
Testing of valves — Fire type-testing requirements

Essais des appareils de robinetterie — Exigences de l'essai au feu

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 153, *Valves*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 69, *Industrial valves*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 10497:2010), which has been technically revised.

The main changes compared are as follows:

- clarification and emphasised importance around the monitoring of cavity pressure during testing for double-seated valves;
- catering for the testing of valves with more than one obturator;
- update of the qualification of other valves by “materials of construction” and inclusion of a new “design” clause;
- accepted fire test certificates of valves tested according to ISO 10497:2010.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document covers the requirements and method for evaluating the performance of valves when they are exposed to specified fire conditions. The performance requirements establish limits of acceptability of a valve, regardless of size, material or pressure rating. The burn period has been established to represent the maximum time required to extinguish most fires. Fires of longer duration are considered to be of major magnitude, with consequences greater than those anticipated in the test.

The test pressure during the burn is set at 0,2 MPa (2 bar) for soft-seated valves rated PN 10, PN 16, PN 25 and PN 40, Class 150 and Class 300, to better simulate the conditions that would be expected in a process plant when a fire is detected, and pumps are shut down. In this case, the source of pressure in the system is the hydrostatic head resulting from liquid levels in towers and vessels. This situation is approximated by this lower test pressure.

In production facilities, valves are typically of a higher rating and the pressure source is not easily reduced when a fire is detected. Therefore, for all other valves, the test pressure during the burn is set at a higher value to better simulate the expected service conditions in these facilities.

Use of this document assumes that the execution of its provisions is entrusted to appropriately qualified and experienced personnel, because it calls for procedures that can be injurious to health, if adequate precautions are not taken. This document refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage of the procedure.

This document highlights the importance of accurate monitoring and recording of test data during fire testing. The monitoring and measuring of cavity pressure has been emphasised for all double-seated valves. Empirical evidence has shown that the cavity pressure during a fire test can increase significantly unless relieved internally (by design) or externally. Without meeting the minimum requirements of the test report, valves cannot be certified as a fire safe design to this document.

It is recognised by this document that not all combinations of potential trim arrangements can be covered by a single fire test report. Certain design or material differences can be accepted by the purchaser if they do not influence sealing or operating performance. Further clarification on soft materials grouping and bolting has been included in this document.

Valves with more than one obturator are regularly used for in-line isolation and instrumentation service. As such, the need to qualify such designs as fire safe certified is now a common requirement. This document now caters for such valve designs.

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Testing of valves — Fire type-testing requirements

1 Scope

This document specifies fire type-testing requirements and a fire type-test method for soft- and metal-seated isolation valves with one or more obturators. It is not applicable to the testing requirements for valve actuators other than manually operated gearboxes or similar mechanisms when these form part of the normal valve assembly. Other types of valve actuators (e.g. electrical, pneumatic or hydraulic) can need special protection to operate in the environment considered in this valve test, and the fire testing of such actuators is outside the scope of this document.

This document specifies the measurement and assessment criteria for:

- a) through-seat leakage;
- b) external leakage;
- c) cavity overpressure relief of double-seated valves;
- d) operability.

This document specifies the rules whereby the fire-type testing qualification for a valve can be extended to untested sizes, pressure ratings and materials of construction of the same basic design type.

Fire test reports of valves tested according to previous editions of this document are acceptable when submitted together with the full and compliant fire test report as per 6.7 of the edition under which it was tested. Any data missing as required from 6.7 within the fire test report are accepted or rejected at the purchaser's discretion.

NOTE For the purposes of this document, the terms “fire type-test” and “fire test” are synonymous.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

nominal size

DN

alphanumeric designation of size for components of a pipework system, which is used for reference purposes, comprising the letters DN followed by a dimensionless whole number which is indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections

[SOURCE: ISO 6708:1995, 2.1, modified — The Notes 1 and 2 to entry have been removed and the term “nominal size” has been added.]

3.2

nominal pressure

PN

numerical designation relating to pressure which is a convenient rounded number for reference purposes, and which comprises the letters PN followed by the appropriate reference number

Note 1 to entry: It is intended that all equipment of the same *nominal size (DN)* (3.1) designated by the same PN number have compatible mating dimensions.

Note 2 to entry: The maximum allowable pressure depends on materials, design and working temperatures, and is selected from the tables of pressure/temperature ratings given in the appropriate standards.

[SOURCE: ISO 7268:1983, Clause 2, modified — The phrase "and which comprises the letters PN followed by the appropriate reference number" was added.]

3.3

NPS

alphanumeric designation of size for components of a pipework system, which is used for reference purposes, and which comprises the letters NPS followed by a dimensionless number indirectly related to the physical size of the bore or outside diameter of the end connections

Note 1 to entry: The number following the letters NPS does not represent a measurable value and is not intended to be used for calculation purposes except where specified in the relevant standard.

3.4

Class

alphanumeric designation used for reference purposes related to a combination of mechanical and dimensional characteristics of a component of a pipework system, which comprises the word "Class" followed by a dimensionless whole number

Note 1 to entry: The number following the word "Class" does not represent a measurable value and is not intended to be used for calculation purposes except where specified in the relevant standard.

3.5

symmetric-seated valve

valve with an internal construction, which has a plane of symmetry perpendicular to the axis of the body ends

Note 1 to entry: This is a valve where both seat and sealing elements are identical.

3.6

asymmetric-seated valve

valve with an internal construction, which has no plane of symmetry perpendicular to the axis of the body ends

Note 1 to entry: This is a valve with a single seat offset from the shaft centreline or containing a twin-seated arrangement where both seats are not identical such as one bidirectional seat and one self-relieving seat.

