution networks to the dust-laden gas they are likely to be subjected to in service.

H.2 Apparatus

Dust-loading bench, with a circulation speed varying between 15 m/s and 20 m/s of natural air loaded with 30 mg/m^3 of dust.

H.3 Procedure

H.3.1 Prior to the wear test, ensure the valve is subjected to, and passes, the requirements of the internal and external leakage tests and the operability test of Annexes C, D and E at mean temperature.

H.3.2 Mount the valve in a dust-loading bench with a circulation speed varying between 15 m/s and 20 m/s of natural air loaded with 30 mg/$m^3$of dust.

H.3.3 Ensure the dust is made of iron oxide with a density of approximately 2.6 g/cm^3.

H.3.4 Ensure the median diameter (by mass) is 17 μm (see Table H.1 for the grain-size distribution of the dust).

Table H.1 — Dust grain-size distribution

Real diameter μm	**Mass percentage lower than the fractionation diameter**
3.30	12.5
9.80	35.9
26.40	61.3
40.00	67.6

H.3.5 Provide the test installation with a bypass valve to avoid accumulation of dust in front of the tested valve.

H.3.6 Open this bypass valve when the test valve is closed.

H.3.7 Subject the test valve to 50 cycles (one cycle is equivalent to: open, closed, open) during the flow conditions specified above at mean temperature.

H.3.8 When the test is completed, test the valve for internal and external leakage (see Annexes D and C, respectively) leakage and operability (see Annex E) at mean temperature and compare the results with the requirements of this procedure.

H.3.9 After testing, examine each valve in accordance with final examination given in Clause **7** to assess its condition.

H.4 Test results

The internal and external leakage rates shall be zero measured before and after testing in accordance with the procedure in Clause **H.3.** The valve shall then be subjected to the operability test in accordance with Annex E and conform to the requirements of **6.4.2** and **6.4.3**, as applicable. No adverse affects on the valve shall be encountered due to tests.

Annex I (normative)
Test 9 – Strength of stops

I.1 Principle

The purpose of this test is to ensure the stops provided resist a rotational torque, as required by **6.4.3**, applied to the square head.

I.2 Apparatus

Equipment capable of subjecting the valve stops to the torque specified, to an accuracy of ±l %.

I.3 Procedure

Subject each valve stop to the torque specified for a minimum of 1 min at mean temperature.

I.4 Results

I.4.1 Compare the results with the requirements of **6.4.3**.

I.4.2 The valve shall conform to **6.4.3** when tested in accordance with this annex.

I.4.3 The mechanical failure or cracking of any component of the valve during this test constitutes failure of the test.

I.4.4 Minor creep or indentation damage may be acceptable provided it does not impair the operation of the valve.

Annex J (normative)
Test 10 – Resistance to bending moment applied via the spindle head

J.1 Principle

The purpose of this test is to ensure that the valve performance does not deteriorate when subjected to a bending moment via the spindle head at mean temperature.

J.2 Apparatus

Rig, with valve held securely by pipe clamps in horizontal and vertical position to apply test via spindle head as shown in Figure J.1.

J.3 Procedure

J.3.1 Test the valve pneumatically in the half open position for 5 min at the test pressures for the tightness class given in Table 2. During this time also subject the spindle head to a bending moment of 200 N·m at mean temperature.

NOTE This is illustrated in Figure J.1.

J.3.2 Test the valve for external leakage in accordance with Annex D as follows.

a) With the closure member in the half-open position, pressurize the valve to the test pressure over and above the hydrostatic head produced by any water surrounding the valve for the purpose of detecting external leakage.

b) While this pressure is being applied, subject the square head to a bending moment of 200 N·m for a minimum period of 5 min. During this time, also check the external leakage in accordance with Annex C. Apply the bending moment both in line and then perpendicular to the bore with the valve in the half open position. With the bending moment removed, check external leakage for a further period of 2 min.

NOTE This is illustrated in Figure J.1.

c) With the valve in the fully-closed position, subject it to the internal leakage test described in Annex D at the test pressure over and above the hydrostatic head produced by any water surrounding the valve.

J.4 Results

J.4.1 Compare the results of the test with the requirements of Annexes C and D.

J.4.2 The mechanical failure of any component of the valve at any stage constitutes a failure.

J.4.3 There shall be no external leakage from the valve or internal leakage past the seats when subjected to a bending moment applied, both in line and perpendicular to the bore with the valve in the half open position when tested in accordance with this annex.

