

INTERNATIONAL STANDARD



Automatic electrical controls ~~for household and similar use~~ –
Part 2-8: Particular requirements for electrically operated water valves,
including mechanical requirements

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INTERNATIONAL STANDARD



Automatic electrical controls ~~for household and similar use~~ –
Part 2-8: Particular requirements for electrically operated water valves,
including mechanical requirements

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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CONTENTS

FOREWORD.....	4
1 Scope and normative references.....	7
2 Terms and definitions	10
3 General requirements	13
4 General notes on tests.....	13
5 Rating	14
6 Classification.....	14
7 Information.....	17
8 Protection against electric shock.....	19
9 Provision for protective earthing.....	20
10 Terminals and terminations.....	20
11 Constructional requirements	21
12 Moisture and dust resistance	21
13 Electric strength and insulation resistance.....	22
14 Heating	22
15 Manufacturing deviation and drift	23
16 Environmental stress	23
17 Endurance.....	24
18 Mechanical strength.....	25
19 Threaded parts and connections	29
20 Creepage distances, clearances and distances through insulation	29
21 Resistance to heat, fire and tracking	29
22 Resistance to corrosion	29
23 Electromagnetic compatibility (EMC) requirements – Emission.....	29
24 Components.....	29
25 Normal operation.....	29
26 Electromagnetic compatibility (EMC) requirements – Immunity.....	30
27 Abnormal operation	30
Annex H (normative) Requirements for electronic controls	35
Annex AA (informative) Relation between different flow coefficients	40
Annex BB (normative) Arrangement for the measurement of transient pressures caused by water valves.....	41
Annex CC (normative) Test on valve bodies of thermoplastic material intended to be connected to the water supply mains Long term pressure test for thermoplastic bodied valves.....	44
Annex DD (normative) Torque.....	46
Annex EE (normative) Arrangement for the measurement of transient pressures caused by water valves with a declared pressure of up to and including 1,0 MPa (10 bar).....	50
Bibliography	52
Figure BB.1 – Transient pressure measurement test rig schematic diagram	42
Figure DD.1 – Arrangements for carrying out the torque test.....	46

Figure EE.1 – Transient pressure measurement test rig for valves with a declared pressure of up to and including 1,0 MPa (10 bar) schematic diagram	50
Table 1 – Required information and methods of providing information	18
Table 101 – Nominal size and thread size of end connections.....	17
Table 102 – Torque test requirement for metal valves with internal threaded end-connections	28
Table 103 – Torque test requirement for metal valves with external threaded end-connections	28
Table 104 – Maximum winding temperature (for test of blocked output conditions and valves declared under Table 1, item 113)	32
Table CC.1 – Test requirements for valves intended for uses other than the control of water for tap and shower outlets	44
Table CC.2 – Test requirements for valves intended for the control of water for tap and shower outlets	45
Table DD.1 2.1 – Required torque for test	47
Table DD.6 DD.2 – Tightening torque in newton metres (Nm) for bolts and screws for adaptors	48

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**AUTOMATIC ELECTRICAL
CONTROLS ~~FOR HOUSEHOLD AND SIMILAR USE~~ –****Part 2-8: Particular requirements for electrically operated water valves,
including mechanical requirements**

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 60730-2-8 has been prepared by IEC technical committee 72: Automatic electrical controls.

This third edition cancels and replaces the second edition published in 2000, Amendment 1:2002 and its Amendment 2:2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- alignment of the text with IEC 60730-1 fifth edition (2013) including Amendment 1:2015;
- introduction of specific requirements for thermoplastic bodied valves for the control of water for tap and shower outlets (18.101.4.3 and Annex CC);
- removal of Subclause 18.102 Wetted material specifications.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The text of this International Standard is based on the following documents:

CDV	Report on voting
72/1077/CDV	72/1120/RVC

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

This part 2-8 is intended to be used in conjunction with IEC 60730-1. It was established on the basis of the fifth edition (2013) including Amendment 1 (2015) of that publication.

This part 2-8 supplements or modifies the corresponding clauses in IEC 60730-1 so as to convert that publication into the IEC standard: *Safety requirements for electrically operated water valves, including mechanical requirements*.

Where this part 2-8 states "addition", "modification" or "replacement", the relevant requirement, test specification or explanatory matter in part 1 should be adapted accordingly.

Where no change is necessary, part 2-8 indicates that the relevant clause or subclause applies.

In the development of a fully international standard, it has been necessary to take into consideration the differing requirements resulting from practical experience in various parts of the world and to recognize the variation in national electrical systems and wiring rules.

The "in some countries" notes regarding differing national practices are contained in the following elements:

- Table 1, footnotes ab and ac
- Table 13, footnote aa
- 1.1.4
- 16.2.1
- 18.101.3
- 27.2.3.1
- 27.101
- Table DD. 1, footnote a
- Table DD.2, footnote a

In this publication:

1) The following print types are used:

- Requirements proper: in roman type.
- *Test specifications: in italic type.*
- Notes: in smaller roman type.
- Defined terms: in **bold type**

2) Subclauses, notes, tables or figures which are additional to those in part 1 are numbered starting from 101, additional annexes are lettered AA, BB, etc.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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AUTOMATIC ELECTRICAL CONTROLS ~~FOR HOUSEHOLD AND SIMILAR USE~~ –

Part 2-8: Particular requirements for electrically operated water valves, including mechanical requirements

1 Scope and normative references

This clause of Part 1 is ~~replaced~~ applicable except as follows:

1.1 Scope

Replacement:

~~1.1 This part 2-8 applies to electrically operated water valves for use in, on or in association with equipment for household and similar use that may use electricity, gas, oil, solid fuel, solar thermal energy, etc. or a combination thereof, including heating, air-conditioning and similar applications.~~

~~This part 2-8 is also applicable to electrically operated water valves for appliances within the scope of IEC 60335.~~

~~1.1.1 This part 2-8 contains requirements for electrical features of water valves and requirements for mechanical features of valves that affect their intended operation.~~

~~1.1.2 This part 2-8 applies to the inherent safety, to the operating values, operating sequences where such are associated with equipment protection, and to the testing of automatic electrical controls used in, on or in association with household and similar equipment.~~

~~Electrically operated valves for equipment not intended for normal household use but which may nevertheless be used by the public, such as equipment intended to be used by laymen in shops, in light industry and on farms, are within the scope of this part 2-8.~~

~~This part 2-8 does not apply to electrically operated water valves designed exclusively for industrial applications.~~

This part of IEC 60730 applies to electrically operated water valves for use in, on or in association with equipment for household and similar use, including heating, air-conditioning and similar applications. The equipment can use electricity, gas, oil, solid fuel, solar thermal energy, etc., or a combination thereof.

NOTE 1 Throughout this document, the word "equipment" means "appliances and equipment."

This document is applicable to electrically operated water valves for building automation within the scope of ISO 16484.

This document also applies to automatic electrically operated water valves for equipment that can be used by the public, such as equipment intended to be used in shops, offices, hospitals, farms and commercial and industrial applications.

EXAMPLE 1: Electrically operated water valves for commercial catering, heating and air-conditioning equipment.

This document does not apply to electrically operated water valves intended exclusively for industrial process applications unless explicitly mentioned in the relevant equipment standard.

This document applies to electrically operated water valves powered by primary or secondary batteries, requirements for which are contained within the standard, including Annex V.

This document does not cover the prevention of contamination of drinking water as a result of contact with materials.

1.1.1 This document applies to the inherent safety, to the operating values, operating times and operating sequences where such are associated with equipment safety, and to the testing of automatic electrical control devices used in, on or in association with, household and similar equipment.

This document contains requirements for electrical features of water valves and requirements for mechanical features of valves that affect their intended operation.

This document is also applicable to electrically operated water valves for appliances within the scope of the IEC 60335 series of standards.

This document does not apply to:

- electrically operated water valves of nominal connection size above DN 50;
- electrically operated water valves for admissible nominal pressure rating above 1,6 MPa;
- food dispensers;
- detergent dispensers;
- steam valves;
- electrically operated water valves designed exclusively for industrial applications.

Throughout this document, where it can be used unambiguously, the term:

- "valve" is used to denote an electrically operated water valve (including actuator and valve body assembly);
- "actuator" means "electrically operated mechanism or prime mover";
- "valve body" means "valve body assembly";
- "equipment" includes "appliance" and "control system".

1.1.2 This document applies to electrically operated water valves, responsive to or controlling such characteristics as temperature, pressure, passage of time, humidity, light, electrostatic effects, flow, or liquid level, current, voltage, acceleration, or combinations thereof.

1.1.3 This document also applies to actuators and to valve bodies which are designed to be fitted to each other.

1.1.4 This document applies to individual valves, valves utilized as part of a system and valves mechanically integral with multi-functional controls having non-electrical outputs.

NOTE Attention is drawn to the fact that, in many countries, additional test requirements and by-laws have been established by the water authorities or companies.

1.1.5 This document applies to AC or DC powered electrically operated water valves with a rated voltage not exceeding 690 V AC or 600 V DC.

1.1.6 This document does not take into account the **response value** of an **automatic action** of a valve, if such a **response value** is dependent upon the method of mounting the valve in

the equipment. Where a **response value** is of significant purpose for the protection of the **user**, or surroundings, the value defined in the appropriate equipment standard or as determined by the manufacturer shall apply.

1.1.7 This document applies also to electrically operated water valves incorporating **electronic devices**, requirements for which are contained in Annex H.

1.1.8 This document applies also to electrically operated water valves using NTC or PTC **thermistors**, requirements for which are contained in Annex J.

1.1.9 This document applies to the electrical and **functional safety** of electrically operated water valves capable of receiving and responding to communications signals, including signals for power billing rate and demand response.

The signals can be transmitted to or received from external units being part of the valve (wired), or to and from external units which are not part of the valve (wireless) under test.

1.1.10 This document does not address the integrity of the output signal to the network devices, such as interoperability with other devices unless it has been evaluated as part of the **control system**.

1.2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

ISO 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads – Part 1: Dimensions, tolerances and designation*

ISO 65:1981, *Carbon steel tubes suitable for screwing in accordance with ISO 7-1*

ISO 228-1:1994, *Pipe threads where pressure-tight joints are not made on the threads – Part 1: Dimensions, tolerances and designation*

ISO 630:1995, ¹ *Structural steels – Plates, wide flats, bars sections and profiles*

~~ISO 1179:1981, *Pipe connections threaded to ISO 228-1 for plain end steel and other metal tubes in industrial applications*~~

ISO 1179-1, *Connections for general use and fluid power – Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing – Part 1: Threaded ports*

ISO 4144:1979, *Pipework – Stainless steel fittings threaded to in accordance with ISO 7-1*

~~ISO 4400:1994, *Fluid power systems and components – Three-pin electrical plug connectors with earth contact – Characteristics and requirements*~~

~~ISO 6952:1994, *Fluid power systems and components – Two-pin electrical plug connectors with earth contact – Characteristics and requirements*~~

¹ ISO 630 has been withdrawn.

2 Terms and definitions

This clause of Part 1 is applicable, except as follows:

2.2 Definitions of types of control according to purpose

2.2.17 electrically operated valve

Addition:

Note 1 to entry: A semi-automatic valve that is opened manually and closes automatically or vice versa is also covered by this definition.

