Gas Industry Standard

GIS/V4:2007

Specification for

Service isolation valves up to 50 mm diameter for use up to 2 bar maximum working pressures

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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.

Disclaimer

This engineering document is provided for use by Gas Transporters and such of their contractors as are obliged by the terms of their contracts to comply with this engineering document. Where this engineering document is used by any other party, it is the responsibility of that party to ensure that the engineering document is correctly applied.

Brief history

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1 Scope

This Gas Industry Standard specifies the requirements for the materials, design, testing, labelling and packaging of non-lubricated service isolation valves, of the spherical plug type, suitable for operation at pressures up to 2 bar and in the temperature range –15 °C to +50 °C.

This standard applies to valves capable of operation by means of a special key that is not permanently attached to the body of the valve.

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)*.

PD 970, *Wrought steels for mechanical and allied engineering purposes — Requirements for carbon, carbon manganese and alloy hot worked or cold finished steels*.

BS EN 682:2002, *Elastomeric seals — Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids*.

BS 1134*, Assessment of surface texture. Guidance and general information*.

BS EN 1562, *Founding — Malleable cast irons*.

BS EN 1563, *Founding — Spheroidal graphite cast iron*.

BS EN 10226-1:2004, *Pipe threads where pressure tight joints are made on the threads — Taper external threads and parallel internal threads — Dimensions, tolerances and designation*.

BS EN 10250-4, *Open steel die forgings for general engineering purposes — Part 4: Stainless steels*.

3Materials

3.1 *Spherical plug (ball)*, valve stem, any metal part associated with securing the stem, quadrant stop plate (if not integral with the shroud) and stop pin (if not integral with the body) consisting of stainless steel conforming to BS EN 10250-4, Grade 316-S16, 316-S12, 320-S17 or 326-S36.

NOTE Of these only 320-S17 may be welded.

3.2 *Valve seats*, consisting of PTFE (polytetrafluoroethylene) based material.

3.3 *Valve body*, consisting of iron or steel cast, forged or machined from bar stock. Iron castings conforming to BS EN 1562 (Whiteheart malleable and Blackheart malleable) or BS EN 1563 (ductile). Forging and bar stock conforming to PD 970. Weldable grades shall be used when welding is to be carried out on the valve body.

3.4 *Bonnet shroud*, with a resistance to corrosion not less than that of the valve body material and of a material compatible with the stem material to which it is attached.

3.5 *Mechanical springs*, used to supply a sealing force, consisting of stainless steel material (stress-relieved spring).

3.6 *Rubber joint rings*, consisting of material conforming to BS EN 682.

4 Design

4.1 General

The general design and construction shall be such that a service life of 40 years may reasonably be expected in the absence of maintenance.

4.2 Body

4.2.1 The main body shall be either of the one piece type with plug assembly effected from one end and locked in position, or of all welded construction.

4.2.2 Flow passages shall be designed to provide a minimum pressure drop across the valve (see also Clause **7**).

4.2.3 Internal cavities, grooves, corners and other dead spaces shall be reduced to a minimum to avoid the trapping of dirt.

4.2.4 Stops shall be provided on the body to prevent rotation of the plug through more than 90°. The stops shall be capable of resisting a torque of 150 N·m without failure.

4.2.5 Valves shall have ends screwed female BSP taper threads conforming to BS 21.

4.3 Spherical plug

4.3.1 The plug shall be fully floating and retained by seals on both upstream and downstream sides.

4.3.2 The plug bore shall be not less than 0.55 of the nominal size of the valve and its design shall not introduce any dirt trap area (see also Clause **7**).

4.3.3 The spherical plug shall have a surface finish not worse than 0.8 μmRa conforming to Table 2 of BS 1134-1:1988.

4.4 Plug seats

Line pressure shall not be relied on as the sole source of seat loading.

4.5 Spindle/bonnet shroud

The stem location in the plug shall be such that no lateral loads can exist between spindle and plug. The bonnet shroud may be integral with the spindle but shall completely cover the bonnet to reduce the lodgement of dirt between spindle and gland. The bonnet shroud shall carry the truncated male pyramid of the special fitting for operating the valve. The pyramid shall be 19 mm square tapering to 12.5 mm square and 25 mm long. The top of the pyramid shall carry a line showing the flow passage through the plug. Movement shall be clockwise to close.

