BS EN 15091:2013

BSI Standards Publication

Sanitary tapware — Electronic opening and closing sanitary tapware

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National foreword

This British Standard is the UK implementation of EN 15091:2013. It supersedes BS EN 15091:2006 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/504, Water supply.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Sanitärarmaturen - Sanitärarmaturen mit elektronischer Öffnungs- und Schließfunktion

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 15091:2013) has been prepared by Technical Committee CEN/TC 164 “Water Supply”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2014, and conflicting national standards shall be withdrawn at the latest by June 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 15091:2006.

Significant technical differences between this edition and EN 15091:2006 are as follows:

- the introduction of a maximum voltage;
- the change of dimensional characteristics (see 5.2);
- the change in minimum flow rates and hammer test (5.3.5 and 5.3.3).

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This standard is relevant for electrically operated (opening and closing) sanitary tapware used with sanitary appliances, with a maximum voltage of 42 V AC / 72 V DC, in the enclosure of the tap.

Such tapware can be operated by any electrical source e.g. mains with a transformer, battery, etc.

Flow and temperature regulation devices installed either upstream or downstream of the tapware are not covered by this specification.

The purpose of this standard is to define requirements for the:

1) marking, identification, leak-tightness, electrical and operational safety, mechanical performance and limitation of water hammer for electrical opening and closing tapware;

2) dimensional, hydraulic, endurance and acoustic characteristics;

3) procedure of tests in order to verify these characteristics.

As for possible unfavourable effects of the product to which this standard applies, on the quality of water intended for human consumption:

4) no information is provided by this standard on possible use restrictions of the product in any of the member states of the EU or EFTA;

5) it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or characteristics of this product remain in force.

Requirements for different products are defined in different clauses of this standard as illustrated in Table 1.

Table 1 — Identification of the clauses of this standard

	MARKING	DIMENSIONAL CHARACTERISTICS	ENDURANCE	ACOUSTIC	ELECTRICAL SAFETY	OPERATIONAL SAFETY	LEAKTIGHTNESS	MECHANICAL RESISTANCE	HYDRAULIC CHARACTERISTICS	WATER HAMMER	WATER HAMMER FOLLOWING PRODUCT STANDARD
Clause 4.General requirements and testing	X				X	X	X	X			
Clause 5. Requirements and testing for tapware		X	X	X					X	X	
Clause 6. Requirements and testing for flushing valves for urinals		X	X						X	X	
Clause 7. Requirements and testing for flushing valves for WCs		X	X	X					X		X

1 Scope

The purpose of this European Standard is to define requirements for marking, identification, leaktightness, electrical and operational safety and mechanical resistance for sanitary tapware with opening and closing controlled electronically.

The conditions of use for the supply system type are specified in Table 2:

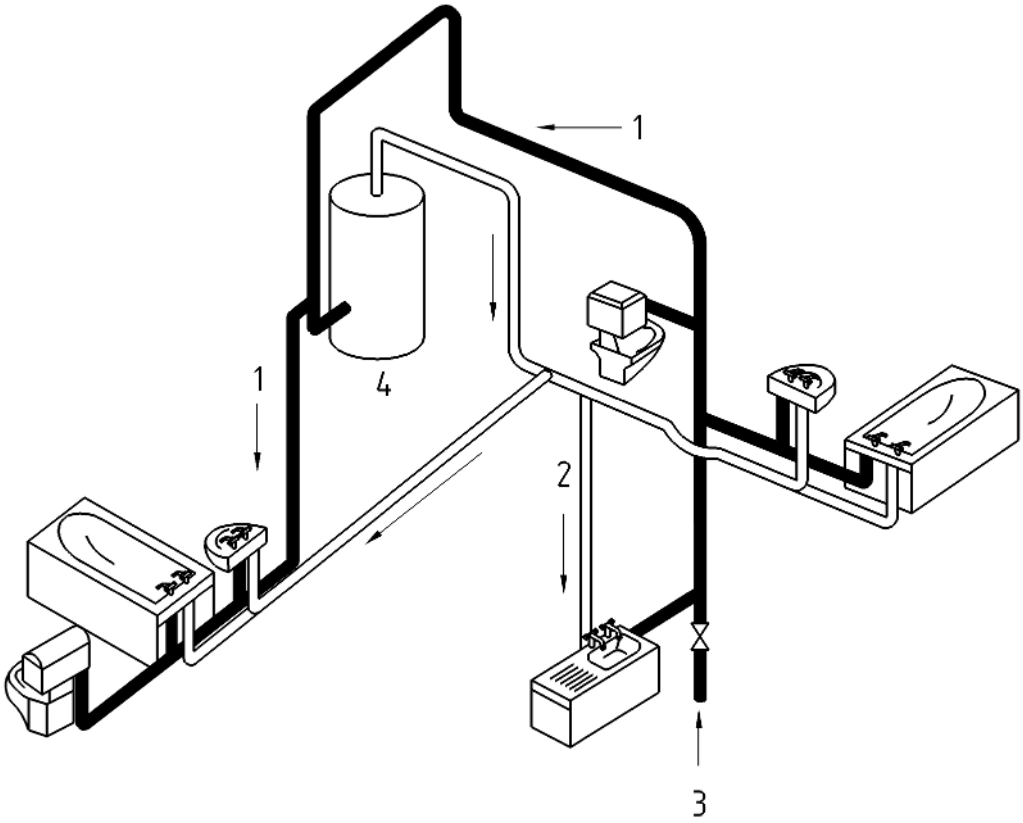
Table 2 — Conditions of use

Water supply system		Limits of use		Recommended limits of operation	
		Tapware with normally open or normally closed (monostable) solenoid valves	Tapware with latching (bistable) solenoid valves	Tapware with normally open or normally closed (monostable) solenoid valves	Tapware with latching (bistable) solenoid valves
Type 1 (see Figure 1)	Minimum dynamic pressure	0,05 MPa (0,5 bar)	0,05 MPa (0,5 bar)	(0,1 to 0,5) MPa [(1 to 5) bar]	(0,1 to 0,5) MPa [(1 to 5) bar]
	Maximum static pressure	1 MPa (10 bar)	1 MPa (10 bar)	1 MPa (10 bar)	0.8 MPa (8 bar)
Type 2 [a] (see Figure 2)	Minimum dynamic pressure	0,01 MPa (0,1 bar)	0,01 MPa (0,1 bar)	(0,01 to 0,2) MPa [(0,1 to 2) bar]	(0,01 to 0,2) MPa [(0,1 to 2) bar]
	Maximum static pressure	1 MPa (10 bar)	1 MPa (10 bar)	0.8 MPa (8 bar)	0.6 MPa (6 bar)
Temperature of the water		≤ 75 °C	≤ 75 °C	≤ 65 °C	≤ 65 °C

[a] For Type 2, the manufacturer is to declare the minimum operating pressure at which opening, closing and the specified flow rate can be obtained.

There is usually no acoustic classification for tapware used in supply systems of Type 2 and no specifications governing the level of noise emissions from these water installations. If supply pressures are such that excessive noise is generated it is recommended that pressure or flow regulators are fitted in the system. Or where practicable, tapware conforming to the appropriate acoustic classification are used.

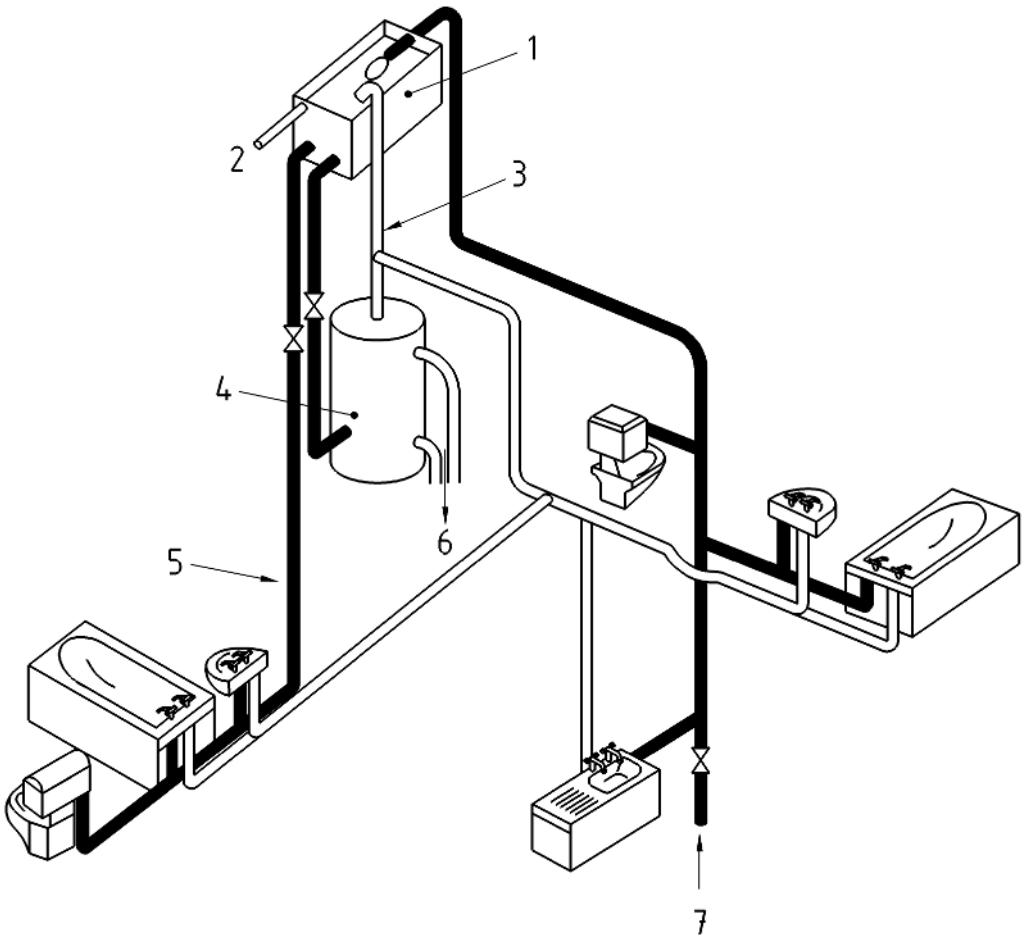
Annex B lists possible consequences of using a product outside its recommended operating range.



Key

1 cold water
2 hot water
3 mains supply pipe (Supply pressures from (0,05 to 1,0) MPa ((0,5 - 10) bar)
4 water heater

Figure 1 —Type 1 — Supply system with a pressure range of (0,05 to 1,0) MPa ((0,5 to 10) bar)



Key

1 cold water storage cistern (cover omitted for clarity)

2 warning pipe

3 vent pipe

4 hot water cylinder

5 alternative cistern fed cold supply to sanitary appliances

6 to boiler

7 mains supply pipe (Supply pressures up to 8 bar)

Figure 2 — Type 2 — Supply system with a pressure range of (0,01 to 0,8) MPa ((0,1 to 8) bar)

A vented domestic hot water and cold water supply system incorporating gravity hot water, mains cold water and alternative gravity cold water supply to sanitary appliances.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 31, *Wash basins — Connecting dimensions*

EN 35, *Pedestal bidets with over-rim supply — Connecting dimensions*

EN 36, *Wall-hung bidets with overrim supply — Connecting dimensions*

EN 246, *Sanitary tapware — General specifications for flow rate regulators*

EN 248, *Sanitary tapware — General specification for electrodeposited coatings of Ni-Cr*

EN 695, *Kitchen sinks — Connecting dimensions*

EN 997, *WC pans and WC suites with integral trap*

EN 12541:2002, *Sanitary tapware — Pressure flushing valves and automatic closing urinal valves PN 10*

EN 13407, *Wall-hung urinals — Functional requirements and test methods*

EN 13618, *Flexible hose assemblies in drinking water installations — Functional requirements and test methods*

EN 13959, *Anti-pollution check valves - DN 6 to DN 250 inclusive family E, type A, B, C and D*

EN 60335-1, *Household and similar electrical appliances — Safety — Part 1: General requirements (IEC 60335-1)*

EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529)*

EN 60730-2-8, *Automatic electrical controls for household and similar use — Part 2-8: Particular requirements for electrically operated water valves, including mechanical requirements (IEC 60730-2-8)*

EN 61000-6-1, *Electromagnetic compatibility (EMC) — Part 6-1: Generic standards — Immunity for residential, commercial and light-industrial environments (IEC 61000-6-1)*

EN 61000-6-3, *Electromagnetic compatibility (EMC) — Part 6-3: Generic standards — Emission standard for residential, commercial and light-industrial environments (IEC 61000-6-3)*

EN ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1)*

EN ISO 3822 (all parts), *Acoustics — Laboratory tests on noise emission from appliances and equipment used in water supply installations (ISO 3822, all parts)*

EN ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 1: General principles and requirements (ISO 5167-1)*

3 Terms and definitions

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

3.1
cold water
water with a temperature less than 25 C

3.2
hot water
water with a temperature between 52 °C and 75 °C

3.3
valve
electrically operated obturator for controlling the flow of water

3.4
normally open or normally closed (monostable) valve
obturation system continuously fed electrically while operated

3.5
latching (bistable) valve
obturation system electrically fed only for operating opening and closing

4 General requirements and testing

4.1 Marking

Tapware conforming to the requirements of this standard shall be permanently and legibly marked with:

— name or logo of the manufacturer;

— acoustic and flow-rate classes (if relevant);

— volume class for urinals (e.g. class 4 or class 6).