Additional definitions:

2.2.17.101 valve

device consisting of an actuator connected to a valve body assembly and used to stop or regulate the flow of fluid by the closure or partial closure of an orifice

2.2.17.102 water valve

valve intended to be connected to a water supply and to control water flow

~~NOTE A water valve is a type 1 action. Switching devices incorporated in water valves are type 1 or 2 actions.~~

2.2.17.103 heating-water valve

valve intended to control the water circulation in heating systems

2.2.17.104 actuator

electrically operated mechanism or prime mover used to effect the opening or closing action of a valve

Note 1 to entry: An actuator may be integral with the valve, fixed to the valve body assembly or delivered as a separate component.

Note 2 to entry: An actuator may also include the valve and closure member.

2.2.17.105 valve body assembly

assembly comprising the valve body, inlet and outlet end connections, the valve seat, closure member and stem or shaft

Note 1 to entry: In some cases, the stem and closure member may be part of the actuator.

2.2.17.106 valve body

part of the valve body assembly which is the main pressure boundary

Note 1 to entry: It provides the water flow passage-ways with end connections.

2.2.17.107 nominal size

numerical designation of size which is common to all components in a fluid-conducting system other than components designated by outside diameter or by thread size

Note 1 to entry: It may be designated by "DN" followed by a convenient round number, for reference purposes only.

Note 2 to entry: Some older international standards refer to nominal size as nominal diameter but, for the purpose of this document, the two terms are synonymous.

2.2.17.108

nominal pressure rating

numerical designation of pressure rating

Note 1 to entry: It may be designated by the letters "PN" (also referred to as the pressure number) followed by a convenient round number, for reference purposes only.

2.2.17.109

end connection

valve body configuration provided to make a pressure-tight joint to the fluid-conducting system

2.2.17.110

valve seat

surface of the orifice within the valve which makes full contact with the closure member

2.2.17.111

closure member

movable part of the valve which is positioned in the flow path to modify the rate of flow through the valve

Note 1 to entry: A closure member may be a plug, ball, disc, vane, gate, etc.

2.2.17.112

stem

component which connects the actuator to, and positions, the closure member

Note 1 to entry: For rotary valves, the word "shaft" should be used in place of "stem".

Note 2 to entry: In some controls, the stem may be part of the actuator.

2.2.17.113

fitting

any device such as a reducer, expander, elbow, or T-piece which is attached directly to an end-connection of the valve body assembly

2.3 Definitions relating to the function of controls

2.3.29

maximum working pressure

Modification:

Delete "maximum rated pressure".

Additional definitions:

2.3.101

on-off valve

valve which is open or closed, without any intermediate positions

2.3.102

normally closed valve

valve which is closed when not electrically energized

2.3.103

normally open valve

valve which is open when not electrically energized

2.3.104**modulating valve**

valve which has a variable flow rate between predetermined flow limits

2.3.105**diverting valve**

valve with one or more inputs and outputs which may permit flow from any combination of inputs to outputs

2.3.106**closed position**

position of the closure member when there is no water flow from the outlet side of the valve

2.3.107**travel**

displacement of the closure member from the closed position

2.3.108**rated travel**

displacement of the closure member from the closed position to the full open position

2.3.109**open position**

position of the closure member when there is a flow of water from the outlet side of the valve

2.3.110**fully open position**

position of the closure member so that the amount of water flowing through the valve is in accordance with the rated flow rate

2.3.111**flow rate**

volume of water flowing through the valve in unit time

2.3.112**rated flow rate**

flow rate at the rated travel under standard reference conditions of temperature and pressure declared at a given pressure difference

2.3.113**flow factor**

factor specifying the amount of water which can pass through the valve at a specified pressure difference

Note 1 to entry: The flow factor may be referred to as flow coefficient.

Note 2 to entry: The relationship between the different flow factors in use is indicated in Annex AA.

2.3.114**maximum operating pressure differential**

declared maximum difference in pressure between inlet and outlet ports of the valve against which the actuator can operate the closure member

2.3.115**minimum operating pressure differential**

declared minimum pressure difference at which the valve opens or closes

2.3.116

Void

2.3.117

water hammer

excessive transient pressure which can occur in some water supply systems as a result of closing a valve as intended

2.3.118

transient pressure

short-time pressure surge exceeding the normal stable supply pressure in the closed condition of the valve

2.3.119

valve with anti-water-hammer characteristics

valve that does not cause an excessive pressure drop when opening and no excessive transient pressure when closing if connected directly, without special precautions to water supply mains applications where water-hammer may occur

2.13 Miscellaneous definitions

Additional definitions:

2.13.101

~~**drinking water**~~

~~water supply which is intended to be suitable for human consumption~~

~~NOTE In some standards, "drinking water" is referred to as "potable water".~~

Void

2.13.102

~~**non-drinking water**~~

~~water supply which is not intended for human consumption~~

Void

2.13.103

water for tap and shower outlets

water intended to supply a bath, shower, bidet, wash basin, kitchen sink, or other such taps that discharge in to a drainage system

3 General requirements

This clause of Part 1 is applicable.

4 General notes on tests

This clause of Part 1 is applicable, except as follows:

4.1 Conditions of test

4.1.2 Addition:

Unless otherwise specified in this document, water temperature for the tests shall be maintained at a temperature of (20 ± 5) °C.

4.2 Samples required

4.2.1 Addition:

One sample is required for each test of Clause 27.

NOTE 101 By agreement between manufacturer and testing authority, one sample ~~may~~ can be submitted to more than one test.

5 Rating

This clause of Part 1 is applicable.

6 Classification

This clause of Part 1 is applicable, except as follows:

6.3.12 – electrically operated valve;

Additional subclause:

6.3.12.101 – water valve;

6.5.2 According to degree of protection provided by enclosures against harmful ingress of water (see IEC 60529)

Replacement of the second ~~explanatory paragraph~~ Note as follows:

NOTE 2 Preferred degrees of protection provided by enclosures are: IP20, IP30, IP40, IP54, IP65. Values differing from these preferred values are allowed.

6.7 According to ambient temperature limits of the switch head

Modification:

In 6.7.1 and 6.7.2, read "valve" for "control" and "actuator" for "switch head".

6.8 According to protection against electric shock

6.8.3 Replacement:

For an independently mounted valve or a valve integrated or incorporated in an assembly utilizing a non-electrical source:

~~*Additional subclauses:*~~

~~**6.8.101** For a single actuator:~~

~~**6.8.101.1** of class 0;~~

~~**6.8.101.2** of class 0I;~~

~~**6.8.101.3** of class I;~~

~~**6.8.101.4** of class II;~~

~~**6.8.101.5** of class III.~~

6.10 Not applicable.

6.11 According to number of automatic cycles 6.11 (A) of each automatic action

Addition:

Water valves shall be subjected to a minimum of 6 000 automatic cycles.

Additional subclauses:

6.101 According to type of end-connections

6.101.1 Valves provided with internally threaded end-connections with either:

- a) ISO 7-1 or NPT thread when pressure-tight joints are made on the thread, or
- b) ISO 228-1 thread when pressure-tight joints are not made on the thread, but via an additional sealing washer.

6.101.2 Valves provided with externally threaded end-connections for:

- a) compression fittings, or
- b) washered union connection, or
- c) cone seated union connection, or
- d) threaded pipe connections either according to ISO 7-1, ISO 228-1 or NPT thread.

6.101.3 Valves provided with flanged end-connections suitable for connection to flanges with or without adaptors.

6.101.4 Valves provided with end-connections with neck-end for soldered or welded connections.

6.101.5 Valves provided with end-connections with hose tails for use with flexible tubing.

6.102 According to features of electrically operated water valves

6.102.1 According to the size and capacity:

Size and capacity to be specified in dimension of inlet and outlet connections and flow factor.

6.102.2 According to the type of operation:

Direct or pilot controlled with or without minimum pressure differential limit.

6.102.3 According to function:

Description of function regarding the number of water connections and the valve position when de-energized.

6.102.4 According to material of wetted parts:

Includes the material identification of all internal parts in contact with water such as the body and the sealing material.

6.102.5 According to construction of the closure member:

The valve may be a direct operated or pilot valve controlled diaphragm or piston-operated poppet type or spool type closing member.

6.102.6 According to construction of the actuator:

Examples are: electromagnetic; electric motor; electrically heated wax or bi-metal controlled actuator with actuator stem in contact with or shielded from the water.

6.103 According to temperature, pressure and type of the water controlled

Valves for controlling:

6.103.1 Cold ~~drinking~~-water supply with a maximum temperature of 25 °C;

6.103.2 Hot ~~drinking~~-water supply with a maximum temperature of 90 °C;

6.103.3 ~~Cold non-drinking water supply with a maximum temperature of 25 °C;~~ Void

6.103.4 ~~Hot non-drinking water supply with a maximum temperature of 90 °C;~~ Void

6.103.5 Circulation heating water with a maximum temperature of between 50 °C and 120 °C;

Replacement:

6.103.6 Water with a maximum rated temperature other than indicated above;

6.103.7 Water flow in systems with a maximum pressure of 0,1 MPa;

6.103.8 Water flow in systems with a maximum pressure of 0,6 MPa;

6.103.9 Water flow in systems with a maximum pressure of 0,86 MPa;

6.103.10 Water flow in systems with a maximum pressure of 1,0 MPa;

6.103.11 Water flow in systems with a maximum pressure of 1,6 MPa;

Additional subclause:

6.103.12 Water flow in systems with a maximum system pressure other than indicated above.

6.104 According to nominal size and thread size of end connections

The nominal size and the thread size of end connections are given in Table 101.

Table 101 – Nominal size and thread size of end connections

Designation of thread (inch)	Nominal size
1/8	DN 6
1/4	DN 8
3/8	DN 10
1/2	DN 15
3/4	DN 20
1	DN 25
1 ¼	DN 32
1 ½	DN 40
2	DN 50

NOTE The designation "DN" followed by the appropriate convenient round number is normally only loosely related to manufacturing dimensions and corresponds for reference purposes only approximately to the internal diameter expressed in millimetres of the water system.

7 Information

This clause of Part 1 is applicable, except as follows:

Table 7.2

Modification:

Replace the following items by:

Requirement	Information	Clause or subclause	Method
7	The type of load controlled by each circuit (for valves with switching devices) ⁷⁾	6.2, 14, 17,	C
22	Temperature limits of the actuator, if T_{min} lower than 0 °C, or T_{max} other than 55 °C	6.7, 14.5, 14.7, 17.3	D
23	Not applicable		
26	Not applicable		
28	Not applicable		
29	Type of disconnection or interruption provided by each circuit (for valves with switching devices)	6.9	X
36 to 38	Not applicable		
39	Type 1 or type 2 action (for valves with switching devices) ¹⁰⁺⁾	6.4	D
40	Additional features of type 1 or type 2 actions (for valves with switching devices) ¹⁰⁺⁾	6.4.3	D
41	Manufacturing deviation and condition of test appropriate to deviation (for valves with switching devices)	11.4.3, 15, 17.14	X
42	Drift (for valves with switching devices)	11.4.3, 15	X
43 to 44	Not applicable		
46 to 48	Not applicable		
49	Control pollution situation of actuator	6.5.3	D

Add the following additional items:

Requirement	Information	Clause or subclause	Method
101	Power consumption in watts or in VA or current rating		C
102	Maximum operating pressure differential in MPa (or in bar)	2.3.114	D
103	Minimum operating pressure differential in MPa (or in bar)	2.3.115	D
104	Maximum working pressure in MPa (or in bar)	2.3.116, 6.103	D
105	Flow direction indicated by an arrow (on valve body)		C
106	Maximum water temperature in °C	6.103	D
107	Suitable for drinking water or non-drinking water	6.103, 18.102	D
108	For valves intended to be cleaned in normal use, the method of disassembling, cleaning, reassembling and maintenance	18.1.101	D
109	If valve is intended to be used in water supply installations where water hammer may occur and test method per annex AA or EE	18.101.3	X
110	Material identification of wetted parts	6.102.4	X
111	Valve features	6.101, 6.102	D
112	Plastic valves intended to be hand-tightened	18.103.5	D
101) The water valve itself is type 1 action.			

