



Shut-off valves

Requirements and test methods

Publishing house: VdS Schadenverhütung GmbH

Amsterdamer Str. 172-174

50735 Köln, Germany

Phone: +49 221 77 66 0; Fax: +49 221 77 66 341

Copyright by VdS Schadenverhütung GmbH. All rights reserved.

VdS Guidelines for water extinguishing systems

Shut-off valves

Requirements and test methods

Content

1	Scope	4
2	Normative references	4
3	Definitions	4
4	Requirements	5
4.1	Technical documentation	5
4.2	Marking	5
4.3	Connections	6
4.4	Design	6
4.5	Performance characteristics	6
4.6	Dimensional accuracy and wear	7
5	Tests	7
5.1	Test conditions and test samples.....	7
5.2	Compliance test	7
5.3	Resistance to corrosion and ageing test.....	7
5.4	Test of the mechanical strength.....	8
5.5	Operating force test.....	9
5.6	Pressure loss test.....	9
5.7	Flow test.....	9
5.8	Low pressure test.....	10
5.9	Pressure test with bent pipes	10
5.10	Measurement and wear check.....	10
5.11	Other tests.....	10
	Annex A Dimensions for groove connections	11

1 Scope

These guidelines specify requirements and test methods for manually operated shut-off valves for the installation in stationary water extinguishing systems according to VdS CEA 4001 and VdS 2109.

These guidelines are applicable to shut-off valves \geq DN50 and take into account the use in the main water flow (suction pipes and pressure pipes).

Note: Gate valves approved according to these guidelines can also be used in test pipes.

2 Normative references

These Guidelines incorporate, by dated or undated references, provisions from other publications (e.g. European Standards EN or International Standards IEC), which are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to these Guidelines only when incorporated in them by amendment or revision. For undated references the latest edition of the publication referred to applies.

VdS CEA 4001	Guidelines for sprinkler systems – Planning and installation
VdS 2109	Guidelines for water spray systems – Planning and installation
VdS 2100-06	Guidelines for water extinguishing systems – Requirements and test methods for pipe joints
DIN EN 1092	Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories, PN designated
DIN EN ISO 228-1	Pipe threads where pressure-tight joints are not made on the threads – Part 1: Dimensions, tolerances and designation
ISO 7-1	Pipe threads where pressure-tight joints are made on the threads – Part 1: Dimensions, tolerances and designation
EN 764-1	Pressure equipment – Part 1: Terminology – Pressure, temperature, volume, nominal size

3 Definitions

For the use of these guidelines the following definitions apply:

Operating pressure: Pressure specified by the manufacturer and with which the component may be operated. The test pressures are calculated and the tests are conducted on the basis of this value.

Maximum allowable pressure: Maximum pressure for which the device is designed according to the manufacturer specification (EN 764-1). The test pressures are calculated and the tests are conducted on the basis of this value when no operating pressure is specified.

Nominal cross section: Calculated cross section on basis of the nominal diameter (e.g. 50 mm for DN 50)

Main water flow: Pipework between water source and sprinkler/nozzle

4 Requirements

4.1 Technical documentation

4.1.1 The following shall be specified in the technical documentation:

- the area of application/use (pressure pipes and/or suction pipes);
- the nominal size;
- the maximum allowable pressure and/or operating pressure (at least 10 bar for the use in pressure pipes, at least 6 bar for the use in suction pipes);

Note: If foot valves are used in suction pipes, it can be necessary to use shut-off valves of the same pressure rating as used on the high-pressure side. This should be referenced in the user documentation.

- the allowable flow velocity in relation to the nominal cross section (at least 6 m/s).

Remark: In case of a series of shut-off valves with several sizes where the different sizes are identical in construction, the individual nominal sizes may be specified differently.

The following should be specified in the technical documentation:

- pressure loss in mbar at flow velocity 5 m/s.

4.1.2 The following documents are required:

a) Manufacturing documents:

- Assembly drawing;
- All detail parts drawings;

The marking according to 4.2 shall be documented in the drawings.

b) User documentation:

- Data sheet with:
 - details according 4.1.1;
 - specification of the joints;
 - outer dimensions of the shut-off valve, incl. dimension for the parts protruding from the body (e.g. open butterfly valve);
 - installation instruction (way and sequence of mounting); including distances to be observed with shut-off valves where parts can protrude into connected components (e.g. valves, pumps);
 - requirements on environment, if necessary;
 - maintenance instructions.

c) List of documents:

- A list (with revision state and/or date) containing all above mentioned documents (each with designation and drawing number as well as revision state and/or date).

4.2 Marking

Shut-off valves shall be marked with following details:

- Name or trade mark of the manufacturer/supplier;

- Type designation;
- Nominal size;
- Maximum allowable pressure and operating pressure (if specified; with wording “maximum operating pressure according VdS”);
- Flow direction, if flow is not permitted in both directions;
- "VdS".