4.2 Materials

4.2.1 Chemical and hygienic requirements

All materials coming into contact with water intended for human consumption shall present no risk to health.

They shall not cause any change to the drinking water in terms of quality, appearance, smell or taste.

4.2.2 Exposed surface conditions

Visible chromium plated surfaces and Ni-Cr coatings shall comply with the requirements of EN 248.

4.3 Functions

Tapware shall be actuated as intended by the manufacturer i.e. as described in the manufacturer's instructions.

Tapware shall be tested so that all functions declared in the manufacturer's instructions are verified. The tests shall be conducted twice. The requirements of this standard are satisfied if all functions are completed satisfactorily.

4.4 Protection against pollution

When taps are equipped with check valves, these shall conform to EN 13959.

4.5 Electric characteristics and requirements

4.5.1 General

The tests described are type tests (laboratory tests), not quality control tests carried out during manufacture.

4.5.2 Electrical safety

Testing for electrical safety is to be conducted as described in the relevant standard(s). A list of relevant standards is listed below but is not necessarily exhaustive.

a) Low voltage specifications:

1) EN 60335-1.

b) EMC:

1) EN 61000-6-1.

2) EN 61000-6-3.

Tapware using radars shall comply with electromagnetic immunity and emission to relevant national standards waiting for European standards.

NOTE Equipment designed to emit and receive signals within the frequency range covered in the series of EN 61000 is subject to additional requirements while appropriate European Standard do not exist.

c) Protection of the Enclosure against ingress of water and dust:

The manufacturer shall declare the degree of protection of the product in accordance with EN 60529.

4.5.3 Electrical operation of solenoid valves

4.5.3.1 Marking

For the valves, marking shall include:

a) AC valves:

1) voltage;

2) power consumption (VA/W);

3) frequency (Hz).

b) DC valves:

1) voltage;

2) power consumption (W);

3) monostable or bistable.

4.5.3.2 Voltage

Solenoid valves shall be operated at less than 42 V and shall comply with the safety extra low voltage (SELV) requirements of EN 60730-2-8.

4.5.4 Electric strength and insulation resistance of the solenoid valve

Solenoid valves shall comply with EN 60730-2-8, where applicable.

4.5.5 Operational safety

4.5.5.1 Test procedure for mains operated tapware

The test is conducted with cold water.

Tapware intended for Type 1 water supply systems are operated at a dynamic pressure of (0,3 ± 0,02) MPa ((3 ± 0,2) bar).

Tapware intended for Type 2 water supply systems are operated at a dynamic pressure of (0,02 ± 0,005) MPa ((0,2 ± 0,05) bar).

Actuate the tap.

Cut off the electrical supply.

4.5.5.2 Requirements for mains operated tapware

The tapware shall always close.

4.5.5.3 Test procedure for battery operated tapware

The test is conducted with cold water.

The principle of the test consists of verifying that when the battery loses its charge, the tapware closes.

Tapware intended for Type 1 water supply systems is operated at a dynamic pressure of (0,3 ± 0,02) MPa ((3 bar ± 0,2) bar).

Tapware intended for Type 2 water supply systems is operated at a dynamic pressure of (0,02 ± 0,005) MPa ((0,2 ± 0,05) bar).

During testing the battery is replaced by an adapted power supply with adjustable voltage.

Beginning at 0,9 x U_n (battery nominal voltage).

a) Actuate the tap.

b) While the water is running, reduce the voltage by 0,1 V.

c) Wait until the tap closes or actuate the closure of the tap.

d) Repeat a), b), c) until the tap does not operate anymore.

4.5.5.4 Requirements for battery operated tapware

After finishing the test, the tap shall remain in closed position.

4.6 Leaktightness characteristics

4.6.1 General

The tests described are type tests (laboratory tests) and not quality control tests carried out during manufacture.

This subclause specifies test methods for verifying the leaktightness of electronic tapware and defines the corresponding requirements (see Table 4).

Tests are carried out with cold water.

4.6.2 Principle

The principle of the test consists of checking under cold water pressure the leaktightness of the tapware (body, head-body unit, etc.).

4.6.3 Apparatus

A hydraulic test circuit capable of supplying the required static and dynamic pressures and of maintaining them throughout the duration of the test.

4.6.4 Leaktightness of tapware upstream of the obturator

4.6.4.1 Procedure

Connect the tapware to the test circuit with the outlet orifice open, and generally turned downwards.

With the obturator closed, apply a static water pressure at the inlet of the tapware of (1,6 ± 0,05) MPa ((16 ± 0,5) bar) for (60 ± 5) s.

4.6.4.2 Requirements

Throughout the duration of the test there shall be no leakage at the obturator and no leakage or seepage through the walls.

4.6.5 Leaktightness of tapware downstream of the obturator with the obturator open

4.6.5.1 General

This test only applies to tapware (Clause 5) and urinal flushing valves (Clause 6).

4.6.5.2 Procedure

— Connect the tapware to the test circuit with the outlet orifice(s) artificially closed, and generally turned downwards;

— open the obturator(s);

— apply a static water pressure of (0,4 ± 0,02) MPa ((4 ± 0,2) bar) for (60 ± 5) s;

— test is to be repeated at a pressure of (0,02 ± 0,005) MPa ((0,2 ± 0,05) bar) for (60 ± 5) s.

4.6.5.3 Requirements

Throughout the duration of the test there shall be no leakage or seepage through the walls.

4.6.6 Leaktightness tests - Summary table

Summary of the leaktightness tests is given in Table 3.

Table 3 — Summary of leaktightness tests

Leaktightness of		Outlet	Pressure	Duration	Requirements
Tapware and urinal flushing valves	Upstream of obturator	Open	(1,6 ± 0,05) MPa ((16 ± 0,5) bar)	(60 ± 5) s	No leakage
	Downstream of obturator	Closed	(0,4 ± 0,02) MPa ((4 ± 0,2) bar)	(60 ± 5) s	
			(0,020 ± 0,002) MPa ((0,2 ± 0,02) bar)	(60 ± 5) s	
WC flushing valve		Open	(1,6 ± 0,05) MPa ((16 ± 0,5) bar)	(60 ± 5) s	

4.7 Pressure resistance characteristics - mechanical performance under pressure

4.7.1 General

This clause describes the test method that shall be carried out to verify the mechanical performance under high pressure and specifies the test criteria.

4.7.2 Principle

The principle is to detect any deformation of the tap which may occur using cold water under pressure. The test is carried out upstream of the obturator.

Valves submitted to the tests specified in 4.7.4 shall not be used for other tests.

4.7.3 Apparatus

The apparatus is described in 4.6.3.

4.7.4 Procedure

Connect the tapware to the test circuit.

With the obturator closed apply a static water pressure of (2,5 ± 0,05) MPa ((25 ± 0,5) bar) for (60 ± 5) s.

4.7.5 Requirements

There shall be no permanent deformation in the any part of the tapware upstream of the obturator.

Seepage is permissible.

5 Requirements and testing for tapware

5.1 Scope

The following subclauses specify the requirements for electrically or electronically operated opening and closing taps used with sanitary appliances installed in toilets, bathrooms and kitchens.

It is not applicable to WC/urinal flushing valves, mechanical single/combination taps and automatic shut-off valves.

The conditions of use are given in Table 2.

5.2 Dimensional characteristics

5.2.1 General

General comment on drawings:

The design and construction of components without defined dimensions permit various design solutions to be adopted by the manufacturer.

Special cases are covered in 5.2.10.

5.2.2 Tap with visible body for horizontal surfaces

The standardized dimensions of electronic opening and closing tapware (see Figure 3 and Table 4) shall:

— facilitate their mounting and interchangeability on sanitary appliances complying with EN 31, EN 35, EN 36, and EN 695;

— provide various options for connecting to the water supply.

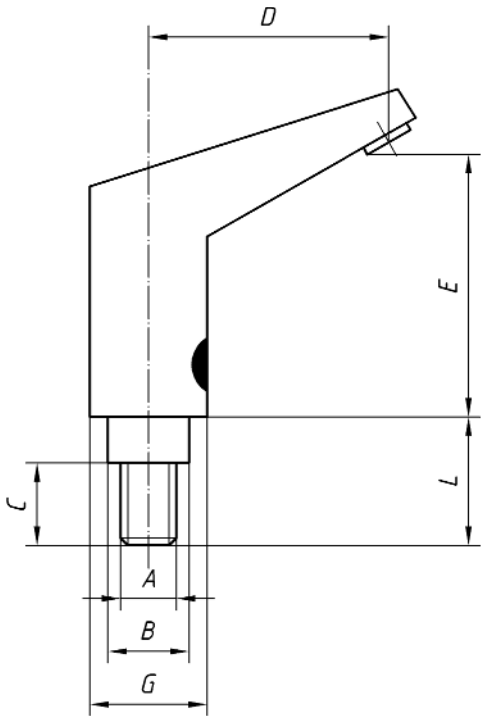


Figure 3 — Tap with visible body for horizontal surface

Table 4 — Dimensions

Dimension	Values mm	Comments
A	G 1/2 B or G 3/4 B	
B	29 max.	
C	11 min.	
D	90 min.	Dimension from the centre of the outlet orifice as supplied.
E [a]	25 min.	Dimension from lowest point of the outlet orifice to the mounting surface for taps intended for Type 1 supply systems and taps intended for Type 2 supply systems – except sinks.
G	45 min.	Smallest dimension of the tap base
L	Value that enables the tapware to be mounted on a support between 1 mm and 18 mm in thickness and connected to the water supply.	
[a] Larger dimensions may be required per national regulatory provisions.		

NOTE Supply by flexible hose complying with EN 13618 is permitted.

5.2.3 Taps with visible body for mounting on vertical surfaces

The standardized dimensions of electronic opening and closing tapware (see Figure 4 and Table 5) shall:

— comply with Figure 4 and Table 5 in the case of inlet dimensions;

— provide various options for connecting to the water supply.

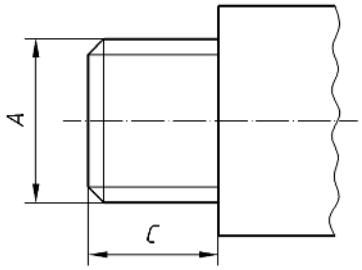


Figure 4 — Threaded inlets of taps with visible body for mounting on vertical surfaces

Table 5 — Dimensions of threaded inlets

Dimension	Values (mm)	
A	G 1/2 B	G 3/4 B
C	11 min.	13 min.