Table 1 – Required information and methods of providing information

Modification:

Replace the following items by:

	Information	Clause or subclause	Method
7	The type of load controlled by each circuit (for valves with switching devices) ^b	6.2, 14, 17, 23.1.1	C
22	Temperature limits of the actuator, if T_{min} lower than 0 °C, or T_{max} other than 55 °C	6.7, 14.5, 14.7, 17.3	D
26	Not applicable		
28	Not applicable		
29	Type of disconnection or interruption provided by each circuit (for valves with switching devices)	6.9, 2.4	X
36 to 38	Not applicable		
39	Type 1 or type 2 action (for valves with switching devices) ^{aa}	6.4	D or E
40	Additional features of type 1 or type 2 actions (for valves with switching devices) ^{aa}	6.4.3, 11.4	D or E
41	Manufacturing deviation and condition of test appropriate to deviation (for valves with switching devices)	11.4.3, 15, 17.14, 2.11.1	X
42	Drift (for valves with switching devices)	11.4.3, 15, 2.11.2	X
43 to 44	Not applicable		
47	Not applicable		
49	Control pollution situation of actuator	6.5.3	D or E

Add the following additional items:

	Information	Clause or subclause	Method
101	Power consumption in watts or in VA or current rating		C
102	Maximum operating pressure differential in MPa (or in bar)	2.3.114	D
103	Minimum operating pressure differential in MPa (or in bar)	2.3.115	D
104	Maximum working pressure in MPa (or in bar)	2.3.29, 6.103	D
105	Flow direction indicated by an arrow (on valve body)		C
106	Maximum water temperature in °C	6.103	D
107	Void		
108	For valves intended to be cleaned in normal use, the method of disassembling, cleaning, reassembling and maintenance	18.1.101	D
109	If valve is intended to be used in water supply installations where water hammer may occur	18.101.3	X
110	Material identification of wetted parts	6.102.4	X
111	Valve features	6.101, 6.102	D
112	Plastic valves intended to be hand-tightened	18.103.5	D
113	Valves incorporated in those household appliances covered by the IEC 60335 series where the loss of water supply or dry valve is considered as an abnormal use condition ^{ab}	14.5.107, 27.101	D
114	For valves identified under item 113, details of any limitation of operating time (duty cycle) ^{ac}	27.101.2	D
115	Water valve intended to be used in accordance with IEC 60335	18.101.3	D
116	If the valve is intended to be used for the control of water for tap and shower outlets	2.13.103 18.101.4	D
^{aa} The water valve itself is type 1 action. ^{ab} Not applicable in Canada, Japan and the USA. ^{ac} Not applicable in Canada, Japan, and the USA.			

7.4 Additional requirements for marking

This clause of Part 1 is applicable except as follows:

7.4.4 Not applicable.

~~Add the following note:~~

~~NOTE This is not applicable to seals, O-rings, springs, and the like.~~

8 Protection against electric shock

This clause of Part 1 is applicable, except as follows:

8.1.4 Addition:

For class II water valves, reinforced insulation shall not be in direct contact with the water.

Additional subclause:

8.1.101 Valves which are declared capable of being cleaned in normal use shall be so constructed that there is adequate protection against accidental contact with live parts during cleaning.

Compliance is checked by inspection and by a simulated cleaning operation as described below:

If the actuator can be removed from the valve body assembly without disconnecting the electrical wiring, the removed actuator shall still meet the requirements for its class of construction. Removal shall not affect electrical characteristics.

If the actuator can only be removed from the valve body assembly after removing the electrical wiring:

- a) *the inspection and simulated cleaning operation shall be made in accordance with the manufacturer's instructions in the documentation;*
- b) *if a plug connector is used, this removal shall be impossible before the plug connector is disconnected. Plug connectors for actuators with earth connection shall be so designed that the disconnection of the electrical supply takes place prior to the disconnection of the earthed wire.*

NOTE For plug connectors, reference is made to ISO 4400 and ISO 6952.

9 Provision for protective earthing

This clause of Part 1 is applicable.

10 Terminals and terminations

This clause of Part 1 is applicable, except as follows:

10.1 Terminals and terminations for external copper conductors

10.1.1.1 ~~Delete the last explanatory paragraph~~ Note 2.

10.1.16 Flying leads (pig tails)

Modification:

Replace the first sentence by:

Where flying lead (pig tail) connections are used, the lead or leads shall be no smaller than 0,75 mm² with an insulation having a nominal thickness not less than 0,6 mm and shall be a minimum of 450 mm long as measured from the coil to the end of the lead, except if the flying lead is intended to be connected to the wiring within the valve enclosure, in which case the flying lead shall be at least 150 mm long.

10.1.16.1 ~~Replace the first sentence by~~ Replacement:

Flying leads shall be provided with strain relief for attachment method Z to prevent mechanical stress from being transmitted to terminals for internal wiring.

Compliance is checked by inspection and by applying a pull of 44 N for 1 min.

During the pull, the lead shall not be damaged and shall not have been displaced longitudinally by more than 2 mm after the test. Creepage distances and clearances shall not have been reduced to less than the value specified in Clause 20.

10.2 Terminals and terminations for internal conductors

Additional notes:

NOTE 101 The requirements of 10.2 also apply to terminals and terminations of ~~controls~~ water valves which are intended to be used for internal wiring which is external to the equipment.

NOTE 102 The requirements of 10.2 apply to terminals and terminations deliberately designed to accept special connectors such as the plug connectors described in ISO 4400 and ISO 6952.

NOTE 103 The requirements of 10.2 apply to terminals and terminations deliberately designed for connection of pilot duty loads.

11 Constructional requirements

This clause of Part 1 is applicable, except as follows:

11.3 Actuation and operation

Modification:

For "controls" read "valves with auxiliary switches" throughout ~~the whole of this subclause~~ entire Subclause 11.3 and its subdivisions.

Replacement:

11.3.9 Manually actuated mechanisms

11.3.9.1 Operation of a manually actuated mechanism of a valve shall not subject parts to distortion or damage to the extent that their intended function is impaired.

Compliance is checked by operation and inspection.

11.3.9.2 Operating parts shall be separated from conductors to be connected to the valve by barriers or by their physical location so that such operating parts are not obstructed by stowed wiring.

Compliance is checked by operation and inspection.

Additional subclause:

11.101 Separation of wetted parts from electrical parts

There shall be no leakage of water to the electrical parts.

Compliance is checked by inspection after the pressure test of 18.101.1.

12 Moisture and dust resistance

This clause of Part 1 is applicable.

13 Electric strength and insulation resistance

This clause of Part 1 is applicable.

14 Heating

This clause of Part 1 is applicable, except as follows:

Replacement:

14.4.3.1 Not applicable.

Additional subclauses:

14.4.101 *If stalling of the motorized electric actuator drive shaft is part of normal operation, then the drive shaft of motorized actuators shall be stalled and temperatures measured after steady-state conditions are reached. The temperatures shall comply with the values of Table ~~14.4~~ 13. In addition, if any protective device provided does not cycle under stalled conditions, then the electric actuator is also considered to comply with the requirements of ~~27.2.101~~ 27.2.3 and 27.2.101 if applicable.*

14.4.102 *If stalling of the motorized electric actuator drive shaft is not part of normal operation, then the values of Table ~~14.4~~ 13 do not apply during stalling. The electric actuator shall comply with the requirements of 27.2.3 and 27.2.101 if applicable.*

14.5 *Replacement:*

Actuators of valves are tested at room temperature or in appropriate heating and/or refrigerating apparatus and fitted ~~so~~ such that the conditions in 14.5.1 ~~to 14.5.6 inclusive~~, 14.5.2, 14.5.101 to 14.5.104, and 14.5.107 are obtained.

14.5.1 *Replacement:*

For the test of ~~14.5.7~~ 14.5.105, the ambient temperature of the actuator is maintained in the range of 15 °C to 30 °C, the resulting measured temperature being corrected to a 25 °C reference.

14.5.2 *Replacement:*

For the test of ~~14.5.8~~ 14.5.106, the ambient temperature of the actuator is maintained at T_{max} .

Additional subclauses:

14.5.3 14.5.101 *If the valve includes switching devices or other auxiliary circuits, all such circuits shall be loaded to carry rated current during the temperature test.*

14.5.4 14.5.102 *A modulating valve shall be caused to execute successive complete cycles of the modulating action for which it is designed until constant temperatures are reached. The time between successive cycles is chosen in accordance with the manufacturer's specifications.*

14.5.5 14.5.103 *A valve intended for rapid repeated operation shall be energized and de-energized at the maximum rate of operation for which it is intended until constant temperatures are reached.*

14.5.6 14.5.104 *The temperature rise of the motor of a motor-operated valve when stalled shall not exceed the values specified in Table ~~14.1~~ 13 if stalling is part of normal operation.*

14.5.7 14.5.105 For valves intended for use at room temperature and for valves handling cold water up to 25 °C, a 30 cm length of iron or copper pipe of the correct size shall be fitted in the inlet and outlet openings of the valve under test. The pipe shall be arranged as a framework so that the valve will be mounted or suspended away from other heat-conduction bodies. The end of the pipes need not be plugged.

NOTE This test does not apply to valves identified under requirement 113 of Table 1.

14.5.8 14.5.106 Valves intended for handling hot water shall be tested with the hot water connected and with and without the hot water flowing through the valve at the highest declared temperature.

NOTE This test does not apply to valves identified under requirement 113 of Table 1.

14.5.107 Valves identified under requirement 113 of Table 1 are tested at their declared operating conditions (for instance: T_{\max} , maximum working pressure, considering any declared limitation of the operating time) with the water connected and flowing through the valve at its highest declared temperature.

~~14.7.4 Addition to table 14.1~~

Table 13 – Maximum heating temperatures

Additional footnote:

Add "~~101~~ aa" to the third value of "85" in the last column of Table ~~14.1~~ 13 against: "All accessible surfaces except those of actuating members, handles, knobs, grips and the like".

~~Addition to the notes of table 14.1~~ Add to the footnotes:

~~101~~ aa This value is increased to 110 °C (120 °C in some countries) for the surface of valves and the like to be mounted on the pipes of central heating systems.

15 Manufacturing deviation and drift

This clause of Part 1 is applicable ~~to valves with type 2 switching devices~~.

16 Environmental stress

This clause of Part 1 is applicable, except as follows:

16.1.1 Additional note:

NOTE 101 At the request of the manufacturer, the appropriate tests of 16.2 can be carried out before the tests of Clause 14.

16.2 Environmental stress of temperature

16.2.1 Replacement:

The effect of temperature is tested as follows:

The valve body and actuator being repacked for dispatching as delivered by the valve manufacturer shall be maintained at a temperature of (-10 ± 2) °C for a period of 24 h, and then at a temperature of (50 ± 5) °C for a period of 4 h.

NOTE In some countries, a temperature of (-40 ± 2) °C is used instead of (-10 ± 2) °C.

During the environmental stress, the valve or actuator is not energized.