3.7

soft seat

seat or sealing element made from, or including, thermoplastic, polymeric or elastomeric material which will burn during the fire test

3.8

obturator

movable component of the valve whose position in the fluid flow path permits, restricts or obstructs the fluid flow

3.9

double-seated valve

valve which utilises two seats for each *obturator* (3.8), resulting in a closed pressure sealed cavity, such as a trunnion mounted or floating ball valve, gate valve, plug valve

3.10**isolating valve**

valve intended for use only in the closed or fully open position

[SOURCE: EN 736-1:2018, 5.2]

4 Test conditions**4.1 Direction and conditions for valves to be tested**

4.1.1 Symmetric-seated valves intended by the manufacturer for bidirectional installation shall be tested in one direction only.

4.1.2 Asymmetric-seated valves intended by the manufacturer for bidirectional installation shall be tested by carrying out the burn test procedure twice, once in each direction of the potential installation.

The same valve may be refurbished and retested, or another, identical, valve may be tested in the other direction.

4.1.3 Valves intended solely for unidirectional installation shall be clearly and permanently marked as such, and shall be tested in the stated direction of installation.

4.1.4 If the valve being tested is fitted with a gearbox or other such manual device, only that particular assembly shall qualify. If a valve can be supplied with or without a gearbox, testing with a gearbox fitted shall qualify valves without a gearbox, but not the converse.

4.1.5 Valves (and gearboxes) shall not be protected with insulation material of any form during testing, except where such protection is part of the design of the component(s).

4.1.6 For valves with more than one obturator, if all seals and obturators are of the same design, through-seat leak testing of the upstream obturator in a single direction shall qualify all obturators in both directions. Asymmetric valves shall be tested on the upstream block in both directions.

For valves with more than one obturator, a qualified assembly is one where all obturators have been qualified in single valves that use the same obturator and seat/seal design.

If required by the purchaser, tests of a complete manifold assembly shall be subject to agreement between purchaser and manufacturer. The test procedure used shall be agreed by all parties.

The complete assembly, including any auxiliary connections, vents and drains shall be subjected to the fire. The upstream obturator shall be in the closed position and the downstream obturator shall be in the partially open position throughout the test. Testing for external leakage shall be on the complete assembly.

If the valve is comprised of an external vent valve, this shall be in the closed position. All other auxiliary connections shall be blinded sufficiently.

4.2 Pressure relief provision

4.2.1 If the valve under test incorporates a means of relieving cavity pressure as part of its standard design and if this provision activates during the fire test, the test shall be continued and any leakage to atmosphere from the provision shall be measured and counted as external leakage. If the design is such that the provision vents to the downstream side of the valve, any leakage shall be counted as through-seat leakage (see [5.6.11](#) and [5.6.13](#)).

4.2.2 The test shall be stopped and considered void if the cavity pressure is exceeded which activates the relief valve described in [5.3.2.8](#).

4.2.3 Double-seated valves tested in compliance with a previous edition of this document where the body cavity relief valve setting and/or cavity pressure during testing was not recorded in the original test report shall be subjected to a supplementary test before claiming compliance with this edition. An overpressure cavity relief test at ambient conditions shall be undertaken to demonstrate the relief performance mechanism of the valve with the test report appended to the original fire test report. Test pressure shall be as specified in [5.3.2.8](#).

5 Fire test method

5.1 General warning

Fire testing of valves is potentially hazardous and it is essential that the safety of personnel be given prime consideration. Given the nature of the fire test and the possibility of weaknesses in the design of the test valve and test equipment, hazardous rupture of the pressure boundary could occur. Adequate shields in the area of the test enclosure and other appropriate means for the protection of personnel are necessary.

Fire testing shall be void if the product or system fails to perform within the limits specified, except when such failure is determined to be the result of a failure within the test facility or test fixture and that failure and its correction do not affect the validity of the test results.

5.2 Principle

A closed valve, completely filled with water under pressure, is completely enveloped in flames with an environmental temperature in the region of the valve of 750 °C to 1 000 °C for a period of 30 min. The objective is to completely envelop the valve in flames to assure that the seat and sealing areas are exposed to the high burn temperature. The intensity of the heat input shall be monitored using thermocouples and calorimeter cubes as specified in [5.6.7](#) and [5.6.8](#). During this period the internal and external leakage is recorded. After cool-down from the fire test, the valve is hydrostatically tested to assess the pressure containing capability of the valve shell, seats and seals.

5.3 Apparatus

5.3.1 General

The test equipment shall not subject the valve to externally applied stress affecting the results of the test.

Schematic diagrams of recommended systems for fire type-testing of valves are given in [Figure 1](#).

Potential pipework-to-valve end connection joint leakage is not evaluated as part of the test and is not included in the allowable external leakage (see [6.3](#) and [6.6](#)). For the purposes of this test, it may be necessary to modify these joints to eliminate leakage.

The test equipment shall be designed such that if the nominal diameter of the pipework situated immediately upstream of the test valve is larger than DN 25 or one-half the DN of the test valve, the pipework shall be enveloped in flames for a minimum distance of 150 mm from the test valve. The diameter of the upstream pipework shall be sufficient to deliver a flow rate in excess of the maximum allowable leak rate for the size of the valve being tested.

The pipework downstream of the test valve shall be at least DN 15 and shall be inclined such that the downstream side is fully drained.

The flame source shall be at least 150 mm minimum away from the valve or any calorimeters, and should have sufficient capacity to completely envelop the valve in flames.