5.2.4 In-line tapware with threaded inlet and outlet

5.2.4.1 Inlets and outlets aligned

The standardized dimensions of electronic opening and closing tapware (see Figure 5 and Table 6) shall:

— comply with Figure 5 and Table 6 in the case of inlet dimensions;

— provide various options for connecting to the water supply.

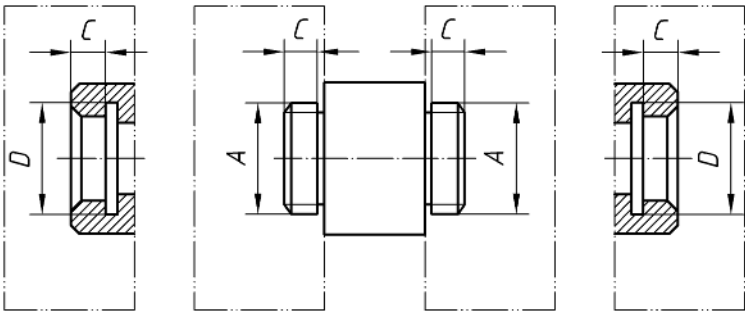


Figure 5 — Tapware with inlets and outlets aligned

5.2.4.2 Inlets and outlets at right angles

The standardized dimensions of electronic opening and closing tapware (see Figure 6 and Table 6) shall:

— comply with Figure 6 and Table 6 in the case of inlet dimensions;

— provide various options for connecting to the water supply.

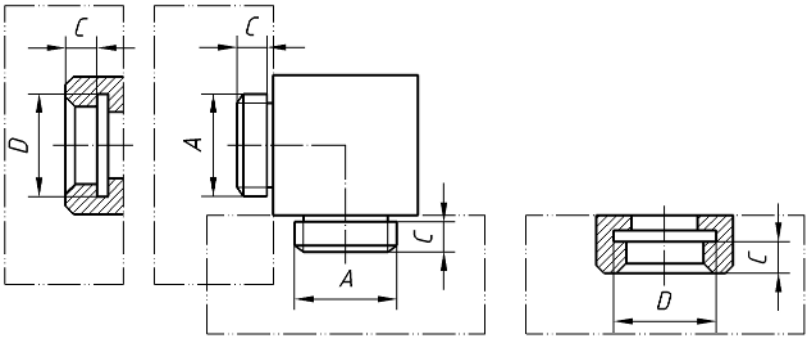


Figure 6 — Tapware with inlets and outlets at right angles

Table 6 — Dimensions of threads

Dimension	Values mm	
A (male)	G 1/2 B	G 3/4 B
D (female)	G 1/2	G 3/4
C	8 min.	10 min.

In the event of a different inlet and outlet size the nominal size is that of the inlet, and the outlet size shall be stated (e.g. In-line tapware G 1/2 B male with female outlet G 3/4 with inlet and outlet aligned).

5.2.5 Concealed tapware for vertical surfaces

The dimensions are left to the discretion of the manufacturer.

5.2.6 Mixing valves for horizontal surface

5.2.6.1 General

The standardized dimensions of electronic opening and closing mixing valves (see Figure 7, Figure 8 and Table 7) shall:

— facilitate mounting and interchangeability on sanitary appliances complying with EN 31, EN 35, EN 36, and EN 695;

— provide various options for connecting to the water supply.

5.2.6.2 Supply by tube

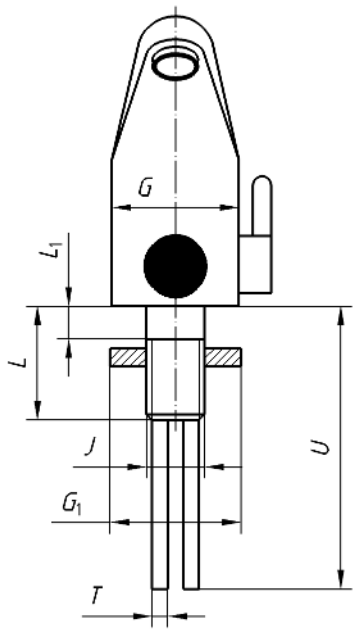


Figure 7 — Mixing valves for horizontal mounting threaded inlet

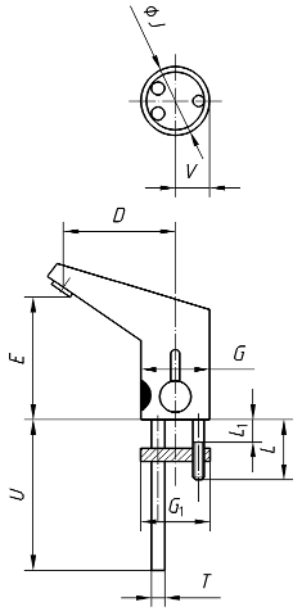


Figure 8 — Mixing valves for horizontal mounting, stud connection

Table 7 — Dimensions of mixing valves

Dimension	Values mm	Comments
D	90 min.	Dimension from the centre of the outlet orifice, to the center of axis J, with or without flow rate regulator, as supplied
E [a]	25 min.	Vertical distance from the lowest point of the outlet orifice, to the mounting surface of the tap
G	45 min.	Dimension of base or flange
G_1	50 max.	Diameter of clamping washer
J	33,5 max.	The 2 supply pipes and the fixing device shall fit into a circle of diameter J.
L and L_1	Value that enables the tapware to be mounted on a support from 1 mm to 18 mm thickness.	
T	Copper tube ø 10 Or: Hose in accordance with EN 13618 with:	Plain or G 3/8 female thread or G3/8 B male or G 1/2 female thread or G1/2 B male Plain end exterior ø 10 or with G 3/8 (male or female thread) or G1/2 (male or female thread)
U	350 min.	May be reduced down to 220 subject to agreement between the manufacturer and the customer
V	32 max.	Maximal dimension of projection to rear measured from axis of diameter *J*
[a] Larger dimensions may be required per national regulatory provisions.		

5.2.6.3 Supply by flexible hose

Supply hoses shall comply with the requirements of EN 13618.

5.2.7 Mixing valves with visible body for mounting on vertical surfaces with captive nuts and eccentric unions

The standardized dimensions of electronic opening and closing tapware (see Figure 9 and Table 8) shall:

— inlet dimensions of mixing valves shall comply with Figure 9 and Table 8;

— provide the various options for connecting to the water supply.

5.2.8 Mixing valves with opposed inlets

The standardized dimensions of electronic opening and closing tapware shall:

— inlet dimensions of mixing valves with opposed inlets comply with Figure 10 and Table 8 in the case of inlet dimensions of mixing valves with opposed inlets;

— provide various options for connecting to the water supply.

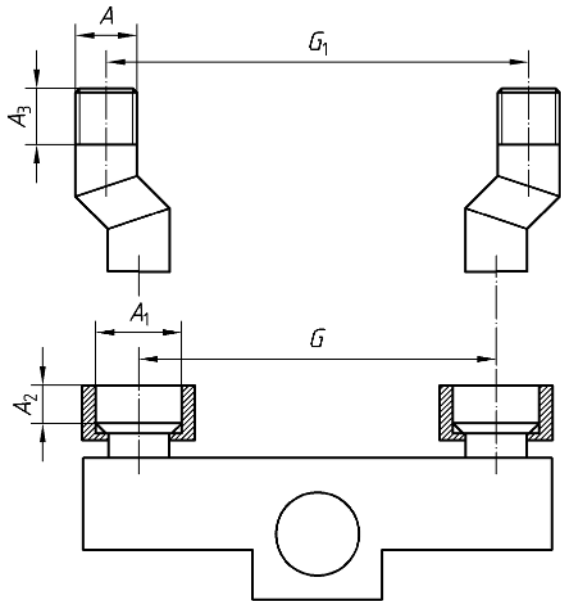


Figure 9 — Mixing valve with captive nuts and eccentric unions

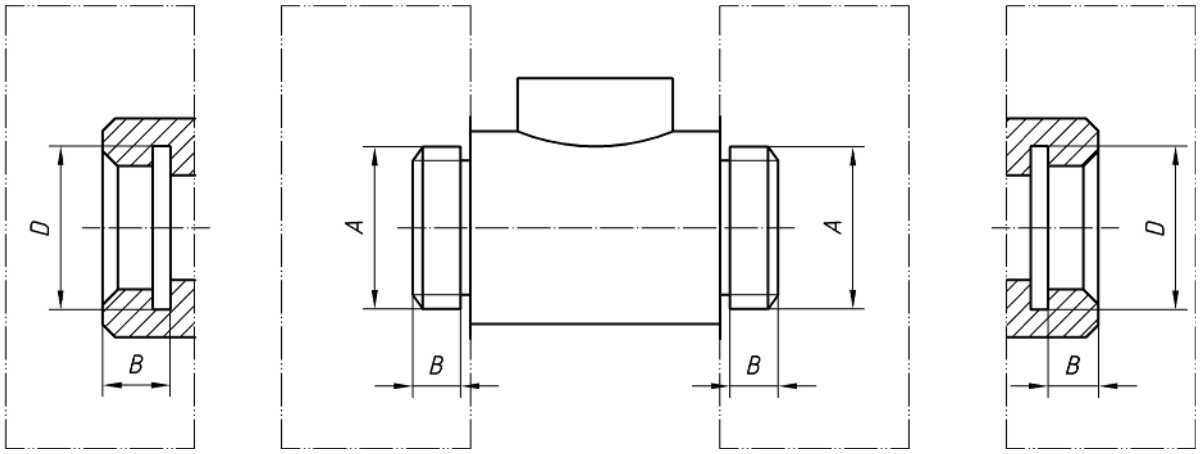


Figure 10 — Mixer with opposed inlets

Table 8 — Dimensions

Dimensions	Values mm	Comments
A [a]	G 1/2 B	EN ISO 228-1
A_1	G 3/4	EN ISO 228-1
A_2	9 min.	Useful length of thread (excluding washer)
A_3	15 min.	Useful length of thread
B	15 min.	Useful length of thread
D	G 1/2	EN ISO 228-1
G_1	(140 to 160)	Extension of this range is permitted
G	150 ± 1	
[a] It is permitted to serrate or knurl this thread to assist the retention of sealing tape or compounds. In such cases, the lower deviation tolerance on the basic major diameter indicated in EN ISO 228-1 may be increased to – 0,35 mm. Use of deformable washers is permissible.		
NOTE Other dimensions are permissible (for replacement) when market tradition requires it, provided the manufacturer specifies the actual dimensions in literature to avoid confusion with the standard dimension – which can be achieved using an excentric connection.		

5.2.9 Nozzle outlets for use with flow rate regulators

Nozzle outlets to accept flow rate regulators shall be in accordance with EN 246.

Nozzle outlets not in accordance with EN 246 are covered by 5.2.10.

5.2.10 Special cases

Tapware intended for special applications e.g. for installation on sanitary appliances not conforming with European Standards or where dimensional interchangeability is not a requirement may incorporate dimensional deviations, provided:

— all other requirements of this standard are satisfied;

— secure fixing to the mounting surface is provided with all fixing holes covered;

— thread connection to the supply pipes complies with EN ISO 228-1;

— suitable air gap dimension or a backflow prevention device is provided.

The manufacturer's literature including the installation instructions supplied with the tapware shall indicate clearly that the tapware has unique characteristics e.g. not standard dimensions.

5.3 Hydraulic characteristics

5.3.1 General

The tests described are type tests (laboratory tests), not quality control tests carried out during manufacture.

This clause gives a test method for measuring the flow rate and the cross-flow between the hot and cold water supply for a given pressure.