16.2.2 Replacement:

The valve or actuator is considered to withstand the environmental stress if it functions in the intended and declared manner after this test.

17 Endurance

This clause of Part 1 is applicable, except as follows:

17.1.1 Addition:

Compliance is checked by the tests of 17.16.

17.1.2 Not applicable.

17.1.2.1 Not applicable.

17.7 Overvoltage test (or overload test in Canada, the USA, and all countries using an overload test) of automatic action at accelerated rate

17.7.1 Replacement:

~~*The automatic operation of the valve shall be tested by causing the valves to operate for the number of automatic operations as declared in table 7.2, requirement 27. The number of automatic operations shall be a minimum of 6 000 or any higher number as required by the application and declared by the manufacturer.*~~

~~*The rate of operation and the method of operation shall be agreed between the testing authority and the manufacturer.*~~

~~*A cycle rate of about 6 cycles/min for a water valve can be used as a guidance. During the test, valves are loaded with 1,06 times rated voltage or 1,06 times the upper limit of the rated voltage range or loaded as indicated in 17.2.3.1.*~~

The electrical conditions shall be 1,06 times the rated voltage or 1,06 times the upper limit of the rated voltage range when performing an overvoltage test or as indicated in 17.2.3.1 and 17.2.3.2 when performing an overload test.

17.7.2 Replacement:

The valve shall be tested at:

- a) *the maximum declared ambient temperature. During the test, the heating or cooling effect of the water flow temperature shall not be allowed to cause the ambient temperature to exceed the maximum declared ambient temperature or fall below the minimum declared ambient temperature;*
- b) *the highest declared water flow temperature;*
- c) *the declared maximum operating pressure differential.*

17.7.3 Replacement:

The rate of operation and the method of operation shall be agreed between the testing authority and the manufacturer.

A cycle rate of about 6 cycles/min for a water valve can be used as guidance.

17.7.4 Not applicable.

17.7.5 Not applicable.

17.7.6 *Replacement:*

The number of automatic cycles for the test shall be a minimum of 6 000 or any higher number as required by the application and declared by the manufacturer in Table 1, requirement 27.

17.7.7 Not applicable.

17.16 Test for particular purpose controls

Replacement:

The tests for electrically operated valves are as follows:

- 17.1 is applicable.
- 17.2 to 17.4 inclusive are applicable to auxiliary switching devices integrated or incorporated in a valve.
- 17.5 is applicable.
- 17.6 is not applicable.
- 17.7 is applicable as modified in this document.
- 17.8 to 17.13 inclusive are applicable to auxiliary switching devices integrated or incorporated in the valve.
- 17.14 is applicable.
- 17.15 is not applicable.

18 Mechanical strength

This clause of Part 1 is applicable, except as follows:

Additional subclauses:

18.101 Valves shall withstand the water pressure occurring in normal use.

Compliance is checked by the following tests.

18.101.1 Test at 1,5 times maximum rated working pressure (test for external leakage)

After the endurance test of 17.7, the valve in open position with the outlet sealed is subjected on the inlet side during 1 h to a static water pressure equal to 1,5 times the declared maximum working pressure.

In the case of diaphragm elements that, in normal usage, are subjected to water pressure on both sides of the diaphragm, the pressure shall be applied slowly and without shock to avoid excessively stressing the diaphragm. After the test, inspection shall show that no leakage of water of more than 5 cm³/h has occurred and that the valve is still operating as intended.

18.101.2 Test at 5 times maximum rated working pressure (hydrostatic strength test)

For metal valves, this test shall be carried out after the torque test of 18.103.

~~After the torque test of 18.103 which is conducted on a separate sample~~ This test is conducted on a sample other than the one used for 18.101.1, this sample is subjected for 1 min to a water pressure 5 times the declared maximum working pressure under the same conditions as indicated in 18.101.1.

External water leakage observed during this test is acceptable if, following this hydrostatic test, the valve complies with the external leakage requirements of 18.101.1.

18.101.3 Anti-water hammer characteristics

Water valves with declared anti-water hammer characteristics intended to be connected directly to water supply mains shall not cause an excessive pressure drop when opening, or an excessive transient pressure when closing.

~~Compliance is checked by carrying out the tests of 18.101.3.1 to 18.101.3.3, inclusive according to the arrangement of annex BB. Annex EE can be used as an alternative method of test for water hammer for water valves connected to water supply mains with maximum working pressure up to and including 1,0 MPa (10 bar) for water valves intended for use in appliances within the scope of IEC 60335-1, if declared.~~

Compliance is checked by carrying out the tests of 18.101.3.1 to 18.101.3.3 according to the method of Annex BB or Annex EE. Annex EE is applied to water valves connected to water supply mains with maximum working pressure up to and including 1,0 MPa (10 bar) within the scope of IEC 60335-1 (see Table 1, requirement 115).

NOTE 1 In most countries, water hammer does not usually occur due to water installation requirements and special precautions based on plumbing practices.

NOTE 2 In general, water valves with end-connection sizes up to DN 15 used in equipment connected via a hose to the water supply mains piping will not cause a water hammer that can damage water conducting systems or equipment.

18.101.3.1 Pressure drop at low supply pressure

For determining the pressure drop at low supply pressure, the pressure at the valve inlet with the water valve under test (see Annex BB, item 15 of Figure BB.1 or Annex EE, ~~valve~~ item 10 of Figure EE.1) in the open position, is adjusted to 0,1 MPa (1 bar) by regulating the pump or the by-pass valve ~~3~~ (see Annex BB, items 2 and 3 of Figure BB.1 or Annex EE, items 2 and 3 of Figure EE.1) ~~or pump 2 (see annex EE)~~. The water valve under test is then closed and after 20 s opened again. The pressure shall at no time become negative.

18.101.3.2 Pressure drop at rated inlet pressure

For determining the pressure drop at rated inlet pressure, the pressure at the valve inlet, with the water valve under test (see Annex BB, item 15 of Figure BB.1 or Annex EE, ~~valve~~ item 10 or Figure EE.1) in the open position is adjusted to 0,6 MPa (6 bar) by regulating ~~valve 3~~ the pump or the by-pass valve (see Annex BB, items 2 and 3 of Figure BB.1 or Annex EE, items 2 and 3 of Figure EE.1) ~~or pump 2 (see annex EE)~~. The water valve under test is then closed and after 20 s opened again. When the water valve is opened, the pressure shall at no time become negative.

18.101.3.3 Transient pressure at high pressure

Valves intended to be connected to the water supply mains shall not cause an excessive transient pressure.

Compliance is checked by the following:

The pressure at the valve inlet, with the water valve ~~15~~ under test (see Annex BB, item 15 of Figure BB.1 or Annex EE, item 10 of Figure EE.1) ~~or valve 10 (see annex EE)~~ in the closed position, is adjusted to 0,6 MPa (6 bar) by regulating ~~valve 3 or pump 2~~ the pump or the by-pass valve (see Annex BB, items 2 and 3 of Figure BB.1 or Annex EE, items 2 and 3 of Figure EE.1). The water valve under test is then opened and after the flow has become constant closed again. When the water valve is closed, the pressure shall at no time exceed 0,9 MPa (9 bar).

NOTE This is to reflect the increasing usage of smaller pipe sizes in the household water installation system.

18.101.4 Test on valve bodies of thermoplastic material

Valve bodies of thermoplastic material shall withstand the thermal conditions to which they may be subjected when used as intended.

Compliance is checked by the following tests:

18.101.4.1 Valve bodies of thermoplastic material intended to be connected to the water supply mains and intended for other uses than control of **water for tap and shower outlets** shall be checked by carrying out the test as indicated in Annex CC, Clause CC.1.

~~18.101.4.2 A test is under consideration for valve bodies of thermoplastic material not intended to be connected to the water supply mains. See annex CC. Void~~

18.101.4.3 Valve bodies of thermoplastic material intended to be connected to the water supply mains for the control of **water for tap and shower outlets** shall be checked by carrying out the test as indicated in Annex CC, Clause CC.2.

18.102 ~~Wetted material specifications~~ Void

~~Under consideration.~~

~~18.102.1~~ Wetted materials shall withstand the chemical conditions to which they may be subjected when used as intended.

~~Compliance is checked by the following tests:~~

~~18.102.1.1~~ ~~Test for corrosion resistance of materials wetted by drinking water~~

~~NOTE~~ Because this test is in general under the control of the water authorities or companies (in most countries part of the local, federal or state government) reference is made to the specifications issued by these national authorities.

~~18.102.1.2~~ ~~Test for corrosion resistance of materials wetted by non-drinking water~~

~~NOTE~~ The method of test is under consideration.

~~18.102.1.3~~ ~~Tests for the effect on drinking water quality by wetted materials~~

~~NOTE~~ This test is under the control of the water authorities responsible for the quality of the drinking water. Reference in this respect is made to the specifications issued by these authorities.

18.103 Torque

18.103.1 Valves and their joints shall withstand the stresses to which they may be subjected during installation and servicing.

Compliance is checked by the applicable torque tested, as indicated in the following subclauses and in Annex DD. After the tests of Annex DD, the hydrostatic strength test of 18.101.2 is carried out. There shall be no evidence of loosening of joints, distortion, external leakage beyond the limits of 18.101.2, or other damage.

18.103.2 Valves with internal threaded end-connections

18.103.2.1 Metal valves with internal threaded end-connections shall be subjected to the appropriate torque test of Annex DD as indicated in Table 102.

Table 102 – Torque test requirement for metal valves with internal threaded end-connections

Thread type	Clause
ISO 7-1	DD.1
ISO 228-1	DD.2
ISO metric for compression fittings	DD.3
NPT	DD.7
SAE	DD.8

NOTE Torque values for plastic valves with internal threaded end-connections are under consideration.

18.103.3 Valves with external threaded end-connections

18.103.3.1 Metal valves with external threaded end-connections shall be subjected to the appropriate torque test of Annex DD as indicated in Table 103.

Table 103 – Torque test requirement for metal valves with external threaded end-connections

Thread type	Clause
ISO 7-1	DD.4
ISO 228-1	DD.5
ISO metric for compression fittings	DD.5
NPT	DD.7
SAE	DD.8

NOTE Torque values for plastic valves with ~~internal~~ external threaded end-connections are under consideration.

18.103.4 Valves with end-connections for adaptors

Metal valves with end-connections for use with adaptors are subjected to the torque test specified in Clause DD.6.

18.103.5 Types of valves that do not require a torque test

The following valves are not subjected to a torque test:

- plastic valves with internal or external threaded end-connections intended to be hand-tightened (see Table 7.2 1, requirement 112);
- metal valves with flanged end-connections;

- valves with end-connections for hose tail or slip-fit connections and for use with flexible tubing;
- metal valves with end-connections for soldered or brazed connections.

19 Threaded parts and connections

This clause of Part 1 is applicable.

20 Creepage distances, clearances and distances through insulation

This clause of Part 1 is applicable.

21 Resistance to heat, fire and tracking

This clause of Part 1 is applicable.

22 Resistance to corrosion

This clause of Part 1 is applicable.

23 Electromagnetic compatibility (EMC) requirements – Emission

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable.

25 Normal operation

See annex H.

This clause of Part 1 is applicable, except as follows:

25.2 Overvoltage and undervoltage test

Replacement:

A valve shall operate as intended at any voltage within the range of 85 % of the minimum rated voltage and 110 % of the maximum rated voltage, inclusive.