The enclosure containing the valve shall provide a horizontal clearance of a minimum of 150 mm between any part of the test valve and the enclosure, and the height of the enclosure above the top of the test valve shall be a minimum of 150 mm.

5.3.2 Specific apparatus

5.3.2.1 Vapour trap, to minimize the cooling effect of the upstream liquid. See [Figure 1](#) (7).

NOTE In [5.3.2](#) the numbered items in parentheses refer to the key numbers for the apparatus in [Figure 1](#).

5.3.2.2 Industrial pressure measurement devices having a full-scale reading of between 1,5 and 4 times the pressure being measured. Each test device used at any point on the scale shall be within 3 % of its maximum scale value for readings taken both up and down the scale, with either increasing or decreasing pressure. See [Figure 1](#) (6).

5.3.2.3 Calorimeter cubes, of carbon steel in accordance with the design and dimensions shown in [Figure 2](#), with a thermocouple (see [5.3.2.4](#)), located in the centre of each cube. Calorimeter cubes shall be scale-free before exposure to the fire environment.

5.3.2.4 Flame environment and valve body thermocouples, at least equal to class 2 for type B or class 3 for other types, as specified in IEC 60584-1. See [Figure 1](#) (11).

5.3.2.5 Containers, of a size suitable for collecting the water leaked from the valve under test. See [Figure 1](#) (16).

5.3.2.6 Calibrated sight gauge, or device for measuring the water volume used during the test. See [Figure 1](#) (4).

5.3.2.7 Calibrated device for measuring the leakage water collected during the test.

5.3.2.8 Pressure relief valve, incorporated in the system, to relieve test valve cavity overpressure due to thermal expansion of test liquid to the atmosphere, to protect against potential rupture, is required for all double-seated valves. For valves with more than one obturator, the connection shall be made into the cavity of the upstream obturator.

The set pressure of the relief valve during the fire test and therefore, the maximum allowable cavity pressure of the valve during the test shall be:

- either that determined by the valve manufacturer from data obtained by hydrostatic cavity overpressure testing of the test valve; proof of this required value is required prior to testing and shall be documented within the report [see [6.7 x](#)]; or
- when pressure test data are not available, a setting not greater than 1,5 times the maximum allowable pressure at 20 °C.

Cavity pressure during the fire test can rise significantly, increasing the risk of rupture, unless this pressure is relieved. Monitoring of this pressure during the fire test is mandatory for all double-seated valves. Where the introduction of a pressure relief valve would cause significant weakening of the pressure retaining shell and subsequent loss of pressure or integrity, the connection of the pressure relief valve pressure tapping to the test valve body may be suitably locally reinforced to provide adequate strength.

5.4 Test fluid

The test fluid used shall be water.

5.5 Test fuel

The test fuel shall be gaseous.

5.6 Procedure

NOTE The numbered items in parentheses refer to the key numbers for the apparatus in [Figure 1](#).

5.6.1 Mount the test valve in the test apparatus such that the stem and bore of the valve are in the horizontal position. Mount a valve that operates in only one direction (unidirectional) in their normal operating position.

Locate the flame environment, body thermocouples and calorimeter cubes in the positions shown in [Figures 3](#) and [4](#), as appropriate. For valves with more than one obturator, the flame thermocouples and calorimeter cubes shall be located on the upstream side.

For soft-seated valves up to DN 100 or NPS 4 and pressure ratings up to PN 40, Class 300, use two flame environment thermocouples, two body thermocouples and two calorimeter cubes as shown in [Figure 3](#).

For all other valves, use two flame environment thermocouples and two calorimeter cubes as shown in [Figure 4](#). For valves DN 200 or NPS 8 and larger, use a third calorimeter cube as shown in [Figure 4](#).

5.6.2 With the test valve in the partially open position, open the water supply, the shut-off valve (5), the vent valves (14) and the shut-off valve (13) to flood the system and purge the air. When the system is completely filled with water, close the shut-off valve (13), the vent valves (14) and the water supply. Pressurize the system with water to a test pressure of 1,4 times the maximum allowable pressure at 20 °C; the actual test pressure may be rounded up to the next highest bar¹⁾. Check for leaks in the test apparatus and eliminate them as necessary. Release the pressure, close the test valve and open the shut-off valve (13).

5.6.3 If the valve under test is of the upstream sealing type, determine the volume of water that is trapped between the upstream seat seal and the downstream seat seal when the valve is closed. Record this volume.

It is assumed that, during the fire type-test, this volume of water would flow through the valve and pass the downstream seat seal to be collected in the container (16). Since this volume has not actually leaked through the upstream seat seal, it is deducted from the total volume collected in the downstream container when determining the through-seat leakage (see [5.6.11](#)).

5.6.4 Pressurize the system to one or the other of the following pressures, as appropriate:

- a) for soft-seated valves rated PN 10, PN 16, PN 25 and PN 40, Class 150 and Class 300, the low test pressure at 0,2 MPa (2 bar);
- b) for all other valves, the high test pressure at 75 % of the maximum allowable seat pressure at 20 °C.

Tolerance on all test pressures is ± 10 %.

Maintain this test pressure during the burn and cool-down periods, momentary pressure losses of up to 50 % of the test pressure being permitted provided that the pressure recovers within 2 min and the cumulative duration is less than 2 min.