5.3.2 Test apparatus for tapware intended for Type 1 water supply systems

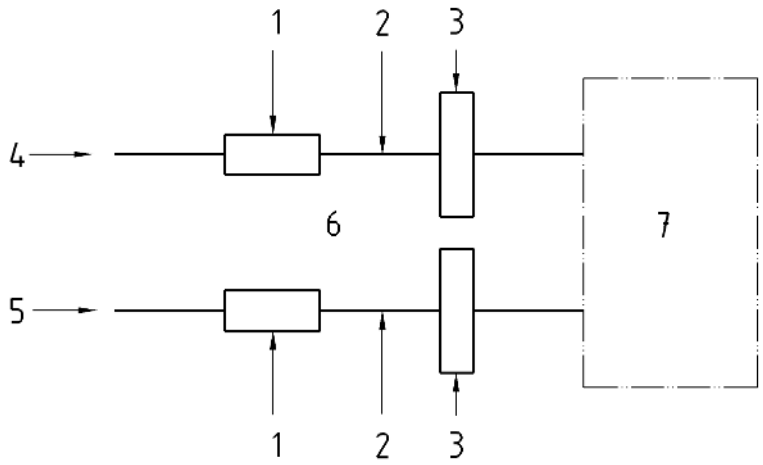
5.3.2.1 General

This comprises:

— two supply circuits (hot water and cold water inlets) (see Figure 11);

— test circuit (see Figure 12).

5.3.2.2 Supply circuits type 1



Key

1 pressure regulator
2 piping
3 flow rate measurement
4 cold water inlet
5 hot water inlet
6 supply circuits
7 sample to be tested

Figure 11 — Supply circuits

Each circuit comprises of:

— device (1) for obtaining the required pressures;

— piping (2) of appropriate cross-section for the flow to be obtained;

— device (3) for measuring the flow rate.

5.3.2.3 Test circuit Type 1

Each inlet to the tap or mixing valve comprises:

a) piping made from a rigid metal tube, of diameter and length in accordance with the dimensions in Table 9;

b) reinforced flexible hoses, 500 mm long with a minimum internal diameter equal to that of the rigid metal tube, with a device for connecting to the tapware;

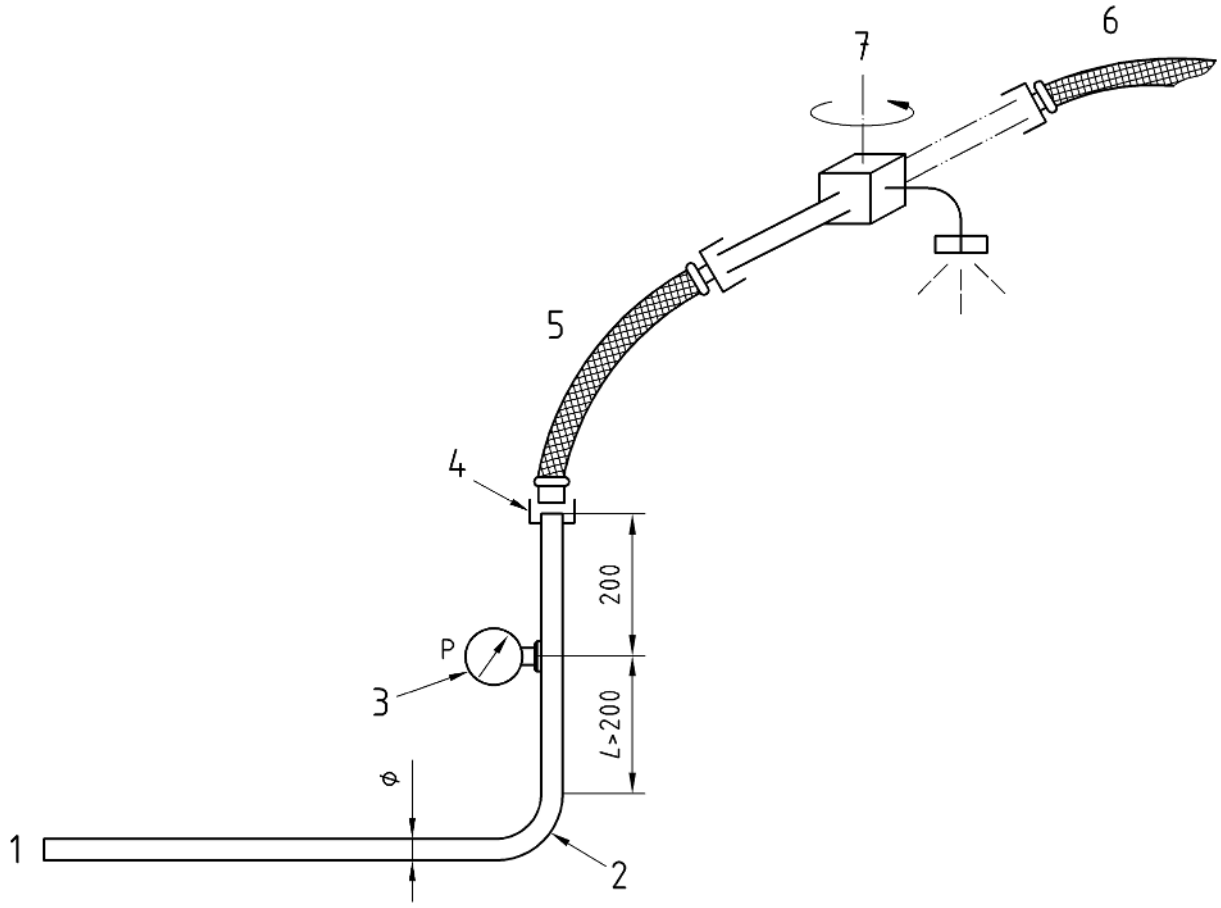
c) device for measuring the flow rates (measurement accuracy ± 2 %);

d) device to connect the piping to the supply circuit;

e) pressure take-off tee for measuring the pressure at the inlets of the mixing valves (measurement accuracy ± 1 %);

f) system for recording the test conditions and results is appropriate.

Dimensions in millimetres



Key

1 connection to supply circuit
2 metal tube
3 pressure taping
4 connection
5 hot water inlet
6 cold water inlet
7 mixing device

Figure 12 — Test circuits for tapware intended for Type 1 water supply systems

Table 9 — Dimensions of pipework

Connection dimension of tapware	Internal diameter (mm)	Union Nut
1/2	13 min.	G 1/2
3/4	20 min.	G 3/4

5.3.2.4 Pressure take-off tees

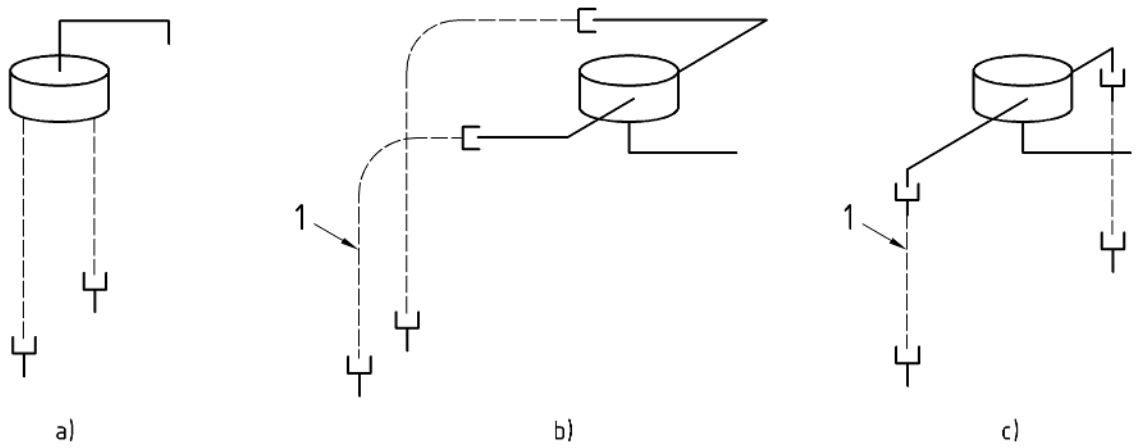
The pressure take-off tees shall be the individual type or the annular slit type (see Annex A).

5.3.2.5 Mounting of single taps intended for Type 1 water supply systems

Only the cold water supply shown in Figure 11 is used for the tests.

5.3.2.6 Mounting of mixing valves intended for Type 1 water supply systems

Depending on the type of mixing valve, one of the mounting arrangements shown in Figure 13 shall be used:



Key

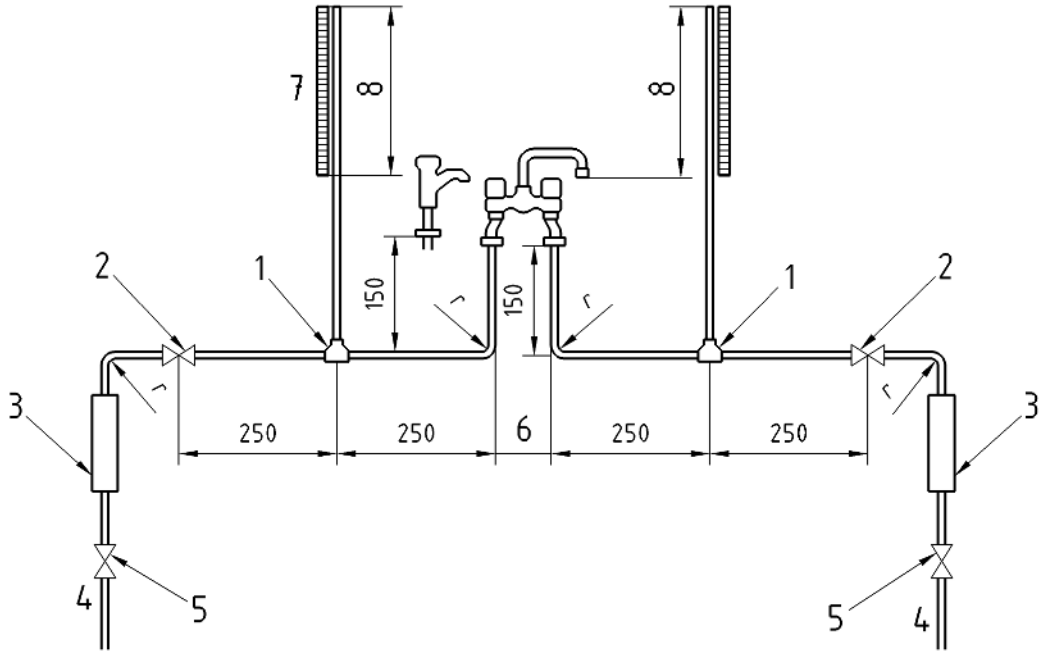
1 flexible hose

Figure 13 — Mounting of mixing valves

5.3.2.7 Test apparatus for tapware intended for Type 2 supply systems

A test rig as shown in Figure 14 shall be used.

Dimensions in millimetres



Key

1 pressure take-off tee
2 control valve
3 flow meter
4 cold supply
5 stop valve
6 centres to suit tap assemblies
7 pressure gauge (Manometer)
8 1 020 mm of water [0,01 MPa (0,1 bar)]

Figure 14 — Flow rate test apparatus for taps intended for type 2 supply systems

NOTE The tube ends are straight, without burrs and inserted to the full depth of dimension A in the pressure take-off tee.

5.3.3 Principle of the flow test

Measurements are carried out on tapware intended for Type 1 supply systems - as supplied e.g. with any accessory fitted.

Measurements are carried out on tapware intended for Type 2 supply systems - with any detachable check valve element, flow rate regulator, etc. removed.

The test is carried out with cold water:

— at a dynamic pressure of (0,3 ± 0,02) MPa ((3,0 ± 0,2) bar) for tapware intended for Type 1 supply systems;

— at a dynamic pressure of (0,01 ± 0,002) MPa ((0,1 ± 0,02) bar) for tapware intended for Type 2 supply systems.

Mixing valves are tested in the hot, cold and mid blend positions with cold water.

The least favourable values are recorded.

The tapware is to be operated following the manufacturer's instructions.

5.3.4 Requirements

The flow rate when fully open and supplied under the conditions specified in 5.3.3 shall comply with the requirements specified in Table 10.