5 Installation

The valve shall permit flow-through in either direction.

6 Production testing

Production tests shall be carried out as shown in Annex C and no valve shall be accepted for

packing and shipping unless all these test requirements have been achieved.

7 Type test

Type tests shall be carried in the following order: pressure loss and strength (see Annex A), operating torque, leakage and environmental conditions (see Annex B).

8 Marking

8.1 Markings on individual product

Products conforming to GIS/V4 shall be permanently marked with the following information:

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

b) maximum working pressure;

c) 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.

8.2 Markings on package/fitting instructions

Products conforming to GIS/V4 shall be permanently marked with the following information:

a) the number and date of this standard, i.e. GIS/V4:2007 [1)];

b) the manufacturer's contact details.

9 Packing and shipping

9.1 All valves shall be fitted with plastic end caps immediately after the production tests given in Clause **6** have been completed.

9.2 Valves shall be individually packed in heat-sealed polyethylene bags. Each bag shall contain vapour phase inhibitor in a paper sachet.

9.3 Shipping containers shall be such that each valve is secured to prevent damage caused by one valve hitting against another.

[1)] Marking GIS/V4:2007 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)
Type test 1 – pressure loss and strength test

A.1 Principle

A.1.1 *Measurement of valve pressure loss*

The pressure drop across a valve cannot be directly measured with reasonable accuracy because at the inlet and outlet faces of the valve the flow pattern is disturbed and pressure measurement inexact.

Pressure tapping points some distance upstream of the front face and downstream of the rear face are therefore used. Hence, the measured pressure drop includes that for a length of pipe.

By measuring the pressure drop across a length of pipe equivalent to that included in the valve pressure drop test, the actual valve pressure drop may be obtained by subtraction.

A.1.2 *Strength test of the valve body*

The purpose of this test is to ensure that the valve is strong enough to withstand the hydrostatic test without any visible damage of valve body or components and no adverse effect on the opening and closing operation of the valve.

A.2 Apparatus

One specimen is used exclusively for both the pressure loss and strength tests for each size of each design submitted

A.2.1 *Test rig*, consisting of a gas (air, nitrogen, methane or other) source at a steady pressure of 25 mbar, a flowmeter and a length of pipe containing the valve under test, pipe size in this test section that of the nominal size of the valve under test, pressure tapping points upstream and downstream of the valve under test.

NOTE Pressure points may be single tappings but preferably should be multiple and communicate with an annulus outside the pipe.

The tapping bore shall be 3 mm and the bore of the pipe to the manometer 6 mm. At the downstream end of the pipe there is a valve for control of the flow rate.

Two versions of the rig are shown in Figures A.1 and A.2. The version in Figure A.1 provides for easy changing of the valve under test and also for the accommodation of valves of different overall length.

Figure A.2 shows a simpler rig without facilities for easy changing and accommodation of various valve lengths.

In both figures, the positions of the pressure tapping points are indicated in terms of the diameter of the pipe.

A.2.2 *Hydrostatic testing equipment*, for testing at minimum of 4 bar pressure.

A.3 Test procedure

A.3.1 *General*

Carry out the test in **A.3.2** first followed by **A.3.3**.

A.3.2 Test the valve in the fully open position. Take readings of inlet pressure (P_1) and differential pressure (ΔP) at increasing pipe flow velocities of approximately 1.5, 3, 4.5, 6, 7.5 and 9 m/s after ensuring that steady conditions have been reached.

Record the same parameters at decreasing velocities of 8, 6.5, 5, 3.5, 2 and 0.5 m/s.

Present results as a graph of ΔP against velocity.

For information only, the volume flow rates of nominal service pipe are given in Table A.1.

A.3.3 Hydrostatically test the valve body to 4 bar for a period of 2 min with valve in the half-open position.

A.4 Test results

A.4.1 Flow measurement shall be within 2 % of true value. Pressure measurement shall be within 1 mbar of true value. Differential pressure measurement shall be within 0.02 mbar of true value.