Compliance is checked by subjecting the valve to the following tests at T_{\max} , maximum water temperature (see Table 1, requirement 106) and maximum operating pressure differential (see Table 1, requirement 102). For this test, any declared limitation of operating time (see Table 1, requirement 34) is considered.

The valve is subjected to $0,85 V_{R\min}$ until equilibrium temperature is reached and then tested immediately for operation at $0,85 V_{R\min}$.

The valve is also subjected to $1,1 V_{R\max}$ until equilibrium temperature is reached and then tested immediately for operation at $1,1 V_{R\max}$ and at rated voltage.

After each test, the valve shall operate once as intended.

26 Electromagnetic compatibility (EMC) requirements – Immunity

~~See annex H.~~

This clause of Part 1 is applicable.

27 Abnormal operation

This clause of Part 1 is applicable, except as follows:

~~27.1 See annex H.~~

~~Replacement:~~

27.2 ~~Blocked mechanism test~~ Burnout test

~~Replacement:~~

Valves incorporating solenoids and valves incorporating motors shall withstand the effects of blocking of the valve mechanism.

For valves where an external mechanical blockage will not cause an internal overload of the valve due to decoupling of the external blockage to the internal mechanical structure, e.g. a clutch, a blockage of the mechanical parts between the motor and the decoupling means shall be tested.

Compliance is checked by the tests of 27.2.1 and 27.2.2.

27.2.1 ~~Replacement:~~

The valve mechanism is blocked in the position assumed when the valve is de-energized. If more than one position is possible, the position which produces the most onerous effects shall be chosen. The valve is then energized at rated frequency, rated voltage, room temperature of (20 ± 5) °C without water and with no consideration of any limitation of the operating time (see Table ~~7.2~~ 1, requirement 34).

The duration of the test is either 7 h; or until an internal protective device, if any, operates; or until burnout, whichever occurs first.

27.2.2 ~~After this test, the valve shall be deemed to comply if:~~

- ~~— there has been no emission of flame or molten metal and there is no evidence of damage to the valve which would impair compliance with this standard;~~
- ~~— the requirements of 13.2 are still met.~~

~~Replacement:~~

After this test, the valve shall comply with items a) to g) of H.27.1.1.3, where applicable.

NOTE The valve need not be operative following the test.

~~Addition:~~

27.2.101 27.2.3 Blocked mechanical output test (abnormal temperature test)*Replacement:*

Valves with motorized electrical actuators shall withstand the effects of blocked output without exceeding the temperatures indicated in Table ~~27.2.101~~ 104. Temperatures are measured by the method specified in 14.7.1.

NOTE This test is not conducted on valves ~~with motorized electric actuators~~ which meet the requirements of 14.4.101.

~~27.2.101.1 Valves with motorized electric actuators are tested for 24 h with the output blocked at rated voltage and in a room temperature in the range of 15 °C to 30 °C, the resulting measured temperature being corrected to a 25 °C reference value.~~

~~NOTE In Canada and the USA, the test is conducted at the voltages indicated in 17.2.3.1 and 17.2.3.2.~~

~~For valves with motorized electric actuators declared for three-phase operation, the test is to be carried out with any one phase disconnected.~~

Table 27.2.101 — Maximum permitted temperatures for test of blocked output conditions

Condition	Temperature of insulation by class				
	A	E	B	F	H
During the first hour					
— maximum value ¹⁾²⁾	200	215	225	240	260
After the first hour					
— maximum value ¹⁾	175	190	200	215	235
— arithmetic average ¹⁾³⁾	150	165	175	190	210
¹⁾ Applicable to actuators with thermal motor protection. ²⁾ Applicable to actuators protected by incorporated fuses or thermal cut-outs. ³⁾ Applicable to actuators with no protection.					

~~27.2.101.2 The average temperature shall be within the limits during both the second and the twenty-fourth hours of the test.~~

NOTE The average temperature of a winding is the arithmetic average of the maximum and minimum values of the winding temperature during the 1 h period.

~~27.2.101.3 During the test, power shall be continually supplied to the actuator.~~

~~27.2.101.4 Immediately upon completion of the test, the electric actuator shall be capable of withstanding the electric strength test specified in clause 13, without first applying the humidity treatment of 12.2.~~

*Replacement:***27.3 — Overvoltage and undervoltage test**

~~A valve shall operate as intended at any voltage within the range of 85 % of the minimum rated voltage and 110 % of the maximum rated voltage, inclusive.~~

~~Compliance is checked by subjecting the valve to the following tests at T_{\max} maximum water temperature (see table 7.2, requirement 106) and maximum operating pressure differential~~

~~(see table 7.2, requirement 102). For this test, any declared limitation of operating time (see table 7.2, requirement 34) is considered.~~

~~The valve is subjected to $0,85 V_{Rmin}$ until equilibrium temperature is reached and then tested immediately for operation at $0,85 V_{Rmin}$.~~

~~The valve is also subjected to $1,1 V_{Rmax}$ until equilibrium temperature is reached and then tested immediately for operation at $1,1 V_{Rmax}$ and at rated voltage.~~

~~After each test, the valve shall operate once as intended.~~

~~27.4 See annex H.~~

27.2.3.1 Replacement:

Valves are tested for 24 h or until thermal equilibrium has been reached with the output blocked in the most unfavorable position at rated voltage and in a room temperature in the range of 15 °C to 30 °C, the resulting measured temperature being corrected to a 25 °C reference value.

NOTE 1 In Canada and the USA, the test is conducted at the voltages indicated in 17.2.3.1 and 17.2.3.2.

NOTE 2 This test is not applicable to valves identified under requirement 113 of Table 1.

Table 104 – Maximum winding temperature (for test of blocked output conditions and valves declared under Table 1, item 113)

Condition	Temperature of insulation by class ^d							
	Class 105 (A)	Class 120 (E)	Class 130 (B)	Class 155 (F)	Class 180 (H)	Class 200 (N)	Class 220 (R)	Class 250
If impedance protected:	150	165	175	190	210	230	250	280
If protected by protective devices:								
during first hour								
– maximum value ^{a b}	200	215	225	240	260	280	300	330
after first hour								
– maximum value ^a	175	190	200	215	235	255	275	305
– arithmetic average ^{a c}	150	165	175	190	210	230	250	280
^a Applicable to actuators with thermal motor protection. ^b Applicable to actuators protected by incorporated fuses or thermal cut-outs. ^c Applicable to actuators with no protection. ^d These classifications correspond to the thermal classes specified in IEC 60085.								

Additional subclauses:

27.2.101 Test on three phase valve

27.2.101.1 With any one phase disconnected, the valve is operated under normal operation and supplied at rated voltage until thermal equilibrium has been reached.

The temperature of the winding shall not exceed the temperatures indicated in Table 104. Temperatures are measured by the method specified in 14.7.1.

Additional subclauses:

27.101 Dry condition test

Valves identified under requirement 113 of Table 1 are subjected to the test of 27.101.1.

NOTE This clause is not applicable in Canada, Japan, and the USA.

27.101.1 Valves shall withstand the abnormal condition occurring in case of loss of the water supply.

Compliance is verified by the test of 27.101.2.

27.101.2 *The water valve, connected but without water, is energized at rated frequency and rated voltage. The valve is operated:*

- *at the ambient temperature, and*
- *considering any limitation of the operating time (duty cycle).*

The duration of the test is either 4 h or until the steady temperature state is reached, whichever occurs first.

The temperature measured shall comply with the temperatures indicated in Table 104.

27.102 Running overload

27.102.1 The running overload test is carried out on motorized electrical actuators that are intended to be remotely or automatically controlled or liable to be operated continuously in unattended mode if overload protective devices relying on electronic circuits to protect the motor windings, other than those that sense winding temperatures directly, are also subjected to the running overload test.

27.102.2 The valve is operated under normal operation conditions and supplied at rated voltage until steady conditions are established. The load is then increased so that the current through the motor windings is raised by 10 % increments and the valve is operated again until steady conditions are established, the supply voltage being maintained at its original value.

27.102.3 During the test, the winding temperature shall not exceed

- 140 °C, for class 105 (A) winding insulation;
- 155 °C, for class 120 (E) winding insulation;
- 165 °C, for class 130 (B) winding insulation;
- 180 °C, for class 155 (F) winding insulation;
- 200 °C, for class 180 (H) winding insulation;
- 220 °C, for class 200 (N) winding insulation;
- 240 °C, for class 220 (R) winding insulation;
- 270 °C, for class 250 winding insulation.

NOTE If the load cannot be increased in appropriate steps, the motor can be removed from the appliance and tested separately.

27.102.4 For valves which are used in a continuously operation for longer than 24 h without interruption, the load is again increased and the test is repeated until the protective device operates or the motor stalls.

27.102.5 For valves which are used in operation mode which will not exceed for longer than 24 h without interruption, the test is repeated after the winding temperature has reached environmental temperature conditions. The test will be performed with an increased load so that the current through the motor windings is raised by 10 % increments. The valve is operated again until steady conditions are established, the supply voltage being maintained at its original value. This procedure will be repeated until the protective device operates or the motor stalls.

28 Guidance on the use of electronic disconnection

This clause of Part 1 is not applicable.

Figures

The figures of part 1 are applicable.

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Annexes

The annexes of Part 1 are applicable, except as follows:

Annex H (normative)

Requirements for electronic controls

This annex of Part 1 is applicable except as follows:

For “controls”, read “water valves” throughout all clauses in Annex H.

H.6 Classification

H.6.18 According to ~~software~~ classes of control functions (see Table 1, requirement 92).

H.6.18.1 Not applicable.

H.6.18.2 Not applicable.

H.6.18.3 Not applicable.

H.7 Information

~~Additional requirements to table 7.2:~~

Requirements 66 to 72, inclusive, are not applicable.

~~H.11 Constructional requirements~~

~~H.11.12 Controls using software~~

~~H.11.12 to H.11.12.13 inclusive are not applicable.~~

H.26 Electromagnetic compatibility (EMC) requirements – immunity

~~Replace the explanatory note by the following:~~

~~NOTE Electrically operated water valves are type 1 action; therefore, only H.26.8, H.26.9 and H.26.13.1 are applicable.~~

~~H.26.9 fast transient burst test~~

~~Replacement:~~

~~NOTE This test is under consideration in Canada and the United States.~~

~~Add the following subclause:~~

~~H.26.9.101 Test procedure~~

~~The valve is subjected to five tests.~~

~~H.26.13 Evaluation of compliance~~

~~H.26.13.1 Replacement:~~

~~After the tests of H.26.8 and H.26.9, the sample(s) shall meet the requirements of clause 8 and 17.5 for basic insulation and clause 20.~~

~~H.26.13.2 Not applicable.~~

This clause of Part 1 is applicable, except as follows.

H.26.5 Voltage dips, voltage interruptions and voltage variations in the power supply network

H.26.5.1 Voltage dips and interruptions

Additional subclause:

H.26.5.1.101 Compliance

After the test according to H.26.5.1.2 of all the voltage dips and the voltage interruption of more than one cycle of the supply waveform, the valve shall provide normal operation.

During the tests according to H.26.5.1.2 of an interruption of one cycle and of an interruption of one half-cycle of the supply waveform, the control shall continue to operate after restoration of the supply voltage from the position the valve was in right before the interruption.

H.26.5.2 Voltage variation test

Additional subclause:

H.26.5.2.101 Compliance

After the test according to H.26.5.2.2 of voltage test level 0 % V_R , the valve shall provide normal operation.

During the tests according to H.26.5.2.2 of voltage test level 40 % V_R , the control shall continue to operate after restoration of the supply voltage from the position the valve was in right before the interruption.