Table 10 — Minimum flow rates and test pressures according to application

Supply system	Taps for supply system Type 1	Taps for supply system Type 2
Test pressure	(0,3 + 0,02) MPa ((3 + 0,2) bar)	(0,01 + 0,002) MPa ((0,1 + 0,02) bar)
Min. flow rate for wash-basin taps	Mixing taps: 4,0 l/min	Mixing taps: 3,0 l/min
	Single taps: 1,5 l/min	Single taps: 1,5 l/min
Test pressure	(0,3 + 0,02) MPa ((3,0 + 0,2) bar)	(0,01 + 0,002) MPa ((0,1 + 0,02) bar)
Min. flow rate for shower [a]	9,0 l/min	4,7 L/min
Other applications	to suit application	to suit application
[a] This is not intended for the shower system.		

5.3.5 Cross flow between hot and cold water

5.3.5.1 Principle

If the mixing device is placed upstream of the solenoid valve, a device to prevent cross flow between hot and cold water is mandatory.

If the mixing device is placed downstream of the solenoid valve, a device to prevent cross flow between hot and cold water is not mandatory.

Such devices may be incorporated into the mixing valve itself, or supplied separately.

5.3.5.2 Procedure

The test is conducted using cold water.

Connect one inlet of the mixing valve to the test circuit.

With the outlet orifice open and obturator closed, apply a water pressure of (0,4 ± 0,02) MPa ((4 ± 0,2) bar) to the mixing valve for (60 ± 5) s for the full operating range of the temperature adjustment device.

Repeat the test with the other water inlet of the mixing valve connected to the test circuit.

5.3.5.3 Requirements

For the duration of the test, there shall be no leakage or seepage at the outlet or at the end of the unconnected inlet.

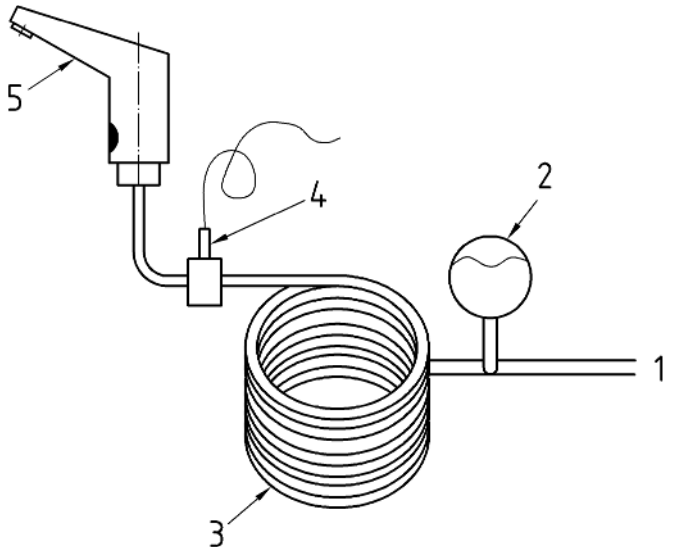
5.4 Water hammer

5.4.1 Principle of water hammer test

The principle is to verify, that the peak of pressure is limited when the tap closes. This applies only to devices intended for use on water systems of Type 1.

5.4.2 Test apparatus

A test rig as described in Figure 15 is to be used:



Key

1 Supply by pump with variable speed drive at a static pressure of (0,5 $^{+0}_{-0,02}$) MPa ((5 $^{+0}_{-0,2}$) bar)

2 Air vessel of 5 l capacity half-filled with air at a static pressure of 0,5 MPa (5 bar)

3 Supply circuit comprising 9 m of copper pipe (see Table 11) wound into a coil of 260 mm internal radius minimum or composed of straight lengths incorporating a maximum of 5 bends with an internal radius greater than 260 mm

4 Pressure tee complying with EN ISO 5167-1 with pressure sensor capable of measuring 0 MPa (0 bar) to 2,0 MPa (20 bar) with a frequency of more than 5 kHz; the recording shall be made at a frequency exceeding 1 kHz

5 Tap to be tested

Figure 15 — Test rig for water hammer test

Table 11 — Dimensions of the supply pipe for water hammer test

Application	Dimension (ID x OD)
Wash basin	13 × 15
Shower	20 × 22

5.4.3 Procedure

The supply circuit shall deliver cold water at a static pressure of (0,5 $^{+0}_{-0,02}$) MPa ((5 $^{+0}_{-0,2}$) bar), with a pump with variable speed.

Procedure of filling of the air vessel in order to fill it at 50 % air:

a) depressurize the test rig;

b) fill the vessel with compressed air to 0,25 MPa (2,5 bar);

c) pressurize the rig with water at 0,5 MPa (5 bar) by regulating the pump speed:

1) connect the sample (5) at the test rig, directly after the pressure tee (4);

2) open the tap at minimum 5 times in order to completely de-aerate the circuit;

3) adjust the static pressure at 5 bar;

d) disable speed regulation of pump;

e) operate the tap 5 s in order to stabilize the pressure, record the pressure and the flow rate;

f) allow the tap to close, whilst continually recording the pressure.

If a mixing valve is being tested, both inlets are connected, and the test is conducted at full cold, full hot and mid-blend positions.

Follow the procedure 3 times.

5.4.4 Requirements

The average of the 3 tests of the peaks of pressure for each position (hot, cold, mid-blend) between the maximum pressure on closure and the static pressure of 5 bar (0,5 MPa) shall be less than or equal to 0,3 MPa (3 bar).

5.5 Endurance

5.5.1 General

The test described is a type test (laboratory tests) not a quality control tests carried out during manufacture.

This clause specifies a method for testing the mechanical endurance or wear resistance of the moving parts and specifies the corresponding requirements.

5.5.2 Principle

The principle of the test is to subject the tapware to a specified number of operations to ensure its behaviour over an extended period of time.

Tests are carried out at a static pressure of (0,4 ± 0,05) MPa ((4 ± 0,5) bar).

The test is carried out operating the tapware in accordance with the manufacturer's instructions. The system shall be adapted to suit the type of tapware under test.

Tapware is to be tested as supplied.

5.5.3 Procedure for single taps

Mount the tap on the test machine and connect a cold water supply circuit that shall be capable of delivering water at a static pressure of (0,4 ± 0,05) MPa ((4 ± 0,5) bar).

The tap shall be opened and allowed to close using its normal mode of operation.

The opening and closing cycle shall be repeated 200 000 times.

If the tap is battery operated, the battery can be changed during the test. The number of times the battery is changed shall be recorded.

5.5.4 Procedure for mixers

Mount the tap on the test machine and connect the cold water supply circuit with cold water and the hot water supply with water at a temperature of (65 ± 2)°C.

With the mixer closed, adjust the hot and cold water pressures upstream of the mixer to (0,4 ± 0,05) MPa ((4 ± 0,5) bar).

The following cycle shall be repeated 70 000 times:

1) adjust the temperature setting device in the mid blend position, mixer closed;

2) actuate the tap;

3) while tap flowing, adjust the temperature setting device to the cold position in approximately 1,5 s;

4) await end of flow;

5) wait for 5 s;

6) actuate the tap;

7) while tap flowing, adjust the temperature setting device to the hot position in approximately 3 s;

8) await end of flow;

9) wait for 5 s;

10) actuate the tap;

11) while tap flowing, adjust the temperature setting device to the mid blend position in approximately 1,5 s;

12) await end of flow;

13) wait for 5 s.

The tap shall be opened and allowed to close using its normal mode of operation.

If the tap is battery operated, the battery can be changed during the test. The number of times the battery is changed shall be recorded.

5.5.5 Requirements

For the duration of the test, no component shall break and the tapware shall continue to operate.

After the total amount of cycles, verify that:

— when tested as specified in 4.6, leaktightness is maintained.

5.6 Acoustic characteristics

5.6.1 General

The tests described are type test (laboratory tests) not quality control tests carried out during manufacture.

This clause specifies the test method for classifying electronic tapware by acoustic group (I, II or not classified), and where applicable an indication of the flow rate class (A, S, B, C or D, Z) used to determine the acoustic group, for tapware intended for use in supply systems of type 1.

5.6.2 Procedure

5.6.2.1 Mounting and operating conditions for tapware

The mounting and operating conditions shall be as specified in EN ISO 3822-2.

5.6.2.2 Test method

The tests are carried out in accordance with EN ISO 3822-1, EN ISO 3822-2 and EN ISO 3822-4.

5.6.3 Requirements

5.6.3.1 Expression of results

The results of the measurements taken in accordance with EN ISO 3822-1 through EN ISO 3822−4 are expressed by the acoustic level of the tapware L_{ap} in dB(A).

5.6.3.2 Determination of the acoustic group

The acoustic group is determined by the value of 'L_{ap}' obtained at a flow pressure of 0,3 MPa (3 bar). The tapware is classified in acoustic group I, II or U as shown in Table 12:

Table 12 — Acoustic groups

Group	L_{ap} (dB(A))
I	$L_{ap} \leq 20$
II	$20 < L_{ap} \leq 30$
U (Not classified)	$L_{ap} > 30$

The acoustic test is not obligatory. Tapware not tested can be certified under the designation "not classified" and will be considered to have a L_{ap} of greater than 30 dB(A).

5.6.3.3 Flow classes

If the tapware has a flow rate restrictor conforming to EN 246, the measurement is carried out without these fittings as these are subject to special acoustic measurements. In such cases, the supplied flow rate restrictor is replaced by a calibrated flow rate restrictor.

If the tapware has a special outlet fitting, the tests are carried out with the tapware as delivered by the manufacturer.

For tapware with no outlet fitting (shower attachment outlet for example), the tests are carried out by replacing this fitting with a hydraulic resistance with calibrated flow rate in accordance with the annexes of EN ISO 3822-4.

Hydraulic resistances tested alone are defined in six classes as a function of their calibrated flow rate at 0,3 MPa (3 bar) as specified in Table 13:

Table 13 — Classes of flow rate

Classes	Flow rate l/s
Z	0,15
A	0,25
S	0,33
B	0,42
C	0,50
D	0,63

If relevant, tapware is allocated to the flow rate class which corresponds to the flow rate of the hydraulic resistance with calibrated flow rate with which it is tested.

6 Requirements and testing for flushing valves for urinals

6.1 Scope

These subclauses specify the requirements for electrically or electronically operated opening and closing flushing valves for urinals.

They are not applicable to mechanical or electric/electronic opening and closing single/combination taps, automatic shut-off valves and WC flushing valves.

The conditions of use are given in Table 2.

6.2 Definitions

6.2.1 Single flush urinal valves

These are intended for wash-down flushing urinal valves (see EN 13407).

6.2.2 Siphon action flushing urinal valves

These are intended for flushing siphonic action urinals (see EN 13407).

6.2.3 Isolating valves for flushing urinal valves

Devices that can be used to stop or regulate the flow of water can be integrated with the urinal flushing valve or be separated.

6.3 Classification of flushing urinal valves

Urinal flushing valves are classified as defined in Table 14.

Flushing valves with flush time/flush water volume control may satisfy the requirements of several volume classes. In this case several classes may be declared.

National Regulations exist in some EU member states that set maximum flush volumes that are lower than those indicated in the European standard.

Table 14 — Classification

Volume class	Volume delivered (min.)	Volume delivered (max.)
1,5	0,75 L	1,5 L
4	2 L	4 L
6	3 L	6 L

6.4 Designation

A urinal flushing valve is designated by:

— type of appliance for which it is intended (Siphon action urinal, single flush urinal…);

— volume class (e.g. class 1,5 or 4, etc.);

— mounting method (top-entry, side-entry...);

— its nominal DN size;

— its connecting dimension of inlet and outlet;

— eventual presence of integral isolating valve.

6.5 Dimensional characteristics

Connecting threads shall comply with the dimensions specified in Table 15 (see Figures 16 and 17).

Table 15 — Threads

Dimensions	Designation	Values (mm)	
DN	Nominal size	15	20
A [a]	Male thread (EN ISO 228-1)	G1/2B	G3/4B
D [a]	Female thread (EN ISO 228-1)	G1/2	G1/2
C min	Useful thread length	8	10
L min	Male thread	11	13
F min	Female thread	10	12

[a] If the urinal connecting pipe is supplied with the valve, dimensions A and D are not mandatory at the outlet.