The flow measurement results shall be recorded in a result graph for each valve and diameter to ensure that the flow capacity at 3 m/s given in Table A.1 for the particular diameter tested is either met or exceeded. The pressure loss through the valve, measured by the method given in Annex A, shall be not greater than 0.5 mbar at a pipe gas velocity of 3 m/s. This figure is based on methane (SG 0.6) at an inlet pressure of 25 mbar and temperature of 20 °C.

A.4.2 No visible damage to or deformation of the valve body or any adverse effect on the opening or closing of the valve shall be observed. That is, the valve shall be strong enough to withstand the hydrostatic test.

Table A.1 — Volume flow rates for service pipe

Service diameter (mm)	Actual mean bore (mm)	Flow capacity at 3 m/sec (m^3/h)
50	51.4	22.4
40	40.3	13.8
25	25.7	5.6

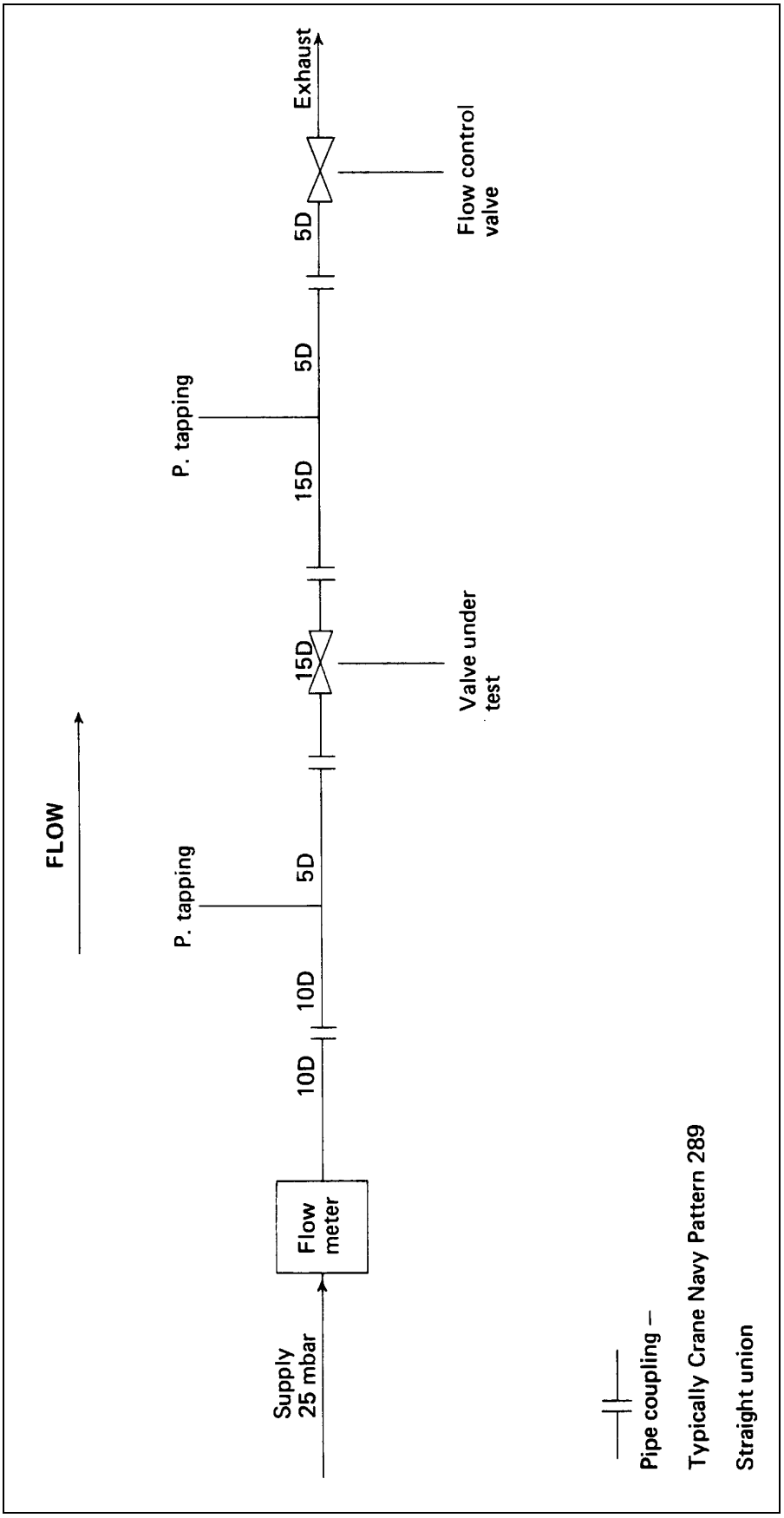

Figure A.1 — Test rig with facilities for easy changing of valves

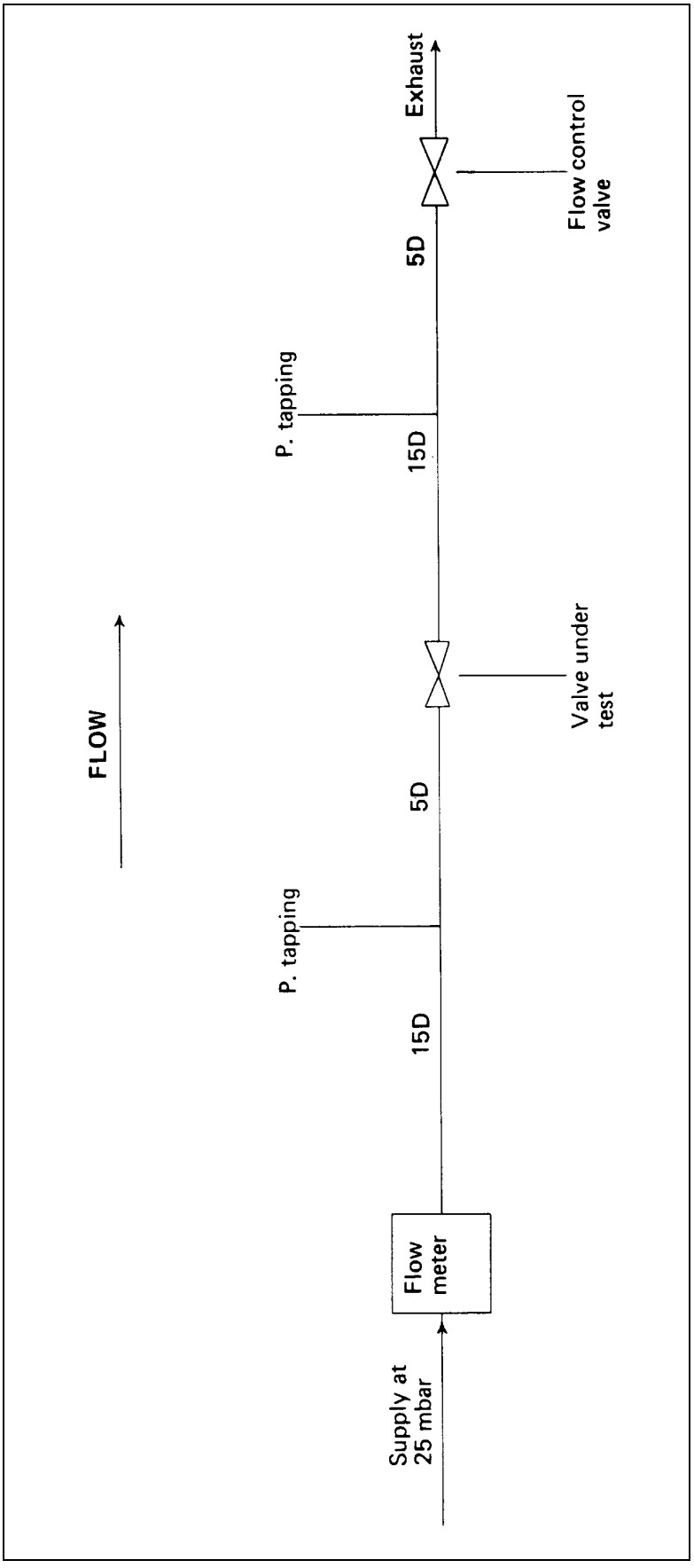

Figure A.2 — Test rig without facilities for easy changing of valves

Annex B (normative)
Type test 2 – operating torque, leakage and environmental conditions tests

B.1 Principle

B.1.1 *Operating torque test*

The torque to initiate movement shall be between 6 N·m and 22.6 N·m and the running torque shall not exceed 22.6 N·m.