This marking shall be non-detachable, non-flammable, permanent and well legible in mounting position.

Note: A marking by means of adhesive foil or similar measures is not acceptable.

4.3 Connections

The connections at the inlet and outlet of the shut-off valve shall be designed as

- Thread connection, preferably according to ISO 7-1 or DIN EN ISO 228-1; or
- Flange connection, preferably according to DIN EN 1092-2; or
- Pipe coupling connection according to annex A (only allowable for materials according annex A); or
- Pipe coupling connection according to groove specification of one or several manufacturers of couplings or relevant standards.

4.4 Design

4.4.1 There shall be sufficient play between all moving and stationary parts to ensure proper function even if corrosion and deposits have formed. All parts which slide one against the other shall be manufactured from corrosion resistant metal and all sealing parts shall be made of corrosion resistant material.

4.4.2 The shut-off valves shall allow only slow opening and closing. When actuated manually there shall be at least five revolutions between the open and closed position of the valve. Other designs shall have a closing time of at least 10 s.

The actuators shall be self-locking. The proof of self-locking is provided if the position does not change during the flow test.

4.4.3 The shut-off valves shall be equipped with a position indicator. It shall be possible to secure shut-off valves against unauthorized actuation (e.g. by lock and belt).

4.4.4 The body shall be made of metal with a melting point > 800°C. For pressures > 12,5 bar, the body shall be made of ductile material as e.g. ductile cast iron or at least equivalent.

4.5 Performance characteristics

4.5.1 Shut-off valves shall be tested according to 5.3, 5.4, 5.5, 5.6 and 5.7 and shall fulfil the requirements described there for each permitted flow direction. If flow is permitted in both directions it may be necessary, dependent on the individual design, to conduct one or more tests with pressurization or flow in both directions.

4.5.2 Shut-off valves for the use in suction pipes shall additionally be tested according to 5.8 and fulfil the requirements described there.

4.5.3 Shut-off valves with pipe coupling connection which does not comply with Annex A shall additionally be tested according to 5.9 and fulfil the requirements described there.

4.6 Dimensional accuracy and wear

In the test according to 5.10 after completion of the performance characteristics tests, the following requirements shall be fulfilled:

- dimensional compliance;
- no plastic deformation;
- no signs of wear which could impair proper function.

5 Tests

5.1 Test conditions and test samples

5.1.1 Test conditions

The tests are conducted at a temperature of (25 ± 10) °C unless otherwise specified for a specific test.

The tolerance of all test parameters is ± 5 % unless specified otherwise.

5.1.2 Test samples

If **one** shut-off valve is tested two test samples are needed as well as:

- one additional test sample for corrosion test, if corrosion test is necessary;
- one additional test sample for bending test, if pipe coupling connection does not comply with Annex A.

If a series of shut-off valves (with several sizes where the different sizes are identical in construction) is tested one sample of each nominal size is needed as well as additional test samples as agreed with VdS for e.g. pressure loss measurements, corrosion tests (if necessary), bent tests (if necessary).

5.2 Compliance test

The test samples are checked visually and dimensionally for compliance with the description given in the technical documentation (drawings, parts lists and instructions for assembly) and for compliance with the auditable requirements of these guidelines.

5.3 Resistance to corrosion and ageing test

It is checked on the basis of the drawings, the parts lists and the test sample, whether or not corrosion and ageing may have a detrimental effect on the performance characteristics of the valve. In case of doubt, corresponding tests have to be conducted.

Shut-off valves with internal coating are always subjected to a salt spray corrosion test.

The test sample is subjected to a salt spray in a mist chamber. Inlet and outlet of the shut-off valve are open. The essential components and properties of the reagents and the test conditions are

- NaCl dissolved in distilled water;

- pH-value: 6,5 - 7,2;
- concentration of the solution: (50 ± 5) g/l;
- spray pressure: 0,7 bar to 1,7 bar;
- spray volume: 1 ml/h to 2 ml/h on a surface of 80 cm²;
- temperature in the test chamber: (35 ± 2) °C;
- spray time: $(240 + 6)$ h;
- drying time: (168 ± 5) h at a relative humidity of maximum 70 %.

After the test the coating shall be undamaged. There shall be no signs of delamination or subsurface corrosion.