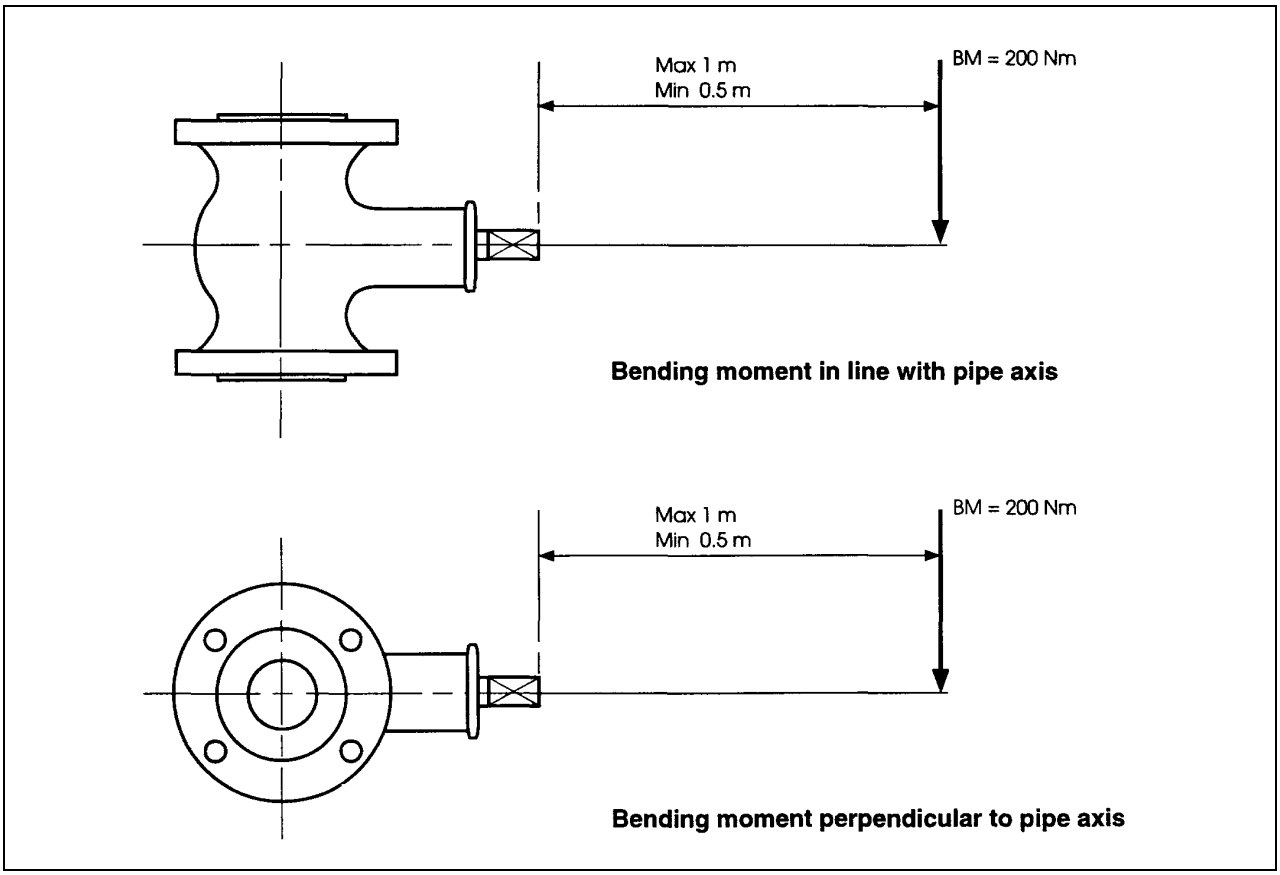


Figure J.1 — Bending strength test applied via the spindle head

Annex K (normative)
Test 11 – Test for double block and bleed (line valves only)

K.1 Principle

The purpose of this test is to check the sealing of seats in both directions for valves with double block and bleed facility.

K.2 Apparatus

K.2.1 *Pneumatic testing equipment*.

K.2.2 *Inert gas apparatus*.

K.3 Procedure

K.3.1 Carry out the test in accordance with BS EN 12266-1:2003 for the seat test durations specified in BS EN 12266-2:2002. This test is not required on construction valves.

K.3.2 Apply this test using air or inert gas to each test pressure specified for the tightness class given in Table 2, with the obturator in the closed positions at mean temperature, at +60 °C and –20 °C.

K.3.3 When tested at temperatures above 7 °C, test the valve in general accordance with BS EN 12266-1.

K.3.4 Operate the valve through two complete opening/closing cycles prior to each test and then place the obturator in the closed position using forces/torques not in excess of the requirements of **6.4.2**.

K.3.5 Apply the required test pressure via the cavity of the valve with the ends at atmospheric pressure for the duration specified in Table A.5.

K.3.6 Do not commence the test period until the pressure and temperature have stabilized to the required test conditions.

K.3.7 Ensure the test temperature holds to within ±2 °C over the test duration.

K.3.8 Monitor leakage using a “bubble” tube in water placed not more than 3 mm below the surface.

K.3.9 Alternatively, for testing at temperatures above 7 °C, fill one end connection of the valve with water to a maximum depth of 25 mm and check for leakage.

K.3.10 Turn the valve through 180° and repeat the procedure.

K.3.11 For valves tested at –20 °C, pressurize the valve with clean/dry nitrogen.

K.4 Results

There shall be no leakage past the seats when the valve is closed and the valve cavity is pneumatically pressurized to the pressures required for the tightness class range given in Table 2.

Compare the results of the test to the requirements specified in Clause **7**.