B.1.2 *Leakage test*

This test ensures no leakage occurs from the valve or past the valve seats when the valve stem is subjected to bending moment, in half-open and closed positions and subjected to cyclic operations. This test aims to simulate what happens in operational use.

B.1.3 *Environmental conditions test*

This test ensures no leakage occurs from the valve or past the valve seats when subjected to bending moment, in half-open or closed positions and subjected to cyclic operations at a range of temperatures to simulate operating environment conditions.

B.2 Apparatus

B.2.1 *One specimen*, used exclusively for the three tests described in **B.1.1** to **B.1.3** for each size of each design submitted.

B.2.2 *Soapy water or leak detector solution*, for leakage tests.

B.2.3 *Method to apply bending moment of 55 N·m to valve stem*, when under water in the water tank.

B.2.4 *Pneumatic testing equipment*, suitable for applications at 25 mbar to 3.5 bar not adversely affected by regular test use under water in the water tank.

B.2.5 *Water manometer*.

B.2.6 *Water tank and restraining equipment*, to hold test specimens under water when carrying out pneumatic tests at 25 mbar and 3.5 bar.

B.2.7 *Timing method*, to time a period from 30 s to 120 min.

B.2.8 *Method to count number of cyclic operations*.

B.2.9 *Method of temperature measurement*, from –15 to +50 °C and environment provision to maintain these temperatures with 100 % humidity for test durations.

B.2.10 *Torque key*, to turn each size and design of valve under test.

B.3 Test procedure

B.3.1 *General*

The tests shall be carried out in the following order:

- operating torque test (**B.3.2**);
- leakage test (**B.3.3**);
- environmental conditions test (**B.3.4**).

B.3.2 ***Operating torque test***

B.3.2.1 Close the valve using the torque key.

B.3.2.2 Using the torque key and torque spanner measure the torque required to initiate movement of the valve and record the result.

B.3.2.3 Using the torque key and torque spanner measure the running torque of the valve and record the result.

B.3.3 ***Leakage test***

B.3.3.1 Test the valve under water with an air pressure of 25 mbar for 30 min. During this time, ensure the valve is in the half open position and the stem is subjected to a bending moment of 55 N·m.

B.3.3.2 Operate the valve 100 times from the fully closed to the fully open position.

B.3.3.3 Repeat **B.3.3.1**.

B.3.3.4 Repeat **B.3.3.2**.

B.3.3.5 Test the valve under water with an air pressure of 3.5 bar for 30 min. During this time, ensure the valve is in the half open position and the stem is subjected to a bending moment of 55 N·m. Ensure there is no leakage.

B.3.3.6 Operate the valve 100 times from the fully closed to the fully open position.

B.3.3.7 Repeat **B.3.3.5**.

B.3.3.8 Repeat **B.3.3.6**.

B.3.3.9 Test the valve, with the valve in the closed position, for leakage past the seats by subjecting each side in turn to an air pressure of 25 mbar for 30 min. Detect leakage on the downstream side of the upstream seat by the change in level of a water manometer. Ensure there is no leakage.

NOTE It may be necessary to provide a tapping into the body of the valve under type test to detect this pressure.

B.3.3.10 Operate the valve 100 times from the fully closed to the fully open position.

B.3.3.11 Repeat **B.3.3.9**.

B.3.3.12 Repeat **B.3.3.10**.

B.3.3.13 Test the valve, with the valve in the closed position, for leakage past the seats by subjecting each side in turn to an air pressure of 2 bar for 30 min. Detect leakage on the downstream side by the change in level of a water manometer. Ensure there is no leakage.

B.3.3.14 Operate the valve 100 times from the fully closed to the fully open position.

B.3.3.15 Repeat **B.3.3.13**.

B.3.4 ***Environmental conditions test***

B.3.4.1 Subject the valve to 200 environmental cycles of –15 °C, 100 % relative humidity and +50 °C, 100 % relative humidity. Carry out each condition for 2 h duration with 30 min for change from one condition to the other.