5.6.5 Record the reading on the calibrated sight gauge or device (4). Empty the container (16).

Measuring and monitoring equipment used during the testing process shall be calibrated in accordance with the requirements of the supplier/manufacturer or test facility. Measuring and monitoring

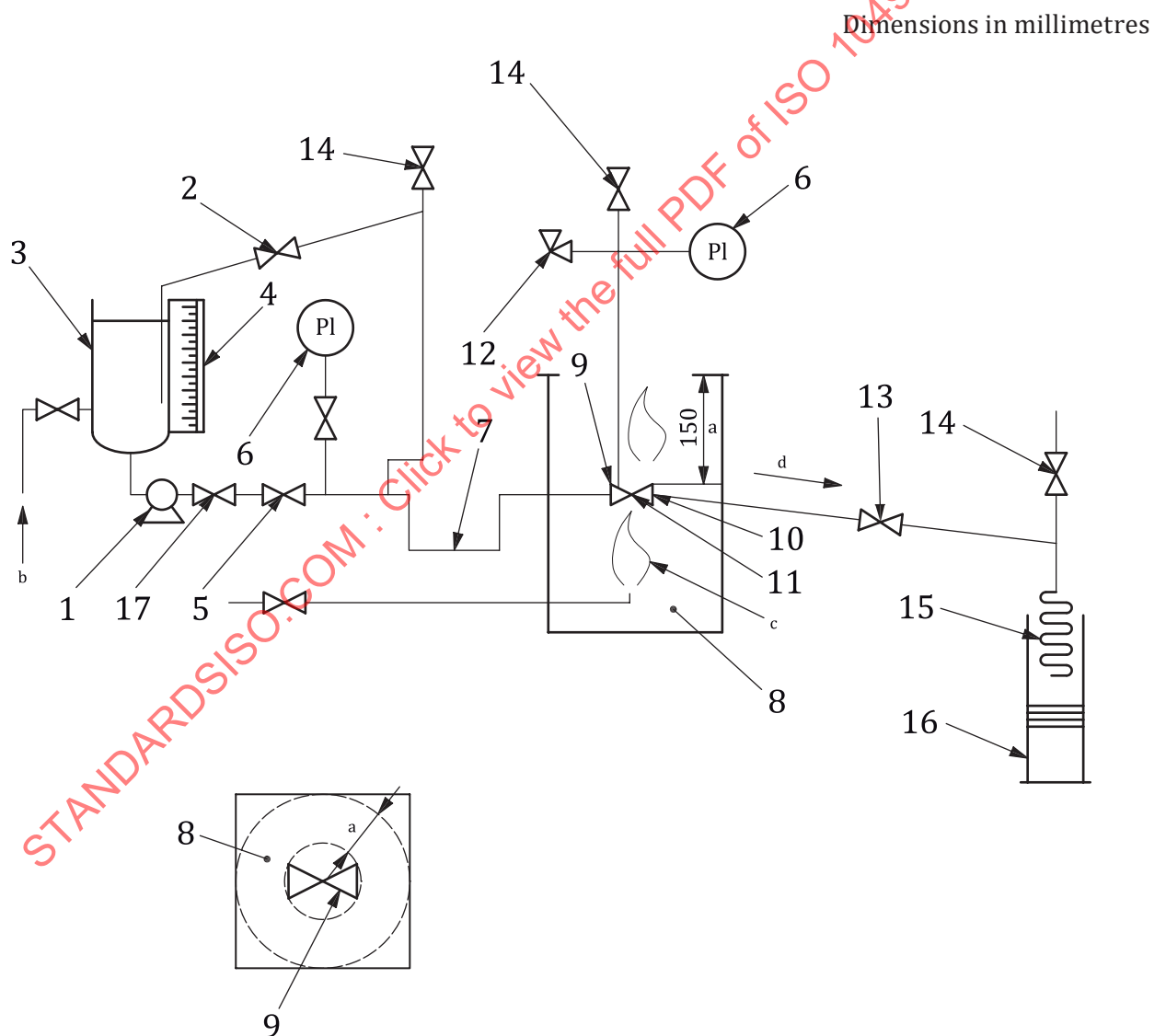
1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm².

equipment shall be used within the calibrated range. The accuracies of all measurements shall be specified in the test report.

Water volume measuring equipment shall meet the requirements with respect to minimum detectable volume and maximum allowable leak rate as specified in [Table 1](#).