H.26.6 Not applicable.

H.26.8 Surge immunity test

H.26.8.3 Test procedure

Addition:

The five pulses in each polarity shall be distributed in the following operating modes:

- 1 pulse in the closed position;
- 3 pulses during energized movement in the most surge sensitive position;
- 1 pulse in the open position.

Additional subclause:

H.26.8.3.101 Compliance

The valve shall tolerate voltage surges on the mains supply and signal lines, so that, when tested in accordance with H.26.8.3,

- a) for the value of severity level 2: it shall continue to function in accordance with the requirements of this document. No influence to the actual position of the valve is recognized;*
- b) for the value of severity level 3: for a valve as a protective actuator used as a component of a protective multi-purpose control or system, it shall either perform as in a) or it may stop operating and shall indicate that it has done so to the protective multi-purpose control or system.*

NOTE The acceptability of the indication to the protective multi-purpose control or system is dependent on the application.

H.26.9 Electrical fast transient/burst immunity test

H.26.9.3 Test procedure

Addition:

The valve is subjected to five tests.

Operating modes are as follows:

- whilst in the closed position;
- during energized movement in the most surge sensitive position;
- whilst in the open position.

Additional subclause:

H.26.9.3.101 Compliance

The valve shall tolerate electrical fast/transient bursts on the mains supply and signal lines, so that, when tested in accordance with H.26.9.3,

- a) for the value of severity level 2: it shall continue to function in accordance with the requirements of this document. No influence to the actual position of the valve is recognized;*
- b) for the value of severity level 3: for a valve as a protective actuator used as a component of a protective multi-purpose control or system, it shall either perform as in a) or it may stop operating and shall indicate that it has done so to the protective multi-purpose control or system.*

NOTE The acceptability of the indication to the protective multi-purpose control or system is dependent on the application.

H.26.11 Electrostatic discharge test

Additional subclauses:

H.26.11.101 Test procedure

The test shall be performed during the following operating modes:

- whilst in the closed position;

- during energized movement in the most surge sensitive position;
- whilst in the open position.

H.26.11.102 Compliance

The valve shall tolerate electrostatic discharges on the mains supply and signal lines, so that, when tested in accordance with H.26.11.101,

- a) for the value of severity level 3: it shall continue to function in accordance with the requirements of this document. No influence to the actual position of the valve is recognized;*
- b) for the value of severity level 4: for a valve as a protective actuator used as a component of a protective multi-purpose control or system, it shall either perform as in a) or it may stop operating and shall indicate that it has done so to the protective multi-purpose control or system.*

NOTE The acceptability of the indication to the protective multi-purpose control or system is dependent on the application.

H.26.12 Radio-frequency electromagnetic field immunity

Additional subclauses:

H.26.12.1.101 Additional requirements

The test procedure and compliance criteria for H.26.12.2 and H.26.12.3 shall be according H.26.12.1.102 and H.26.12.1.103.

H.26.12.1.102 Test procedure

The test shall be performed during the following operating modes:

- whilst in the closed position;
- during energized movement in the most surge sensitive position;
- whilst in the open position.

H.26.12.1.103 Compliance

The valve shall tolerate high frequency signals and fields on the mains supply, signal terminals and the enclosure, so that, when tested in accordance with H.26.12.1.102,

- a) for the value of severity level 2: it shall continue to function in accordance with the requirements of this document. No influence to the actual position of the valve is recognized;*
- b) for the value of severity level 3: for a valve as a protective actuator used as a component of a protective multi-purpose control or system, it shall either perform as in a) or it may stop operating and shall indicate that it has done so to the protective multi-purpose control or system.*

NOTE The acceptability of the indication to the protective multi-purpose control or system is dependent on the application.

H.26.13 Test of influence of supply frequency variations

Addition:

This subclause is applicable for a valve as a protective actuator used as a component of a protective multi-purpose control or system where the protective function depends on the supply frequency.

H.26.13.3 Test procedure

Addition:

The travel time to move the valve from the closed position to the open position as well as in the other direction as well as to remain in the final position shall be verified for each of the frequencies of Table H.19.

Additional subclause:

H.26.13.3.101 Compliance

The percentage of the travel time deviation shall not be higher than the percentage of the frequency variation. A final position shall be maintained.

H.26.14 Power frequency magnetic field immunity test

Modification:

Replace the second paragraph with the following new paragraph:

Compliance is checked by H.26.14.3.101 after the test of H.26.14.2.

H.26.14.3 Test procedure

Addition:

Operating modes are as follows:

- whilst in the closed position;
- moving between the closed and open position and vice-a-versa (being in operation);
- whilst in the open position.

The test shall be performed in all three operating modes.

Additional subclause:

H.26.14.3.101 Compliance

The valve shall tolerate a power frequency magnetic field, so that, when tested in accordance with H.26.14.3,

- a) *for the value of severity level 2: it shall continue to function in accordance with the requirements of this document. No influence to the actual position of the valve shall be recognized;*
- b) *for the value of severity level 3: for a valve as a protective actuator used as a component of a protective multi-purpose control or system, it shall either perform as in a) or it may stop operating and shall indicate that it has done so to the protective multi-purpose control or system.*

NOTE The acceptability of the indication to the protective multi-purpose control or system is dependent on the application.

Additional annexes:

Annex AA (informative)

Relation between different flow coefficients

AA.1 K_v value

The flow factor indicated by the symbol K_v represents the number of cubic metres per hour of water, at a temperature between 5 °C and 40 °C, that will flow through a valve in the fully open position at a pressure differential across the valve of 100 kPa (1 bar).

AA.2 C_v value

The flow factor indicated by the symbol C_v generally referred to as the flow coefficient represents the number of US gallons (3,785 dm³) per minute of water, at a temperature between 4,5 °C and 37,8 °C (40 °F and 100 °F) that will flow through a valve in the full open position at a pressure differential across the valve of 6,89 kPa (1 lb/in²).

$$K_v = 0,865 C_v$$

$$C_v = 1,16 K_v$$

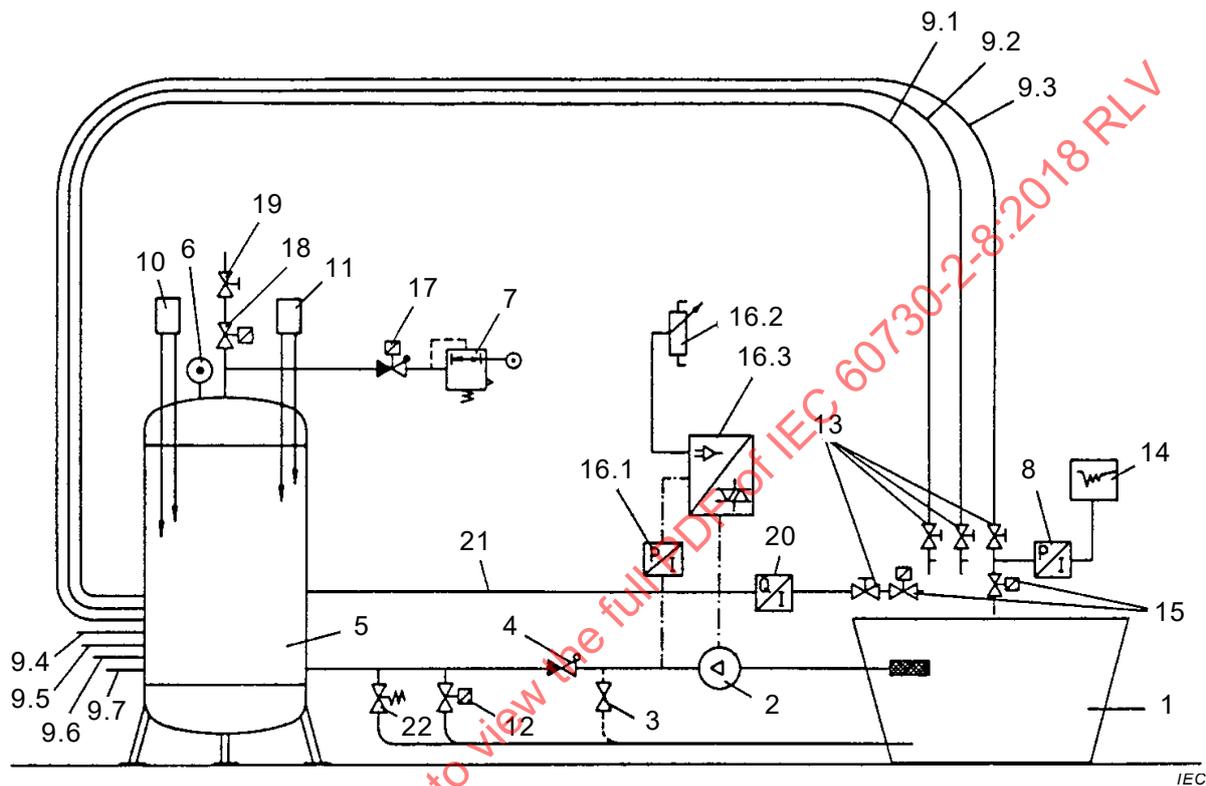
If the flow factor is indicated in litres per minute, the relation is

$$K_v = 16,7 \text{ times flow factor in l/min}$$

$$C_v = 14,4 \text{ times flow factor in l/min}$$

Annex BB (normative)

Arrangement for the measurement of transient pressures caused by water valves



Key

- 1 container of appropriate size filled with water
- 2 pump having a capacity of at least 100 l/min at a dynamic pressure of 1 MPa (10 bar)
- 3 by-pass valve; this valve is not necessary if the pump is adjustable
- 4 Non-return valve 1 1/4 in
- 5 compensating tank having a capacity of at least 350 l
- 6 pressure gauge
- 7 pressure reducer 3/8 in
- 8 pressure transducer having a pressure range between atmospheric pressure and 1,6 MPa (16 bar) and a natural frequency of more than 200 Hz
- 9 steel pipe or copper pipe with a lining having a wall thickness of 1,0 mm to 2,0 mm and a length of approximately 9 m and as well as an internal diameter which should be such that the velocity of the water flow does not exceed 2 m/s with the sample valve fully open and a static pressure of 0,6 MPa

The pipe 9.4 is bent at a radius of not less than 300 mm and the other pipes are adjusted at a respectively appropriate radius.

9.1	pipe 3/8 in	15 mm × 1 mm
9.2	pipe 1/2 in	18 mm × 1 mm
9.3	pipe 3/4 in	22 mm × 1 mm
9.4	pipe 1 in	28 mm × 1,5 mm
9.5	pipe 1 1/4 in	35 mm × 1,5 mm
9.6	pipe 1 1/2 in	42 mm × 1,5 mm
9.7	pipe 2 in	54 mm × 2 mm

- 10 level controller which controls the minimum water level; the level-controller is adjusted according to the size of the container
- 11 level controller which controls the maximum water level; the level-controller is adjusted according to the size of the container
- 12 magnetic valve having a capacity 25 % that of the pump capacity at 0,6 MPa or with flow regulator 25 l/min
- 13 ball valve or clap valve having a nominal diameter of the same size as the pipe (see 9.1 to 9.7)
- 14 recorder with which the march of pressure at the pressure transducer can be graphically demonstrated
- 15 sample valve
- 16.1 pressure indicator for pump control system (actual value)
- 16.2 adjusting potentiometer for pump control system (desired value)
- 16.3 frequency converter at rotary current actuation or thyristor control system instrument at direct current actuation. Items 16.1 to 16.3 do not apply if the testing stand is controlled by a by-pass valve 3
- 17 air pressure valve 1/2 in having a non-return valve
- 18 bleeder valve 3/8 in
- 19 reducing valve
- 20 instrument for flow measurements of respective size to measure the flow of the sample valve at 0,6 MPa
- 21 supply pipe to the instrument for flow measurements of minimum size 3/4 in (22 mm × 1 mm)
- 22 safety valve

Figure BB.1 – Transient pressure measurement test rig schematic diagram

The extension of the test arrangements depends on the transfer rate of the samples. The velocity of water flow shall not exceed 2 m/s.