5.4 Test of the mechanical strength

The tests described below are preferably conducted in the sequence indicated:

Test	Test medium	Pressure	Test duration/cycles	Requirements
Body pressure test	water	4 times maximum allowable pressure or 4 times operating pressure (see section 3)	10 min	no cracks, breakage or plastic deformations
Body leakage test	air	maximum allowable pressure or operating pressure (see section 3), however not exceeding 10 bar	10 min	no leakage
Leakage test of the closing component	water	2 bar and 1.5 times maximum allowable pressure or 1.5 times operating pressure (see section 3)	10 min	permissible leak rate: 30 droplets/min
Water hammer test of the body	water	between approx 3.5 bar and (maximum allowable pressure or operating pressure plus 25) bar alternately	3000 cycles	no cracks, breakage or plastic deformations
Water hammer test of closing component	water	between approx 3.5 bar and (maximum allowable pressure or operating pressure plus 25) bar alternately	3000 cycles	no cracks, breakage or plastic deformations

5.5 Operating force test

The manual force required to actuate the shut-off valve is measured by bringing the shut-off valve from the position „close“ into the position „open“ for five times.

The pump pressure with the valve closed is equivalent to the operating pressure, however 10 bar maximum, and the flow velocity in the pipe with the valve open is 5 m/s.

The force needed to open or close the shut-off valves shall not exceed the values specified in the following table.

Hand wheel diameter in mm	Force in N	Torque in Nm
50	40*	1
63	50*	1.6
80	60*	2.4
100	70*	3.5
125	170	10.6
160	200	16
200	250	25
250	300	37.5
315	400	63

* single-handed control

5.6 Pressure loss test

In case of a series of shut-off valves (with several sizes where the different sizes are identical in construction) the test is conducted with each nominal size unless the manufacturer has given details on the pressure loss. If details are specified they are verified in spot checks.

The pressure loss is measured using a steel pipe measuring section with a straight inlet pipe of a length of at least 10 times the nominal diameter and a straight outlet pipe of a length of at least 5 times the nominal diameter.

The pressure loss is determined at a flow velocity of 5 m/s in relation to the nominal cross section. The value determined is used to calculate the ζ -value and the equivalent length.

The pressure loss at a flow velocity of 5 m/s in relation to the nominal cross section shall not exceed 0.5 bar.

5.7 Flow test

The shut-off valve is subjected to 1.25 times the allowable flow velocity specified by the manufacturer for 90 min, however at least 7.5 m/s (in relation to the nominal cross section). The upstream pressure is preferably 1.5 bar.

The flow test shall ensure that the shut-off valve does not endanger the safe operation of the extinguishing system (e.g. by loosening of parts).

During and after the test there shall be no signs visible of:

- plastic deformation, or
- loosening of parts, or
- changes which endanger the safe operation, or
- change of the position of the closing component.

5.8 Low pressure test

Note: Only for shut-off valves for use in suction pipes.

The pressure in the test sample is reduced by 0.6 bar below the ambient pressure for 10 minutes.

The test sample shall be tight during the test.

5.9 Pressure test with bent pipes

Note: Only for shut-off valves with pipe coupling connection which does not comply with Annex A.

The test is conducted according to VdS 2100-06 (pressure test with bent pipes).

During the test the connection shall be held safely together and be tight.

5.10 Measurement and wear check

After the tests have been conducted, the shut-off valve is disassembled and checked for dimensional accuracy, manufacturing quality and wear in compliance with the drawings. No wear may be present which could impair proper functioning.

5.11 Other tests

Where necessary due to special designs or new manufacturing methods, additional tests will be conducted in agreement with the manufacturer.

Annex A Dimensions for groove connections

This annex contains the dimensions for valve connections for use with pipe couplings.

Valid for cutting machined connections of malleable iron, cast ductile iron, steel or cast steel with 350 N/mm² minimum tensile strength.

Nominal size		Nominal outer diameter in mm	Outer diameter in mm		Pipe length up to groove in mm ± 0,76	Groove width in mm ± 0,76	Diameter at groove ground in mm	
			max.	min.			max.	min.
DN	25	33.7	33.73	33.07	15.87	7.92	30.23	29.85
DN	32	42.4	42.57	41.76	15.87	7.92	38.99	38.61
DN	40	48.3	48.74	47.78	15.87	7.92	45.09	44.70
DN	50	60.3	60.94	59.72	15.87	7.92	57.15	56.77
DN	65	76.1	76.85	75.35	15.87	7.92	72.26	71.80
DN	80	88.9	89.79	88.11	15.87	7.92	84.94	84.48
DN	100	114.3	115.44	113.51	15.87	9.52	110.08	109.58
DN	125	139.7	141.10	138.91	15.87	9.52	135.48	134.97
DN	150	168.3	169.85	167.49	15.87	9.52	163.95	163.40
DN	200	219.1	220.65	218.29	19.05	11.13	214.40	213.77
DN	250	273	274.62	272.26	19.05	12.70	268.27	267.59
DN	300	323.9	325.42	323.06	19.05	12.70	318.29	317.53
<i>Remark 1: Groove shoulder flash-free with cutting up to max. 0.3 mm x 45°.</i>								
<i>Remark 2: Groove ground with radius up to max. 0.8 mm.</i>								
Table A.1: Dimensions for valve connections								