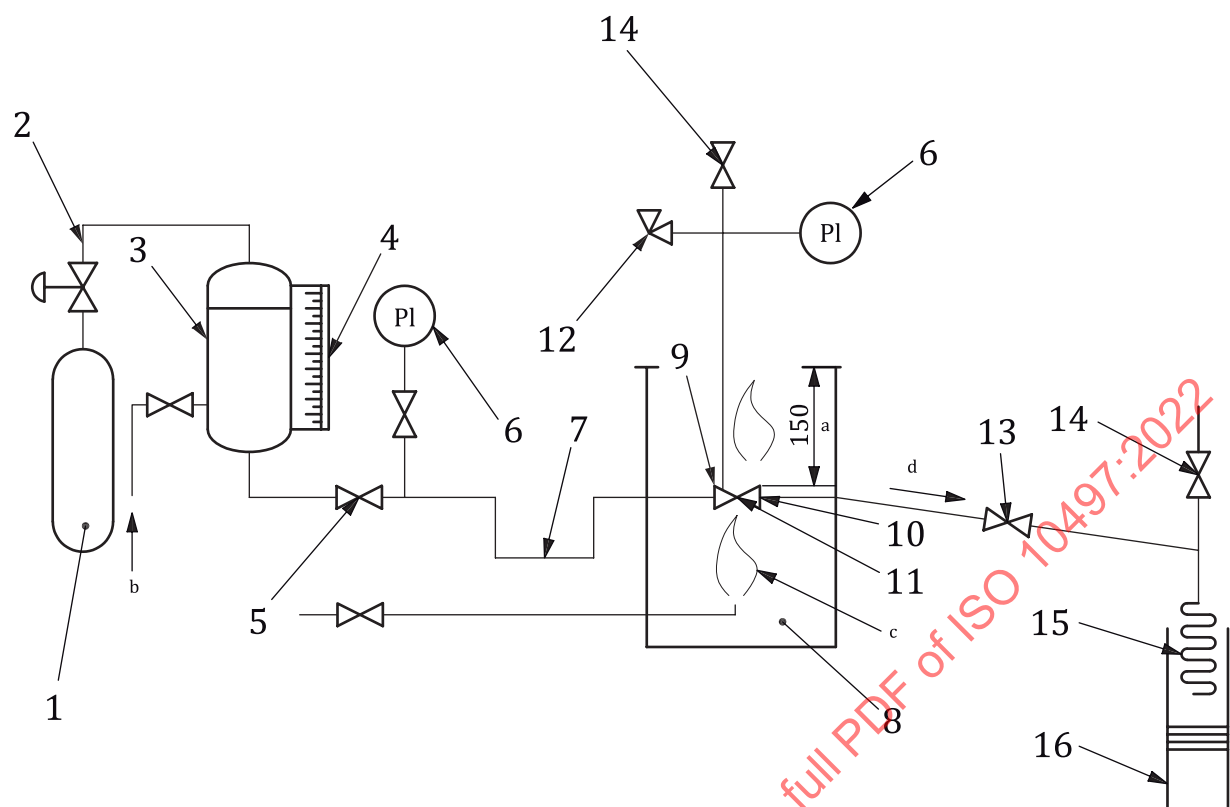
5.6.6 Adjust the test system, excluding the test valve, during the test period to maintain the temperatures and pressures required.

5.6.7 Open the fuel supply, establish a fire and monitor the flame-environment temperature throughout the burn period of 30_0^{+5} min. Check that the average temperature of the two flame-environment thermocouples (11) reaches $750\text{ }^{\circ}\text{C}$ within 2 min from the start of the burn period, i.e. from ignition of the burners. Maintain the average temperature between $750\text{ }^{\circ}\text{C}$ and $1000\text{ }^{\circ}\text{C}$, with no reading less than $700\text{ }^{\circ}\text{C}$ for the remainder of the burn period of 30 min.



a) Pump as pressure source

Dimensions in millimetres



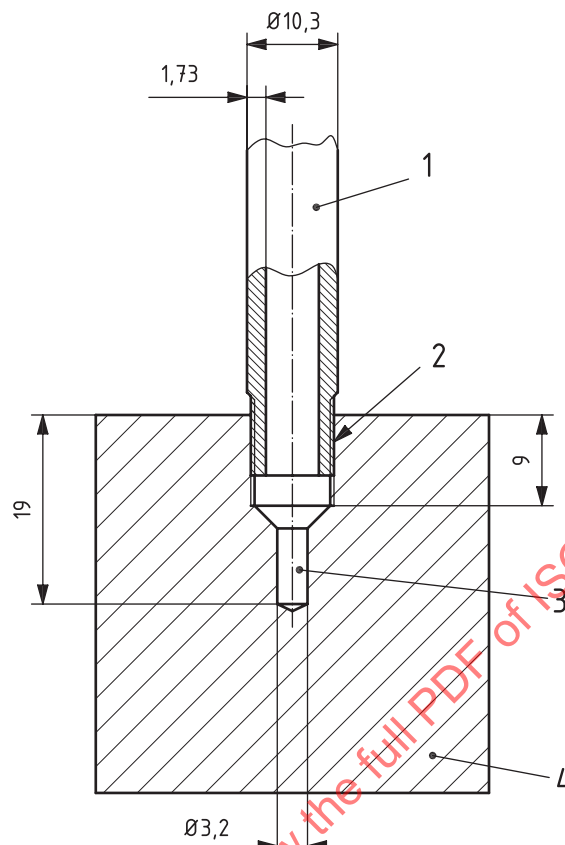
b) Compressed gas as pressure source

Key

- | | |
|--|---|
| 1 pressure source | 10 calorimeter cubes (see 5.3.2.3) |
| 2 pressure regulator and relief | 11 flame environment and body thermocouples (see 5.3.2.4) |
| 3 vessel for water | 12 relief valve (see 5.3.2.8) |
| 4 calibrated sight gauge | 13 shut-off valve |
| 5 shut-off valve | 14 vent valve |
| 6 pressure gauges | 15 condenser |
| 7 piping arranged to provide vapour trap (see 5.3.2.1) | 16 container (see 5.3.2.5) |
| 8 enclosure for test | 17 check valve |
| 9 test valve mounted horizontally with stem in horizontal position (see 5.6.1) | |
| a Clearance of 150 mm. | |
| b Water supply. | |
| c Fuel gas supply and burners. | |
| d Slope. | |

Figure 1 — Recommended systems

Dimensions in millimetres

**Key**

- | | | | |
|---|---|---|------------------------------|
| 1 | pipe | 3 | thermocouple well |
| 2 | pipe thread Rc 1/8 complying with ISO 7-1 | 4 | 38 mm flame calorimeter cube |

Figure 2 — Calorimeter cube design and dimensions

5.6.8 The average temperature of the calorimeter cubes shall be 650 °C within 15 min of starting the burn period. For the remainder of the burn period, maintain the minimum average temperature of 650 °C, with no temperature falling to less than 560 °C. For valves subjected to the low-pressure test [see 5.6.4 a)], the body thermocouple shall maintain 590 °C (1 100 °F) for at least 5 min and the bonnet thermocouple shall maintain 650 °C (1 200 °F) for at least 15 min of the burn period. The burn period may be extended by up to 5 min in order to achieve this requirement.