NOTE Neglecting the flow resistance on base of turbulent flow, the difference in static pressure in the supply pipe between test arrangement with closed and open valve can be written as

$$\Delta p = 0,5 \rho v^2$$

A pressure drop of 0,5 bar will therefore result in a flow velocity of about 10 m/s.

Measurement procedure

Using an equipment as described in Figure BB.1

- a) Connect the sample valve (15) to the flow measurement arrangement, determine the flow at 0,6 MPa and select the appropriate pipe to limit the velocity of water flow to less than 2 m/s.
- b) Connect the sample valve (15) to the nominal size pipe as declared by the valve manufacturer to be the smallest sized pipe dimension intended to fit the valve under test to and not to exceed the limit of 2 m/s for the velocity of water flow, and connect the actuator of the sample valve to an electric pulse generator.
- c) Adjust the pressure reducer (7) and pump pressure to the pressure of 0,1 MPa (desired value potentiometer 16,2 or by-pass valve (3)).
- d) Start pump (2) and air pressure valve (17) to fill the compensating tank.
The level controller (10) opens valve (18) so that compressed air is let off if the level is not reached. The level controller (11) controls valve (12) and monitors the filling height. By the reducing valve (19) and the pressure reducer (7), the arrangement is stabilized so that the level between the shift points of the level controllers (10) and (11) stays constant at approximately 75 % of the contents of the container.
- e) De-aerate the sample valve (15) completely by using it several times. If multiple chambered valves are used, the de-aeration shall be carried out on all valves before the measurement starts.
- f) Check the pressure of the container and the level and correct if necessary.
- g) Recorder instrument (14) is triggered from the starting-point of the sample valve to record the results of the sample valve (15) indicated by the pressure transducer (8).

- h) Open sample valve (15) for 2 s and close it again.
- i) Check if the results recorded by recorder (14) fulfil the requirements.
- j) Adjust the pressure of the container to 0,6 MPa while the sample valve (15) is closed. If necessary, repeat the de-aeration. For this measurement, sample valve (15) is triggered from the switch-off-point.
- k) Open sample valve (15) for 2 s and close it again. Check the result by reading the recorder.
- l) Repeat if necessary procedures g) (with 0,1 MPa) to k).

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Annex CC
(normative)

~~Test on valve bodies of thermoplastic material intended to be connected to the water supply mains~~

Long term pressure test for thermoplastic bodied valves

~~NOTE—This test is under consideration.~~

CC.1 Valves of thermoplastic material intended to be connected to the water supply mains

~~The valves of thermoplastic material intended to be connected to the water supply mains are checked by the following test, which is made in a heating cabinet in which the air is caused to circulate and is maintained at a temperature within –5 °C of the maximum value air temperature specified in Table CC.1. The test is made on 10 valves which have not been subjected to any other test. The samples are connected to a water supply system as in normal use and are filled with water, but not exposed to any other pressure; they are kept under these conditions for a period of 3 h. After this period, the water pressure is raised, at a rate of no more than 0,084 MPa/s (0,84 bar/s), but within 5 60 s to a pressure of 2,5 MPa ± 0,05 MPa (25 bar ± 0,5 bar). The samples are kept under these conditions for the test period specified in Table CC.1:~~

Table CC.1 – Test requirements for valves intended for uses other than the control of water for tap and shower outlets

Temperature marking	Type of material used ^a	Maximum air temperature	Test period
		°C	h
30 °C max.	Polyacetate resins	60	100
30 °C max.	Stabilized polyamide	60	400
90 °C max.	Glass-fibre reinforced polyamide	95	600

^a Other materials may be used that give equivalent results.

~~After this period, the samples are kept in the cabinet, at the same water pressure and temperature, for an additional period of half the duration specified in the table. During the test periods, no water shall leak from the enclosure of the samples and any leakage downstream of the samples shall not exceed 10 cm³ per day (24 h). A failure of one of the samples within the first minute the water pressure specified has been attained is neglected. During the additional test period, failure of more than three samples will entail a rejection.~~

~~NOTE—In some countries, this test does not apply.~~

CC.2 Valves of thermoplastic material intended to be connected to the water supply mains for the control of water for tap and shower outlets

~~The valves are checked by the following test, which is made in a heating cabinet in which the air is caused to circulate and is maintained at a temperature within –5 °C of the air temperature specified in Table CC.2. The test is made on 10 valves which have not been subjected to any other test. The samples are connected to a water supply system as in normal use and are filled with water, but not exposed to any other pressure; they are kept under these conditions for a period of 3 h. After this period, the water pressure is raised, at a rate of~~

no more than 0,084 MPa/s (0,84 bar/s), but within 60 s to a pressure of 2,5 MPa ± 0,05 MPa (25 bar ± 0,5 bar). The samples are kept under these conditions for 500 h.

Table CC.2 – Test requirements for valves intended for the control of water for tap and shower outlets

Maximum water temperature marking °C	Air temperature ^a °C
Up to 30	60
65	80
90	95

^a Values of air temperature for maximum water temperature markings between 30 °C and 90 °C may be calculated by linear interpolation.

During the test period, no water shall leak from the enclosure of the samples and any leakage downstream of the samples shall not exceed 10 cm³ per day (24 h). A failure of one of the samples within the first minute the water pressure specified has been attained is neglected.

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Annex DD (normative)

Torque

DD.1 Torque test for valves with internally threaded end-connections according to ISO 7-1

DD.1.1 General

DD.1.1.1 The steel pipes used for testing purposes shall comply with the "medium series" according to ISO 65 and be of a material equivalent to designation "Fe 360-B" according to ISO 630.

DD.1.1.2 The steel pipes shall be at least 300 mm in length or $4 D$ (D = nominal outside diameter of the pipe), whichever is the greater, plus the length of useful thread for maximum gauge length belonging to the appropriate D as indicated in column 16 of Table 1 of ISO 7-1:1994.

DD.1.1.3 The threaded pipe end of the test pipes shall be provided with taper external thread according to ISO 7-1.

DD.1.1.4 Only non-hardening thermosetting sealing paste shall be used on the connections during the tests, to ensure leak tightness, where necessary.

DD.1.2 Torque test

DD.1.2.1 General

Figure DD.1 provides two arrangements for carrying out the torque test.

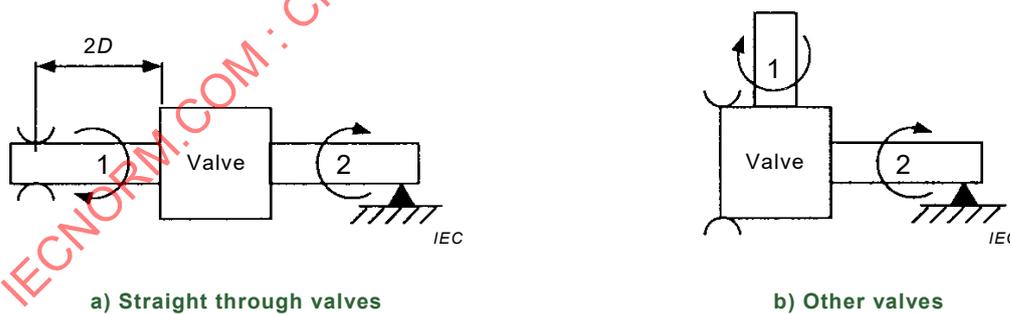


Figure DD.1 – Arrangements for carrying out the torque test

DD.1.2.42 Torque test for two ports straight through-of equal sizes of inlet and outlet (see Figure DD.1a)

- Screw pipe 1 by hand into the outlet of the valve with a spanner if necessary, in order to get a leak-tight connection.
- Clamp pipe 1 at a distance equal to $2 D$ from the valve.
- Screw pipe 2 by hand into the inlet of the valve with a spanner if necessary in order to get a leak-tight connection.
- Check that the assembly is leak tight.
- Support pipe 2 in such a way that no bending stresses are applied to the valve.

- f) Apply the required torque appropriate to the nominal size progressively and smoothly without undue delay, the last 10 % of the torque being applied over a period not exceeding 1 min. Maintain the required torque given in Table DD.1 for 10 s ensuring that this torque is not exceeded.
- g) With the stress removed, the assembly is checked for hydrostatic strength according to 18.101.2.

Table DD.1.2.1 – Required torque for test

Size in	DN	ISO 7-1 ^a	Torque in Nm for: ISO 228-1 thread, ISO metric thread, NPT and SAE thread, compression fittings ^a
1/8	6	15	10
1/4	8	20	15
3/8	10	35	30
1/2	15	50	45
3/4	20	85	65
1	25	125	85
1 1/4	32	160	100
1 1/2	40	200	110
2	50	250	135

^a In some countries, other values apply.

DD.1.2.23 Torque test for two ports straight through unequal size of inlet and outlet

The torque test is carried out as indicated in DD.1.2.42 with the exception that the inlet and outlet threads are tested separately and independently from each other, with a torque appropriate to the nominal size of the inlet or outlet under test.

DD.1.2.34 Torque test for two or more ports under an angle (not on the same axis) of inlets and outlets of equal or unequal size

The torque test is carried out as indicated in DD.1.2.23 with the exception that the opposite end of the valve body is rigidly clamped instead of the pipe (see Figure DD.1b).

DD.2 Torque test for valves with internally threaded end-connections according to ISO 228-1

- a) A pipe connector with a male thread and basic dimensions according to ISO 1179-1 appropriate to the nominal size of the inlet or outlet under test, and provided with a fibre sealing washer, is inserted in the inlet of the valve and turned hand-tight.
- b) With the pipe connection secured in a vice, the appropriate torque as specified in Table DD.1.2.1 is applied at the opposite end of the valve body by means of wrench flats or bosses. The torque is applied progressively and smoothly without undue delay, the last 10 % of the torque being applied over a period not exceeding 1 min. Maintain the required torque for 10 s ensuring that this torque is not exceeded.
- c) The test is then repeated with the other inlets or outlets inserted with the appropriate pipe connection and the torque applied at the opposite end of the valve body.
- d) With the stress removed, the valve is checked for hydrostatic strength according to 18.101.2.

DD.3 Torque test for valves with internally threaded end-connections with ISO metric thread for compression fittings

DD.3.1 Olive type compression fittings

- a) For olive compression fittings, a steel tube and tubing nut is used with a new brass olive of the recommended size and inserted in the inlet and outlet of the valve and turned hand-tight.
- b) With the tubing nut secured in a vice, the torque test is carried out as indicated in Clause DD.2 b), c) and d).

NOTE Any deformation of the olive seating or mating surfaces consistent with the applied torque is discounted.

DD.3.2 Flared compression fittings

For flared compression fittings, a short length of steel tube with a flared end is used and the procedure given in DD.3.1a) and b) is followed.

NOTE Any deformation of the cone seating or mating surfaces consistent with the applied torque is discounted.