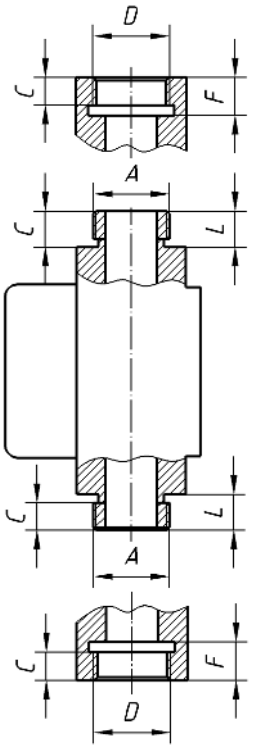


Figure 16 — Top-entry urinal flushing valve

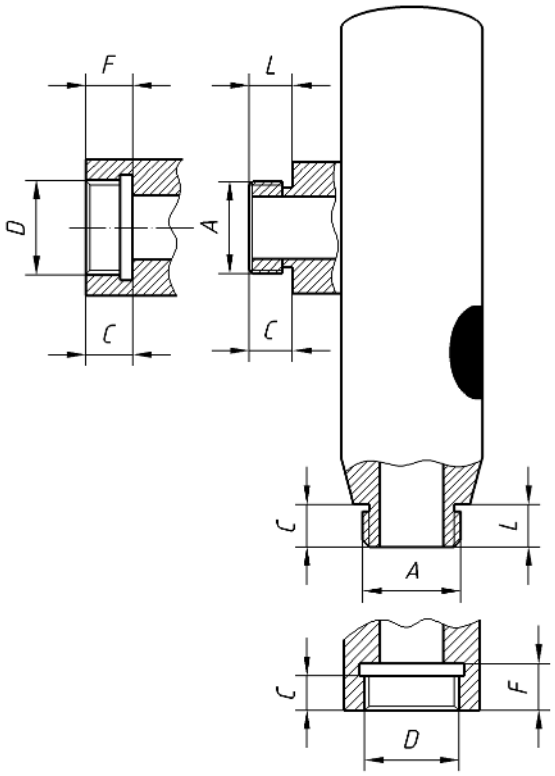


Figure 17 — Side-entry urinal flushing valve

6.6 Hydraulic characteristics

6.6.1 General

This clause specifies a test method for measuring at a given pressure:

— flow rate;

— volume of flush water delivered.

6.6.2 Test method

6.6.2.1 Test apparatus

The test rig comprizes that part illustrated by element I of the apparatus specified in EN 12541:2002, Figure 6.

6.6.2.2 Test methodology

Open the urinal flushing valve 5 times in order to completely de-aerate the circuit. Use cold water.

Have the flushing valve operated, following the operating mode.

The adjustment of the flow rate can be made in operating the isolating valve if it exists. If the flushing valve is supplied with an automatic flow mechanism it will be tested as delivered.

The measurement is taken from the start of activation.

Measuring may be made by simultaneous recording of pressure and flow rate as a function of time.

The volume may be measured by continually recording the flow rate curve.

6.6.2.3 Requirements

The flow rate and volume of flush shall comply with the values specified in Table 16.

Table 16 — Flow rate

DN	Class	Designation	Dynamic pressure	Q(l/s) ≥	V min (l) ≥	V max (l) ≤
15	1,5	Single flush with siphon Low flow rate	(0,1 $^{0}_{+0,01}$) MPa ((1 $^{0}_{+0,1}$) bar)	0,15	0,75	1,5
15	4	Single flush with siphon High flow rate		0,3	2	4
		Siphon action				
20	6	Siphon action		0,5	3	6

6.7 Measurement of water hammer for urinal flushing valves

6.7.1 Principle of water hammer test

The principle is to verify that the peak of pressure is limited, when a flushing valve closes.

6.7.2 Test apparatus

6.7.2.1 General

A test rig as described in Figure 15 is used.

6.7.2.2 Procedure of choice of pipe sizing

Select the size of the supply pipe (2) according to Table 17 using the flow rate value (Q in l/s) according to Table 16.

Table 17 — Dimension of the supply pipe

DN ≤ to	Q **l/s** ≤ to	D **int**	**Pipe**
15	0,15	13	13 X 15
15	0,3	20	20 X 22
20	0,5	20	20 X 22

6.7.3 Procedure

The supply circuit shall deliver cold water at a static pressure of (0,5 $^{+0}_{-0,02}$) MPa ((5 $^{+0}_{-0,2}$) bar), with a pump with variable speed.

Procedure of filling of the air vessel in order to fill it at 50 % air:

a) depressurize the test rig;

b) fill the vessel with compressed air to 2,5 bar (0,25 MPa);

c) pressurize the rig with water at 5 bar (0,5 MPa) by regulating the pump speed;

   1) connect the sample (5) at the test rig, directly after the pressure tee (4);

   2) open the tap at minimum 5 times in order to completely de-aerate the circuit;

   3) adjust the static pressure at 5 bar (0,5 MPa);

d) disable speed regulation of pump;

e) operate the flushing valve 5 s in order to stabilize the pressure, record the pressure and the flow rate;

f) allow the flushing valve to close, whilst continually recording the pressure.

Repeat the tests 3 times.

If a flow rate adjustment device has been set as indicated in 6.6.2.2, it will not be modified, unless if the flow rate exceeds 0,6 l/s . In this case, the flow rate shall be adjusted to 0,6 l/s.

6.7.4 Requirements

The average of the peaks of pressure between the maximum pressure recorded during closure and the static pressure 0,5 MPa (5 bar) shall not exceed 0,3 MPa (3 bar).

6.8 Mechanical endurance

6.8.1 General

The test described is a type test (laboratory test), not a quality control test carried out during manufacture.

This clause specifies a test method for verifying the mechanical endurance or resistance to wear of the mechanical elements of urinal flushing valves.

The test consists of subjecting a urinal flushing valve to a specified number of operations in order to establish its behaviour over time.

Tests are carried out at a dynamic pressure of (0,25 ± 0,02) MPa ((2,5 ± 0,2) bar) with cold water.

6.8.2 Apparatus

A suitable test rig and water supply circuit to allow normal operation of the flushing valve within the parameters described.

6.8.3 Procedure

Connect the flushing valve to be tested to the water supply circuit, adjusted to deliver cold water at a dynamic flow pressure of (0,25 ± 0,02) MPa ((2,5 ± 0,2) bar):

— operate the flushing valve and measure the rate of flow whilst the flush is being delivered;

— measure also the volume of flush water delivered – which shall comply with one of the values specified in Table 16;

— wait until 2 s after the flow has stopped;

— subject the flushing valve to 70 000 flushing cycles;

— if the valve is battery operated, the battery can be changed during the test; the number of times the battery is changed shall be recorded.

6.8.4 Requirements

— Flow rate shall still comply with the appropriate minimum requirement specified in Table 16;

— flush volume measured under the same supply conditions as those specified for the test shall not vary by more than 25 % from the volume delivered initially;

— requirements of 4.6 (leaktightness) shall be maintained.

7 Requirements and testing for flushing valves for WCs

7.1 Scope

These subclauses specify requirements for electrically or electronically operated opening and closing WC flushing valves which are intended to be connected directly to a mains water supply pipe.

It is not applicable to mechanical or electric/electronic opening and closing single/combination taps, automatic shut-off valves, urinal flushing valves, and WC boxes (cisterns).

The conditions of use are given in Table 2.

NOTE These products are not permitted in all EU countries.

7.2 Definitions

7.2.1 WC flushing valve.

Valve, with electronic control of opening and closing, capable of supplying flush water so that a WC complying with EN 997 will be cleaned.

7.2.1.1 Servo-operated hydraulic flushing valve.

Hydraulic, self-actuation flushing valve according to EN 12541, where opening and closing operation is carried out by relieving pressure on a valve piston with a magnetic pilot valve, the amount of flushing water is controlled mechanically by limiting the stroke of the valve piston.

7.2.1.2 Directly operated flushing valve.

A flushing valve that closes time-controlled and where opening and closing operation are controlled by a magnetic valve in direct flow of media, the amount of flushing water is controlled by a set flushing time.

7.2.2 Stop valve for a WC flushing valve.

Device used to stop the flow upstream of a flushing valve. Such devices may be supplied as an integral part of a flushing valve, or as a separate component.

7.2.3 Flow control equipment.

Manually set or automatically operated mechanism supplied integrally with either the flushing valve or with the stop valve to regulate the flow of water.

If a flow control device is supplied as part of a stop valve, the stop valve shall not be connected to the flushing valve by a thread complying with EN ISO 228-1.

7.2.4 Volume control.

Mechanism or electronic function that can be adjusted to regulate the flush volume delivered.

7.3 Classification

7.3.1 General

WC flushing valves are classified according to their flush volume.

National Regulations exist in some EU member states that set maximum flush volumes that are lower than those indicated in this European Standard.

7.3.2 6 l and 6 to 9 l valves

If a valve is intended to deliver 6 l of water or is adjustable to deliver flush volumes from 6 l to 9 l, it shall be designated as “Class 6”.

7.3.3 9 l valves

If a valve is intended to deliver 9 l it shall be designated as “Class 9”.

7.4 Dimensional characteristics

Connecting thread and outlet pipe dimensions shall comply with the values specified in Table 18 and Table 19.

Table 18 — Threads and outlet pipe

Dimensions	**Designation**	**Values** (mm)		
DN	**Nominal size**	**20**	**25**	**32**
A	Male thread (EN ISO 228-1)	G 3/4 B	G 1 B	G 1 $^{1}/_{4}$ B
D	Female thread (EN ISO 228-1)	G 1/2	G 3/4	G 1
G (+0/-0,5)	Diameter of pipe connection sleeve	26	26 or 30	30
H (+0,2/+0,5)	Diameter of valve outlet for connection to pipe by compression joint	28	28 or 32	32

Table 19 — Permitted thread lengths

Dimension	**Comment**	**G 1/2**	**G 3/4 B**	**G 3/4**	**G 1 B**	**G 1**	**G 1 1/4 B**
C min	Useful thread length (mm)		10		10		11
L min	Male thread (mm)		13		15		19
F min	Female thread (mm)	10		12		12	

Side-entry WC flushing valves shall comply with the dimensions specified in Figure 18.

Top-entry flushing valves shall comply with the dimensions specified in Figure 19.

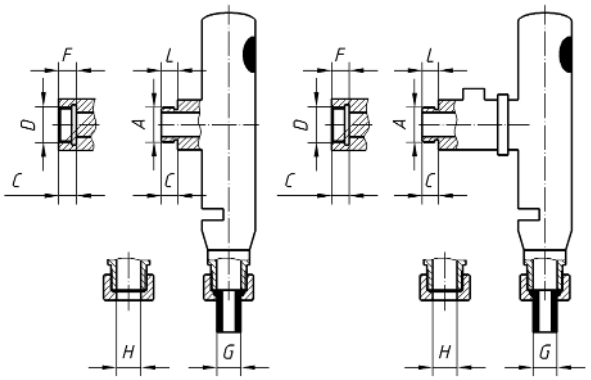


Figure 18 — Side-entry WC flushing valves

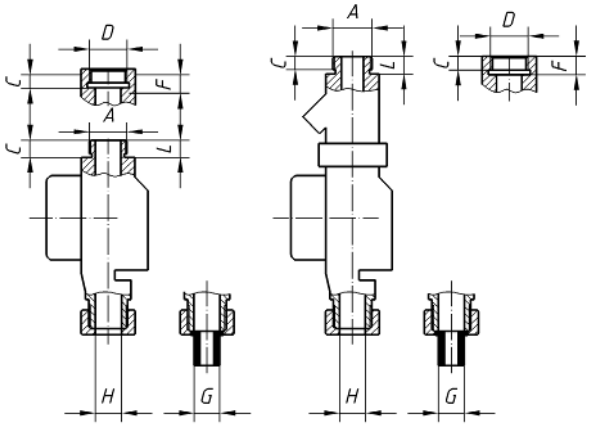


Figure 19 — Top-entry WC flushing valves

7.5 Hydraulic characteristics

7.5.1 General

This subclause specifies a test method with which the following is measured, using a given pressure:

— flush flow rate;

— impact force;

— flush time;

— flush water volume;

— pressure increase (water hammer) ΔP while closing the tap.