5.6.9 Record instrument and calorimeter readings (6, 10, 11) every 30 s during the burn period. Thermocouples should be numbered and individual records of temperature shall be recorded.

5.6.10 At the end of the burn period, 30⁺⁵ min, shut off the fuel supply.

5.6.11 Immediately determine the amount of water collected in the container (16) and establish the total through-seat leakage during the burn period. If the test valve is an upstream sealing type (see 5.6.3), deduct the volume of water trapped between the upstream seat seal and the downstream seat seal. Continue collecting water in the container (16) for use in establishing the external leakage rate of the test valve during the burn and cool-down periods.

5.6.12 Within 5 min of extinguishing the fire, force-cool the test valve with water so that its external surface temperature remains below 100 °C; the time for cooling shall not exceed 10 min. Record the time taken to force-cool the external surface of the valve below 100 °C. Measurement of the external

surface temperature can be performed by placing an extra thermocouple, infrared thermometer or other suitable monitoring equipment on the external surface of the valve body.

WARNING — The internal parts of the valve could remain at significantly higher temperatures than the external surface of the valve. Following the force cooling with water, additional time may be necessary to allow internals to cool to less than 100 °C.

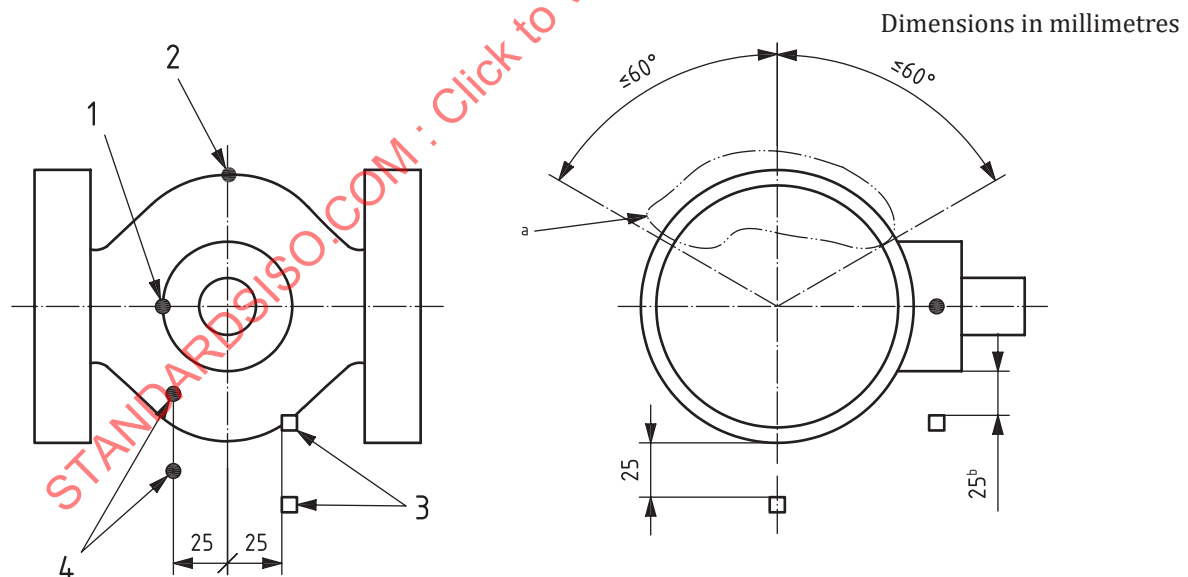
5.6.13 Check and adjust the test pressure in accordance with 5.6.4. Record the readings on the sight gauge (4) and determine the quantity of water in the container (16). Record any leakage through the external pressure relief device if fitted as part of the standard design. The figures are used to calculate the total external leakage throughout the burn and cool-down periods.

5.6.14 For valves PN 100 or Class 600 and lower, decrease or stabilize the pressure to the low test pressure at 0,2 MPa (2 bar), and measure the through-seat leakage over a 5 min period.

5.6.15 After completing the applicable static leakage tests (5.6.11 through 5.6.14), close the shut-off valve (Figure 1, 13), operate the test valve against the low test pressure at 0,2 MPa to the fully open position and then to the fully closed position. Open the shut-off valve (Figure 1, 13). Allow the system to stabilize for a 5-minute period, and once completed, record in the test report the through-seat leakage over a 5-minute time period.

5.6.16 For all valves, increase or stabilize the test pressure to the high test pressure (75 % of the maximum allowable pressure at 20 °C), then close the shut-off valve (13). Operate the test valve against the test pressure to the fully open position one time.