B.3.4.2 At the 100th and 200th environmental cycle, operate the valve 100 times at each temperature given in **B.3.4.1**.

B.3.4.3 Repeat **B.3.2**, **B.3.3.5**, **B.3.3.9** and **B.3.3.13** at ambient temperature.

B.4 Test results

B.4.1 The torque to initiate movement shall be between 6 N·m and 22.6 N·m and the running torque shall not exceed 22.6 N·m.

B.4.2 No leakage is permitted from the leak detector solution / soapy water or the water manometer test for either **B.3.3** or **B.3.4**.

B.4.3 The valve shall be able to cope with no detrimental effect at temperatures when cyclic operations, bending torque or leakage tests are applied as required in **B.3.3** and **B.3.4**.

Annex C (normative)
Production tests

C.1 Principle

C.1.1 The purpose of these tests is to test each valve for external leakage when in the half-open position and leakage past the seats with the valve in the closed position.

C.1.2 The purpose of these tests is also to randomly sample one valve from each shift output for external leakage when subjected to a bending moment on the valve stem when the valve is in the half-open position. Also, to ensure the torque to initiate movement of the plug is not less than 6 N·m nor the running torque exceeding 22.6 N·m in both the valve opening and closing directions.

C.2 Apparatus

C.2.1 *Every assembled valve ready for shipping*, for **C.3.1**.

C.2.2 *Random sample of valve from each shift*, for **C.3.2**.

C.2.3 *Soapy water or leak detector solution*, for leakage tests.

C.2.4 *Method to apply bending moment of 55 N·m to valve stem*, when under water in the water tank.

C.2.5 *Pneumatic testing equipment*, suitable for applications at 25 mbar to 3.5 bar not adversely affected by regular test use underwater in the water tank.

C.2.6 *Water tank and restraining equipment*, to hold test specimens underwater when carrying out pneumatic tests at 25 mbar and 3.5 bar.

C.2.7 *Timing method*, to time a period from 30 s to 1 min.

C.2.8 *Torque key*, to turn each size and design of valve under test.

C.3 Procedure

C.3.1 *Production test 1 (every valve before packaging and shipping)*

a) Test the valve under water with an air pressure of 25 mbar for a minimum time of 1 min. During the test, ensure the valve is in the half open position. Ensure there is no external leakage. Ensure that the design of the test fixture is such that the spindle seal from which leakage may occur is not more than 50 mm below the water surface.

b) Test the valve under water with an air pressure of 3.5 bar for a minimum time of 1 min. During the test, ensure the valve is in the half open position. Ensure there is no leakage.

c) Test the valve, with the valve in the closed position, for leakage past the seats by subjecting each side in turn to an air pressure of 25 mbar for 30 s. Ensure there is no leakage.

d) Test the valve, with the valve in the closed position, for leakage past the seats by subjecting each side in turn to an air pressure of 2 bar for 30 s. Ensure there is no leakage.

C.3.2 *Production test 2 (random sample from each shift)*

The suppliers subject one valve selected at random from the output of each shift to the additional tests given below.

a) Test the valve under water with an air pressure of 25 mbar for a minimum time of 1 min. During the test, ensure the valve is in the half open position and subject the stem to a bending moment of 55 N·m. Ensure there is no external leakage. Ensure the design of the test fixture is such that the spindle seal, from which leakage may occur, is not more than 50 mm below the water surface.

b) Test the valve under water with an air pressure of 3.5 bar for a minimum time of 1 min. During the test, ensure the valve is in the half open position, and subject the stem to a bending moment of 55 N·m. Ensure there is no leakage.

c) Ensure that neither the torque to initiate movement of the plug nor the running torque exceed 22.6 N·m. This applies to both the opening and closing directions. Ensure the torque to initiate movement is not less than 6 N·m. Use a torque key for valve operation at the testing stage.

After all testing, the suppliers ensure that each valve is completely dried out before packing.

C.4 Test results

C.4.1 No leakage is permitted from any of the tests listed in **C.3.1** and **C.3.2**.

C.4.2 The torque to initiate movement shall be between 6 N·m and 22.6 N·m and the running torque shall not exceed 22.6 N·m.