In this subclause, the corresponding requirements are specified.

7.5.2 Test method

7.5.2.1 General

The WC flushing valve is assembled with a flushing pipe corresponding with the nominal size DN in accordance with Table 20.

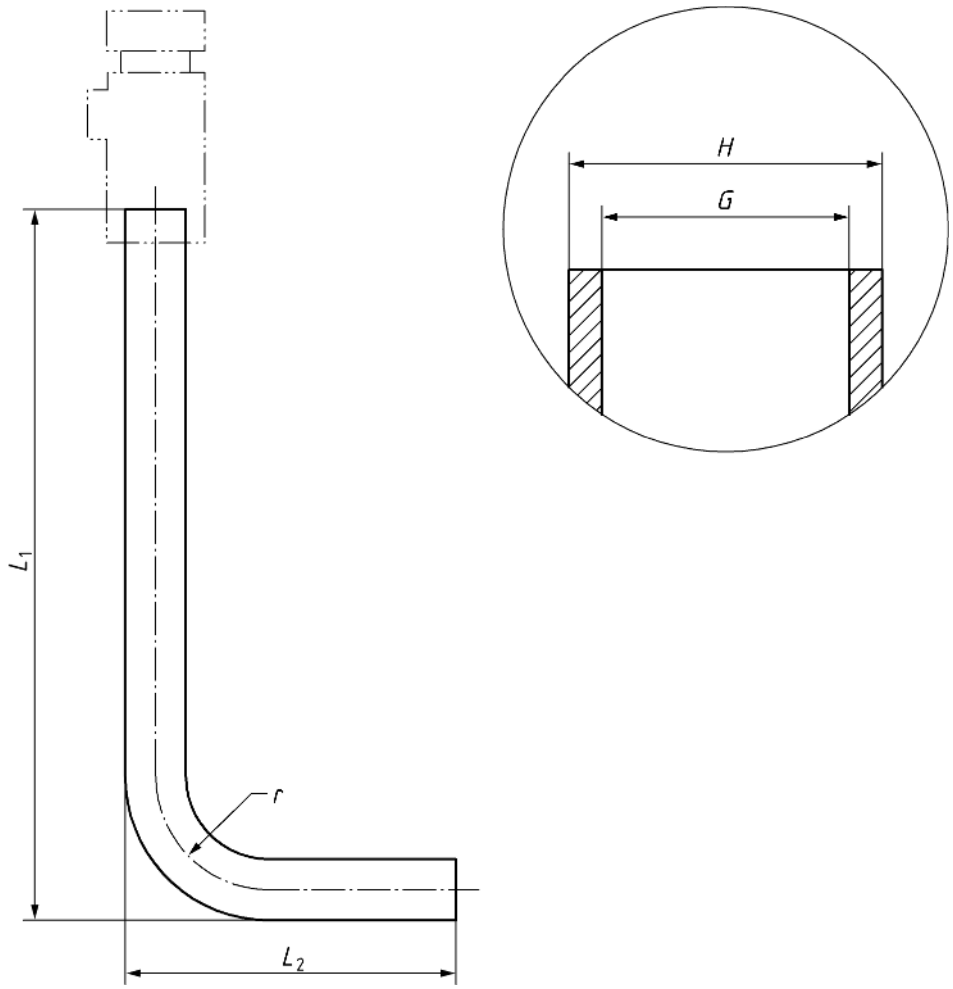


Figure 20 — Flushing pipe

Table 20 — Flushing pipe dimensions

DN	*H*	*G*	L_1	L_2	*r*
20	28	26	600	200	100
25	32	30	600	200	100
32	32	30	600	200	100

7.5.2.2 Principle

The tests shall be performed with cold water.

Before each test, the valve to be tested is operated five times before taking the measurement (air bleeding).

The tests are performed according to the sequences indicated in Table 21.

Table 21 — Sequences of tests

Order	Pressure	Test
Adjustement for lower dynamic pressure		
1	lower pressure	flow rate / impact force
2		flow rate / volume
Adjustement for upper dynamic pressure		
3	higher pressure	flow rate / impact force
4	higher pressure	water hammer

7.5.2.3 Procedure for flow rate / impact force test

For the measurement of flow rate/impact force, the tapware is to be adjusted and operated in accordance with the manufacturer's information, depending on the valve design type.

To set the dynamic pressures and measure the impact force, the tapware shall be held in an open position.

7.5.2.4 Procedure for flow rate / volume test

For the measurement of the flow rate / volume according to the flow rate curve, the adjustment of the tapware is not modified, regarding to the precedent test.

The flush time is to be taken from the start of activation.

The measurement is to be taken by simultaneously recording pressure and flow rate as a function of time.

The volume can be measured by continuous recording of the flow curve.

To check the requirements in accordance with Figure 21, depending on the valve design type according to 7.2, the course of the flush flow rate curve in relation to time is evaluated from the diagrams which have been recorded during the test.

7.5.2.5 Test apparatus

The test apparatus shall be in accordance with EN 12541.

7.5.2.6 Impact force measuring instrument

The calibration of the impact force measuring instrument shall be in accordance with EN 12541.

7.5.2.7 Definitions

Q_{min} minimal flush flow rate to be achieved or exceeded after 2 s of operation

Q_s significant flush flow rate; 0,85 × Q_{min}

T_1 time period during which Q_s for servo-controlled hydraulic flushing valves in accordance with 7.2.1.1 shall be maintained to obtain a volume of water supplied of 6 l

T_2 time period during which Q_s for servo-controlled hydraulic flushing valves in accordance with 7.2.1.1 shall be maintained to obtain a volume of water supplied of 9 l

T_3 time period during which the flush flow rate for direct controlled flushing valves in accordance with 7.2.1.2 reaches Q_{min}

T_4 time period during which Q_s for direct controlled flushing valves in accordance with 7.2.1.2, after exceeding Q_{min}, shall be maintained to obtain a volume of water supplied of 6 l.

T_5 time period in which Q_s for direct controlled flushing valves in accordance with 7.2.1.2, after exceeding Q_{min}, shall be maintained in order to obtain a volume of water supplied of 9 l.

0 Origin of corresponding graph for time at start of activation of control device

A on x-axis of time 2 s

A_1 on x-axis of time T_3

B on x-axis of time T_1 or T_4

C on x-axis of time T_2 or T_5

D on y-axis at $Q_s = 0{,}85 \times Q_{min}$

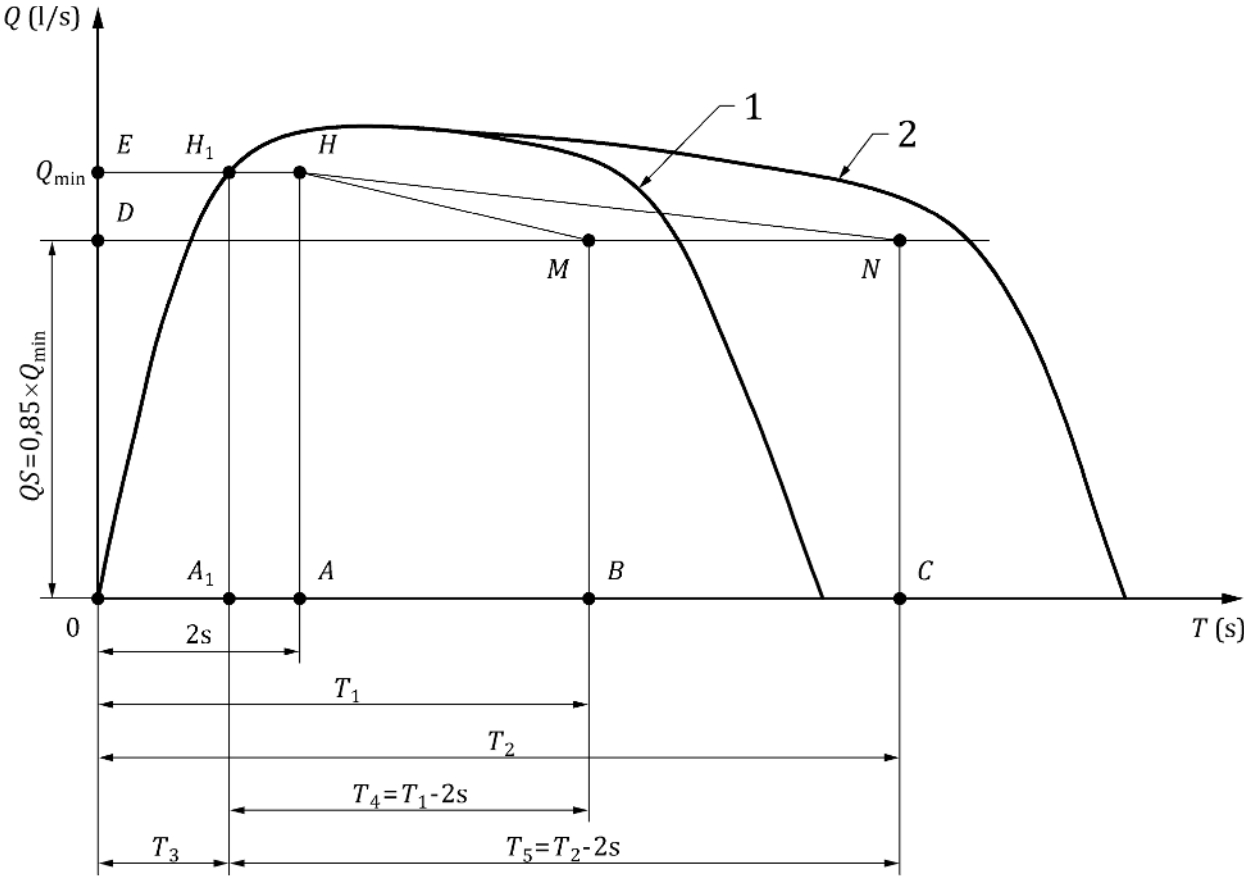
E on y-axis at Q_{min}

H intersection of a vertical line from A and a horizontal line from E

H_1 intersection of a vertical line from A_1 and a horizontal line from E

M intersection of a vertical line from B and a horizontal line from D

N intersection of a vertical line from C and a horizontal line from D



Key

1 V = 6 l

2 V = 9 l

Figure 21 — Flush flow rate/flush time diagram

7.5.3 Testing of the flow rate / Impact force at lower dynamic pressure

7.5.3.1 Procedure

The procedure takes place in accordance with 7.5.2.3.

7.5.3.2 Requirements for flush flow rate impact force for valves DN 20

For a set dynamic pressure of ($0{,}12^{+\ 0{,}005}$) MPa (($1{,}2^{+\ 0{,}05}$) bar), the impact force and flush flow rate (Q_{min}) shall correspond at minimum with the values in the lower dynamic pressure range given in Table 22.

7.5.3.3 Requirements for flush flow rate/impact force for valves DN 25 and DN 32

For a set dynamic pressure of ($0{,}08^{+\ 0{,}005}$) MPa (($0{,}8^{+\ 0{,}05}$) bar), the impact force and flush flow rate (Q_{min}) shall correspond at minimum with the values in the lower dynamic pressure range given in Table 22.

7.5.4 Testing of the flow rate / Volume at lower dynamic pressure

7.5.4.1 Procedure

Testing in the lower flow pressure range is performed in accordance with Figure 21. In a graphic representation, points *A*-*E*, *M*, *N* are recorded and their conformity with the requirements in Table 21 is checked, depending on the valve design type.

Flow pressure, flush flow rate and time shall be recorded.

The flush times shall be evaluated in accordance with Table 21, depending on valve design type.