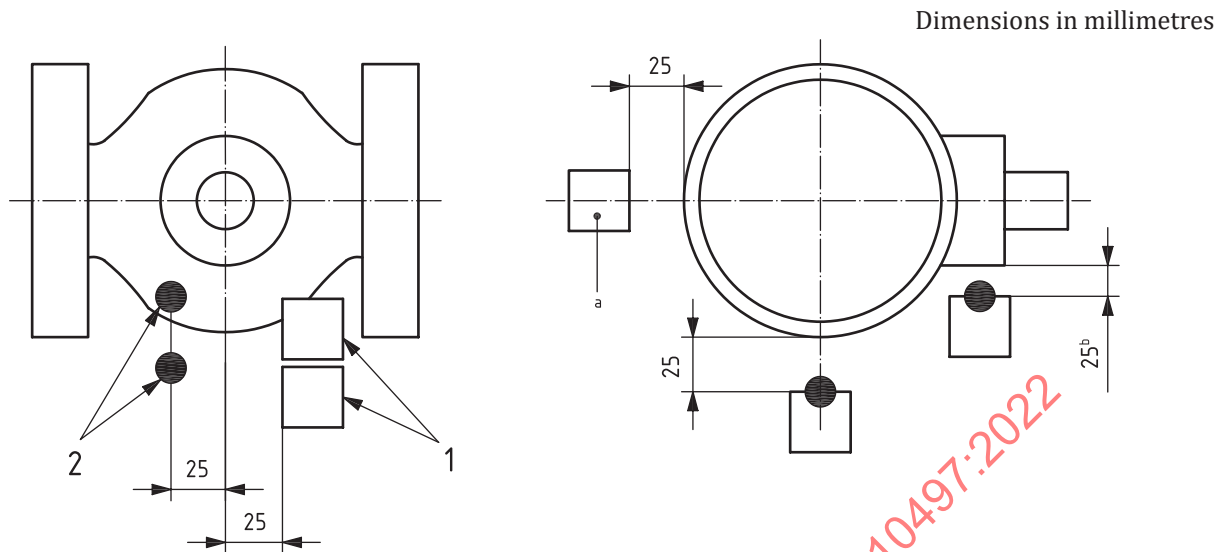
5.6.17 Stabilize the pressure to the high test pressure and measure the external leakage over a 5-minute period.



Key

- | | | | |
|---|---|---|-------------------------------|
| 1 | bonnet thermocouple | 3 | 38 mm flame calorimeter cubes |
| 2 | body thermocouple | 4 | flame thermocouples |
| a | The body thermocouple is installed in this area. When installed, the body and bonnet thermocouples are recessed into the valve body/bonnet a distance of 1/2 the thickness of the wall or 13 mm, whichever is the lesser. | | |
| b | From the stem seal. | | |

Figure 3 — Location of temperature measurement sensors — Soft-seated valves up to DN 100 — NPS 4 — PN 10, PN 16, PN 25 and PN 40 — Class 150 and Class 300

**Key**

- 1 38 mm flame calorimeter cubes
- 2 flame thermocouples
- a Additional calorimeter cube added for DN 200 (8 in) and above.
- b From the stem seal.

NOTE These other valves include soft-seated valves larger than DN 100, NPS 4, PN 10, PN 16, PN 25 and PN 40, Class 150 and Class 300, and all valve sizes larger than PN 40, Class 300.

Figure 4 — Location of temperature measurement sensors for all other valves

6 Performance

6.1 General

Valves tested in accordance with [Clause 5](#) shall be in accordance with [6.2](#) to [6.7](#).

6.2 Through-seat leakage during burn period

For the low-pressure test, the average through-seat leakage at low test pressure during the burn period (see [5.6.11](#)) shall not exceed the value given in [Table 1](#).

For the high-pressure test, the average through-seat leakage at high test pressure during the burn period (see [5.6.11](#)) shall not exceed the value given in [Table 1](#).

6.3 External leakage during burn and cool-down periods

For the low-pressure test, the average external leakage, not including through-seat leakage, during the burn and cool-down periods (see [5.6.13](#)) shall not exceed the value given in [Table 1](#).

For the high-pressure test, the average external leakage, not including through-seat leakage, during the burn and cool-down periods (see [5.6.13](#)) shall not exceed the value given in [Table 1](#).

6.4 Low-pressure test through-seat leakage after cool-down

The maximum through-seat leakage shall not exceed the value given in [Table 1](#).

6.5 Operability

After the completion of fire testing, the operability of the valve shall be checked. After the fire test, the valve shall be unseated from the closed position against the high test pressure and moved to the fully open position (see 5.6.15) using the operator fitted to the test valve. Extension handles shall be allowed to protect the operator from risks associated with potential loss of containment during the valve operation if this does not result in an applied torque that is higher than the manufacturer's published torque value. Failure of the valve to operate means failure of the fire test.

6.6 External leakage following operational test

The average external leakage of the valve in the open position at the high test pressure (see 5.6.16) shall not exceed the value given in Table 1.

NOTE External leakage does not include potential leakage from the pipework-to-valve end connection (see 5.3.1).

Table 1 — Maximum leak rates

Maximum leak rates [ml/min]							
Valve size		Through-seat leakage testing			External leakage testing		
DN	NPS	During burn (see 5.6.11 and 6.2)		After cool-down (see 5.6.14, 5.6.15 and 6.4)	During burn and cool-down (see 5.6.13 and 6.3)		After operational test (see 5.6.16 and 6.6)
		Low-pres- sure test	High-pres- sure test	Low-pressure test	Low-pressure test	High-pressure test	High-pressure test
8	¼	32	128	13	8	32	8
10	⅜	40	160	16	10	40	10
15	½	60	240	24	15	60	15
20	¾	80	320	32	20	80	20
25	1	100	400	40	25	100	25
32	1 ¼	128	512	51	32	128	32
40	1 ½	160	640	64	40	160	40
50	2	200	800	80	50	200	50
65	2 ½	260	1 040	104	65	260	65
80	3	320	1 280	128	80	320	80
100	4	400	1 600	160	100	400	100
125	5	500	2 000	200	125	500	125
150	6	600	2 400	240	150	600	150
200	8	800	3 200	320	200	800	200
> 200	> 8	800	3 200	320	200	800	200

6.7 Test report

The test report shall include the following information:

- date of fire type-test;
- place at which the fire type-test was conducted;
- the International Standard used for the fire type-test (including date of publication and applicable amendments);
- valve manufacturer's name and address;

- e) statement that the fire-tested valve has passed all the required hydrostatic, air type and production pressure tests required by the standard to which the valve was manufactured (manufacturer's statement may be accepted);
- f) full description of the valve tested, including nominal size, pressure rating designation, type (e.g. gate), weight, whether reduced or full bore, material of body/bonnet, trim material and manufacturer's reference number;
- g) markings on the valve and their locations, including manufacturer's nameplate date (if fitted);
- h) manufacturer's sectional drawing of the test valve with a detailed parts list, including materials, of all valve components tested, identified in the text by identification number (drawing number) and revision and date of issue of documents. For all double-seated valves, the drawing shall show the cavity test connections;
- i) statement as to whether or not a gearbox is fitted to the test valve and, if fitted, the type, manufacturer's name, model number and mechanical advantage;
- j) test pressure during burn and cool-down to be recorded at start and at 30 s intervals throughout duration of test;
- k) time of test start, i.e. of ignition of burners;
- l) temperatures recorded at start and at 30 s intervals throughout duration of test, with individual records for each thermocouple;
- m) through-seat leakage during burn period (see [6.2](#));
- n) external leakage during burn and cool-down periods (see [6.3](#));
- o) time required for valve to cool to 100 °C;
- p) through-seat leakage (low-pressure test) for valves PN 100 and Class 600 and lower;
- q) valve through-seat leakage and external leakage from testing in [5.6.15](#) and [5.6.17](#) respectively;
- r) external leakage in the open position (see [6.6](#));
- s) whether the valve is asymmetric and intended for bidirectional installation (test results in both directions);
- t) observations made during the course of the test that may have bearing on the results provided including a reference to the operability of the valve if the fully open position in [5.6.15](#) was not achieved during the cycle test;
- u) declaration as to whether or not the test valve complied with the requirements of the fire test and tests of this document:
 - 1) through-seat leakage;
 - 2) external leakage;
 - 3) cavity overpressure of double seat valves;
 - 4) operability;
- v) indication on the cover sheet or table of contents of the test report of the total number of pages contained in the document (including drawings), with each page being numbered, e.g. 1/12, 2/12;
- w) names and affiliation of individuals witnessing the fire test (if applicable);
- x) confirmation of pressure relief valve, set pressure (see [5.3.2.8](#)) and cavity pressure during test (every 30 s), as required for all double-seated valves;

- y) confirmation via statement or photograph that apparatus was set up as per [5.3](#).

7 Qualification of other valves by representative size, pressure rating, design considerations and materials of construction

7.1 General

Instead of testing each nominal size and nominal pressure rating of a given valve design, all valves of the same basic design as the test valve may be deemed to have been fire-tested, subject to the following limitations.

- a) A test valve may be used to qualify valves larger than the test valve, but not exceeding twice the nominal size of the test valve (see [7.5](#)). A size DN 200 or NPS 8 test valve qualifies all larger sizes. If the minimum size of a given range of valves is greater than DN 200, NPS 8 or nominal size 9, then the minimum size of the range shall be tested to qualify all sizes.
- b) Any valve DN 50 or NPS 2 or below may be used to qualify all sizes of valve of the same types up to and including DN 50 or NPS 2. If the maximum size of a given range of valves is smaller than DN 50 or NPS 2, then the maximum size of the range shall be tested to qualify all sizes.
- c) A test valve may be used to qualify valves with higher PN or Class ratings but not exceeding twice the PN or Class rating of the test valve as per [Table 3](#).
- d) A reduced bore (or Venturi pattern) test valve may be used to qualify a smaller nominal size full bore (or regular pattern) valve when the components associated with the obturator, seat seals and stem are identical in design and size. Leakage rates shall be those of the equivalent smaller nominal size bore (full bore) valve, as shall qualification of larger nominal size valves in accordance with [7.5](#).

EXAMPLE 1 Testing a $2 \times 1 \frac{1}{2}$ NPS reduced bore valve is treated as a $1 \frac{1}{2}$ NPS full bore valve and qualifies full bore valves sizes 3 NPS and below and reduced bore valves $4 \text{ NPS} \times 3 \text{ NPS}$ and below and DN equivalents according to [Table 2](#).

EXAMPLE 2 Testing a $\text{DN } 150 \times \text{DN } 100$ reduced bore valve is treated as a DN 100 full bore valve and qualifies only sizes 100, 125, 150, 200 and equivalent NPS sizes as per [Table 2](#).

- e) The type of valve body ends is not considered by this document. However, the mass of the valve is determined in part by the body end type. For qualification to the present document, and providing that all other qualification criteria have been met, valves with ends different to those of the test valve may also qualify provided that:
 - their mass is greater than that of the test valve, or
 - their mass is not less than 75 % of that of the test valve.

7.2 Design considerations

7.2.1 The test valve and qualified valve(s) shall have the same basic design and meet the following criteria:

- valve-design type shall be the same, for example, a gate valve does not cover a ball valve and vice versa;
- valve style shall be the same, for example, a floating ball does not cover a trunnion-mounted valve and vice versa;
- a symmetric valve does not cover an asymmetric valve and vice versa;
- a one-piece body valve does not cover a split-body valve;