7.5.4.2 Requiremegnts for WC flushing valve DN 20

For a set dynamic pressure of ($0{,}12^{+\ 0{,}005}$) MPa (($1{,}2^{+\ 0{,}05}$) bar), the flush flow rate, flush water volume and flush time shall correspond with the following requirements:

- **Class 6 - WC flushing valves** (intended for the release of 6 l or 6 l to 9 l):

  The flush flow rate (Q_{min}) shall correspond at Point H/H_1 of the diagram (Figure 21) at minimum with the values in the lower dynamic range provided in Table 22.

  After a flush time T_1 or T_4 in Table 22, the measured flow rate shall be at least the significant flush flow rate (Q_{s}). The measured flow rate may fall below the significant flush flow rate (Q_{s}) after point *M* of the diagram (Figure 21).

  The flush water volume shall not be less than 6 l and shall not exceed 6,6 l.

  The flush times shall be evaluated in accordance with Table 22, depending on the valve design type.

- **Class 9 - WC flushing valves** (intended for the release of 9 l):

  The flush flow rate (Q_{min}) shall correspond at Point H/H_1 of the diagram (Figure 21) at minimum with the values in the lower dynamic range provided in Table 22.

  After a flush time T_2 or T_5 in Table 22, the measured flow rate shall be at least the significant flush flow rate (Q_{s}). The measured flow rate may fall below the significant flush flow rate (Q_{s}) after point *M* of the diagram (Figure 21).

  The flush water volume shall not be less than 9 l and shall not exceed 9,9 l.

  The flush times shall be evaluated in accordance with Table 22, depending on the valve design type.

7.5.4.3 Requirements for WC flushing valves DN 25 and DN 32

For a set dynamic pressure of ($0{,}08^{+\ 0{,}005}$) MPa (($0{,}8^{+\ 0{,}05}$) bar), the flush flow rate, flush water volume and flush time shall correspond with the following requirements.

- **Class 6 -WC flushing valves** (intended for the release of 6 l or 6 l to 9 l):

  The flush flow rate (Q_{min}) shall correspond at Point H/H_1 of the diagram (Figure 21) at minimum with the values in the lower dynamic range provided in Table 22.

  After a flush time T_1 or T_4 in Table 22, the measured flow rate shall be at least the significant flush flow rate (Q_{s}). The measured flow rate may fall below the significant flush flow rate (Q_{s}) after point M of the diagram (Figure 21).

The flush water volume shall not be less than 6 l and shall not exceed 6,6 l.

The flush times shall be evaluated in accordance with Table 22, depending on the valve design type.

- **Class 9 - WC flushing valves** (intended for the release of 9 l):

The flush flow rate (Q_{min}) shall correspond at Point H/H_1 of the diagram (Figure 21) at minimum with the values in the lower dynamic range provided in Table 22.

After a flush time T_2 or T_5 in Table 22, the measured flow rate shall be at least the significant flush flow rate (Q_s). The measured flow rate may fall below the significant flush flow rate (Q_s) after point *M* of the diagram (Figure 21).

The flush water volume shall not be less than 9 l and shall not exceed 9,9 l.

The flush times shall be evaluated in accordance with Table 22, depending on the valve design type.

7.5.5 Testing of flush flow rate / impact force at upper dynamic pressure

7.5.5.1 Procedure

The procedure takes place in accordance with 7.5.2.3.

7.5.5.2 Requirements for WC flushing valves DN 20

For a set dynamic pressure of ($0,4_{-0,001}$) MPa (($4_{-0,1}$) bar), the maximum flush flow rate (Q_{max}) shall not exceed the values in the upper dynamic pressure range provided in Table 22, depending on the valve design type.

7.5.5.3 Requirements for WC flushing valves DN 25 and DN 32

For a set dynamic pressure of ($0,25_{-0,001}$) MPa (($2,5_{-0,1}$) bar) for DN 25 and of ($0,2_{-0,001}$) MPa (($2_{-0,1}$) bar) for DN 32, the maximum flush flow rate (Q_{max}) shall not exceed the values in the upper dynamic pressure range provided in Table 22, depending on the valve design type.

Table 22 — Summary of the requirements for servo-controlled hydraulic flushing valves

DN	Lower dynamic pressure in MPa and bar	Q_{min} (l/s) at T = 2 s	Impact force min. (N)	Flush water volume (l)	Flush time T (s) at Q_s min.				Upper dynamic pressure in MPa and bar	Q_{max} (l/s) at T = 2s	Impact force min. (N)
					Servo-operated hydraulic flushing valve		Direct controlled flushing valve				
15	$0{,}12\,^{+0{,}005}_{0}$ MPa $1{,}2\,^{+0{,}05}_{0}$ bar	0,7	5	$6\,^{+0{,}6}_{0}$ l (Class 6)	—				$0{,}4\,^{0}_{-0{,}01}$ MPa $4\,^{0}_{-0{,}1}$ bar	1	12
20	$0{,}12\,^{+0{,}005}_{0}$ MPa	1,0	5	$6\,^{+0{,}6}_{0}$ l (Class 6)	T_1	5s	T_4	3s	$0{,}4\,^{0}_{-0{,}01}$ MPa	1,3	12
	$1{,}2\,^{0{,}05}_{0}$ bar			$9\,^{+0{,}9}_{0}$ l (Class 9)	T_2	8s	T_5	6s	$4\,^{0}_{-0{,}1}$ bar		
25	$0{,}08\,^{+0{,}005}_{0}$ MPa	1,2	5	$6\,^{+0{,}6}_{0}$ l (Class 6)	T_1	4s	T_4	2s	$0{,}25\,^{0}_{-0{,}01}$ MPa	1,4	12
	$0{,}8\,^{+0{,}05}_{0}$ bar			$9\,^{+0{,}9}_{0}$ l (Class 9)	T_2	7s	T_5	5s	$2{,}5\,^{0}_{-0{,}1}$ bar		
32	$0{,}08\,^{+0{,}005}_{0}$ MPa	1,2	5	$6\,^{+0{,}6}_{0}$ l (Class 6)	T_1	4s	T_4	2s	$0{,}2\,^{0}_{-0{,}01}$ MPa	1,4	12
	$0{,}8\,^{+0{,}05}_{0}$ bar			$9\,^{+0{,}9}_{0}$ l (Class 9)	T_2	7s	T_5	5s	$2\,^{0}_{-0{,}1}$ bar		

7.5.6 Measurement of water hammer

7.5.6.1 Procedure

The test shall be performed in accordance with EN 12541:2002, 10.5.1 “Test method”.

The test takes place in the upper dynamic pressure range, in accordance with Table 22.

The tapware is adjusted, in accordance with 7.5.2.3 for DN 20 and 7.5.2.4 for DN 25 and 32.

7.5.6.2 Requirements

The difference ΔP between the maximum pressure recorded during the closure and the static rest pressure after closure shall not exceed 0,3 MPa (3 bar).

7.6 Principle and verification of atmospheric pipe interrupters of WC flushing valves

EN 12541:2002, Clause 11 “Principle and verification of atmospheric pipe interrupters of WC flushing valves” is applicable.

7.7 Mechanical endurance

7.7.1 General

EN 12541:2002, 14.1 “General” is applicable.

7.7.2 Procedure

EN 12541:2002, 14.2.1 “Procedure” is applicable.

7.7.3 Minimum requirements

EN 12541:2002, 14.2.2 “Minimum requirements” is applicable.

7.8 Acoustic characteristics

EN 12541:2002, Clause 15 “Acoustic characteristics” is applicable.

Annex A
(normative)

Design of pressure take-off tees

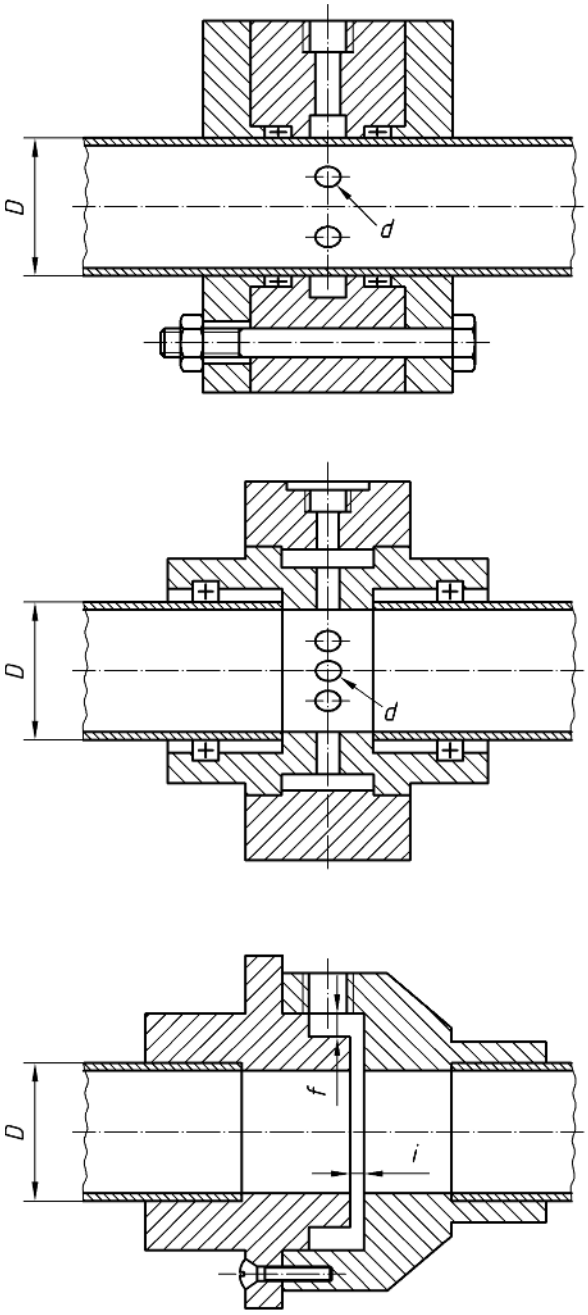


Figure A.1 — Examples of pressure take-off tees

Figure A.1 shows three examples of pressure take-off tees giving equivalent results:

— individual: type A and type B;

— annular slit: type C.

Requirements relating to the design and manufacture of pressure take-off tees are given in EN ISO 5167-1.

The main principles are:

a) Individual type:

1) Axis of the pressure orifices shall intersect the axis of the piping (or the casing) and be perpendicular to it; the opening of the orifice shall be circular and the edges flush with the wall of the piping (or the casing) with an angle as sharp as possible. Slight rounding at entry is permitted (radius < 1/10 diameter of the pressure orifice).

2) Diameter of the pressure orifice shall be less than 0,1xD.

3) There shall be an even number (at least 4) of the pressure orifices. The angles formed by the arcs of the pressure orifices shall be approximately equal.

The area of the free cross section of the annular chamber of the casing shall be greater than or equal to half the total area of the orifices connecting the chamber to the piping.

b) Annular slit:

1) Thickness f of the annular slit shall be greater than twice the width “i” of the slit.

2) Area of the free section of the annular chamber should be equal to or greater than half the total area of the annular slit connecting the chamber to the piping.

3) All surfaces coming into contact with the fluid measured shall be clean and well finished.

4) Width of the annular slit shall be nominally 1 mm.

Annex B
(informative)

Potential consequences of use outside the recommended operating limits

Table B.1 — Performance characteristics to be noted if used outside the recommended operating range

Issue	Supply system type 1	Supply system type 2
Flow performance	Taps for Type 2 systems may result in excessive flow velocity.	Taps for Type 1 system may not provide an acceptable flow rate.
Noise	National regulations shall be observed, the criteria for classification in acoustic groups according to these national (special) regulations being different and more detailed than those given in this standard. Taps for type 1 and type 2 systems may result in excessive noise when used above the recommended pressure.	

Bibliography

[1] EN 60730-1, *Automatic electrical controls for household and similar use — Part 1: General requirements (IEC 60730-1)*

[2] EN 61000 (all parts), *Electromagnetic compatibility (EMC) (IEC 61000 series)*

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