DD.4 Torque test for valves with externally threaded end-connections according to ISO 7-1

The torque test shall be carried out as indicated in Clause DD.1 with the exception that the test pipe provided with taper external thread according to ISO 7-1 as required in DD.1.1.3 is connected to the valve via a steel socket according to ISO 4144 with parallel threads and appropriate size.

DD.5 Torque test for valves with external threaded end-connections according to ISO 228-1 or to ISO metric thread for compression fittings

- a) For external thread according to ISO 228-1, the torque test is carried out as indicated in Clause DD.2 with the exception that a pipe connector with a female thread and basic dimensions according to ISO 1179-1 is used instead of a connector with a male thread.
- b) For external thread for compression fittings, the torque test is carried out as indicated in Clause DD.3 with the exception that instead of a tubing nut (see DD.3.1), a union nut is used for olive type compression fittings.

DD.6 Torque test for valves with adaptors

With screws or bolts tightened with a torque as indicated in Table DD.2, a valve with adaptors for ISO 7-1 thread is subjected to the torque test as indicated in Clause DD.1.

Table DD.2 – Tightening torque in newton metres (Nm) for bolts and screws for adaptors

Size mm	Torque for screws Nm ^a	Torque for bolts Nm ^a
2,5	0,4	0,4
3	0,5	0,5
3,5	0,8	0,8
4	1,2	1,2
5	2	2
6	2,5	3
8	3,5	6
10	4	10

12	–	15
16	–	30
^a In some countries, other values apply.		

DD.7 Torque test for valves with internally or externally threaded end-connections for NPT thread

DD.7.1 One sample of the largest connection size for the valve body is subjected to the following test.

DD.7.2 A length of new, clean, and properly threaded schedule 40 iron pipe or pipe fitting, as applicable, is used. Non-hardening thermosetting sealing paste is applied to the threaded connections which are then screwed to the inlet of the closed test valve with the torque specified in Table DD.1-2.1 applied progressively and smoothly, by gripping the inlet wrench flats, if provided, or any suitable area of the valve. With the valve in the closed position, the torque is applied for 15 min and then released.

DD.7.3 The procedure in DD.7.2 is repeated for the outlet of the valve using the outlet wrench flats, if provided.

DD.7.4 With the torque removed, the assembly is checked for hydrostatic strength according to 18.101.2.

DD.8 Torque test for valves with internally or externally threaded end-connections for SAE thread

DD.8.1 One sample of the largest connection size for the valve body is subjected to the following test.

DD.8.2 A length of new, clean steel tube of the proper size, with the end flared and a fitting to match the valve, is used. The fitting is screwed to the inlet of the closed test valve with the torque specified in Table DD.1-2.1 applied progressively and smoothly, by gripping the inlet wrench flats, if provided, or any suitable area of the valve.

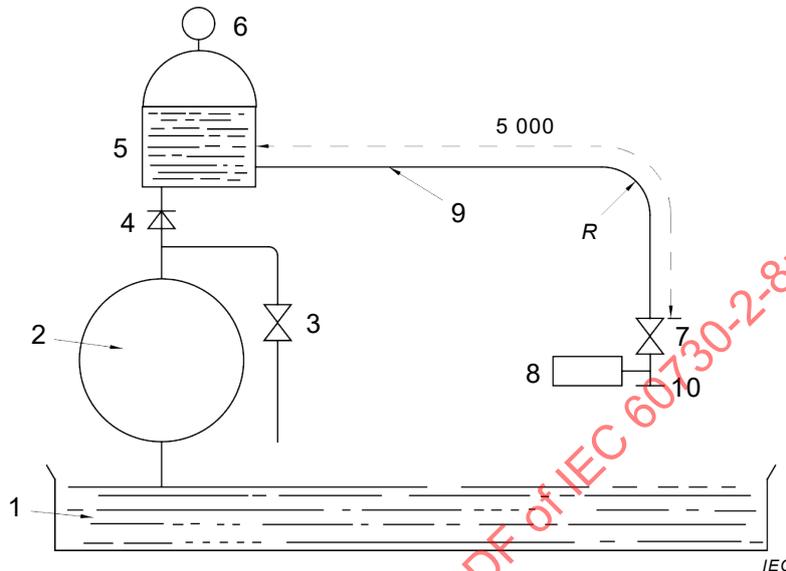
With the valve in the closed position, the torque is applied for 15 min and then released.

DD.8.3 The procedure in DD.8.2 is repeated for the outlet of the valve using the outlet wrench flats, if provided.

DD.8.4 With the torque removed, the assembly is checked for hydrostatic strength according to 18.101.2.

Annex EE
(normative)

Arrangement for the measurement of transient pressures caused by water valves with a declared pressure of up to and including 1,0 MPa (10 bar)



Key

- 1 container of appropriate size filled with water
- 2 pump having a capacity of at least 100 l/min, at a dynamic pressure of 1 MPa (10 bar)
- 3 by-pass valve (not necessary if the pump is controlled by an adjustable power unit, ~~item 11~~)
- 4 non-return valve
- 5 compensating tank having a capacity of at least 100 l, filled with water to two-thirds of its capacity
- 6 pressure gauge
- 7 ball valve or clap having a nominal diameter $\frac{3}{4}$ in (19 mm)
- 8 pressure transducer, having a pressure range between atmospheric pressure and 1,6 MPa (16 bar) and a natural frequency of more than 200 Hz
- 9 copper pipe having a wall thickness of 1,0 mm to 1,5 mm, a length of approximately 5 m \pm 0,1 m, as well as a suitable diameter of not less than the nominal size of the water valve under test shall be chosen.
In this condition, verify the velocity of the water flow be at any convenient value not exceeding 2 m/s measured with the valve under test fully open and at a dynamic pressure of 0,6 MPa (6 bar). The velocity of the water flow is calculated starting from the measurement of the flow rate using a flowmeter. The pipe is bent at radius R not less than 300 mm
- 10 connection for the water valve under test, equipped with a slide, clap or ball tap having ~~a~~ the same nominal diameter as the valve under test

Figure EE.1 – Transient pressure measurement test rig for valves with a declared pressure of up to and including 1,0 MPa (10 bar) schematic diagram

Measurement procedure ~~for arrangement~~

Using equipment as described in Figure EE.1

- a) After the measurement of the waterflow at a dynamic pressure of 0,6 MPa (6 bar), verify the velocity of the water flow; if the velocity is equal or less than 2 m/s, use the same pipe as for the tests of 18.101.3.1 to 18.101.3.3. In cases where the velocity is higher, select an appropriate pipe from the list shown in Annex BB item 9, choosing one that maintains the velocity of the waterflow below 2 m/s.
- b) Connect the actuator of the valve under test to an adequate electrical power supply.

- c) Start the pump (2), and eventually use the by-pass valve (3) to adjust the pressure at 0,1 MPa (1 bar) with the valve under test fully opened.
- d) De-aerate the valve under test completely, opening and closing it several times. If it is a multiple chambered valve, this de-aeration shall be carried out on each chamber before the measurement starts.
- e) Check the pressure of the container (5) by the pressure gauge (6) and correct it if necessary using the by-pass valve (3).
- f) A recorder instrument or a plotter should be connected to the pressure transducer output (8). This recorder shall be triggered from the starting point and the test at low pressure of 18.101.3.1 may start.
- g) Check if the results recorded fulfil the relevant requirements.
- h) Adjust the static pressure at 0,6 MPa (6 bar) using the by-pass valve (3) with the valve (10) in open position. Repeat items d) to g) to verify the requirements of 18.101.3.2.
- i) Verify the static pressure at 0,6 MPa (6 bar) with the valve (10) closed. If necessary, repeat the de-aeration. The recorder shall be triggered again; at this point, the transient pressure test of 18.101.3.3 can start.
- j) Check the results recorded and if it is necessary, repeat points i) and j).

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Bibliography

The Bibliography of Part 1 is applicable except as follows.

Addition:

ISO 4400, *Fluid power systems and components – Three-pin electrical plug connectors with earth contact – Characteristics and requirements*

ISO 6952, *Fluid power systems and components – Two-pin electrical plug connectors with earth contact – Characteristics and requirements*

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INTERNATIONAL STANDARD

**Automatic electrical controls –
Part 2-8: Particular requirements for electrically operated water valves,
including mechanical requirements**

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CONTENTS

FOREWORD.....	4
1 Scope and normative references.....	7
2 Terms and definitions	9
3 General requirements	13
4 General notes on tests.....	13
5 Rating	13
6 Classification.....	13
7 Information.....	16
8 Protection against electric shock.....	17
9 Provision for protective earthing.....	18
10 Terminals and terminations.....	18
11 Constructional requirements	19
12 Moisture and dust resistance	19
13 Electric strength and insulation resistance.....	19
14 Heating	20
15 Manufacturing deviation and drift	21
16 Environmental stress	21
17 Endurance.....	22
18 Mechanical strength.....	23
19 Threaded parts and connections	26
20 Creepage distances, clearances and distances through insulation	26
21 Resistance to heat, fire and tracking	26
22 Resistance to corrosion	26
23 Electromagnetic compatibility (EMC) requirements – Emission.....	26
24 Components.....	27
25 Normal operation.....	27
26 Electromagnetic compatibility (EMC) requirements – Immunity.....	27
27 Abnormal operation	27
28 Guidance on the use of electronic disconnection	30
Annex H (normative) Requirements for electronic controls	31
Annex AA (informative) Relation between different flow coefficients	36
Annex BB (normative) Arrangement for the measurement of transient pressures caused by water valves.....	37
Annex CC (normative) Long term pressure test for thermoplastic bodied valves	40
Annex DD (normative) Torque	42
Annex EE (normative) Arrangement for the measurement of transient pressures caused by water valves with a declared pressure of up to and including 1,0 MPa (10 bar)	46
Bibliography	48
Figure BB.1 – Transient pressure measurement test rig schematic diagram	38
Figure DD.1 – Arrangements for carrying out the torque test.....	42

Figure EE.1 – Transient pressure measurement test rig for valves with a declared pressure of up to and including 1,0 MPa (10 bar) schematic diagram	46
Table 1 – Required information and methods of providing information	16
Table 101 – Nominal size and thread size of end connections.....	16
Table 102 – Torque test requirement for metal valves with internal threaded end-connections	25
Table 103 – Torque test requirement for metal valves with external threaded end-connections	26
Table 104 – Maximum winding temperature (for test of blocked output conditions and valves declared under Table 1, item 113)	28
Table CC.1 – Test requirements for valves intended for uses other than the control of water for tap and shower outlets	40
Table CC.2 – Test requirements for valves intended for the control of water for tap and shower outlets	41
Table DD.1 – Required torque for test	43
Table DD.2 – Tightening torque in newton metres (Nm) for bolts and screws for adaptors	44

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

AUTOMATIC ELECTRICAL CONTROLS –**Part 2-8: Particular requirements for electrically operated water valves,
including mechanical requirements**

FOREWORD

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- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60730-2-8 has been prepared by IEC technical committee 72: Automatic electrical controls.

This third edition cancels and replaces the second edition published in 2000, Amendment 1:2002 and its Amendment 2:2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- alignment of the text with IEC 60730-1 fifth edition (2013) including Amendment 1:2015;
- introduction of specific requirements for thermoplastic bodied valves for the control of water for tap and shower outlets (18.101.4.3 and Annex CC);
- removal of Subclause 18.102 Wetted material specifications.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The text of this International Standard is based on the following documents:

CDV	Report on voting
72/1077/CDV	72/1120/RVC

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

This part 2-8 is intended to be used in conjunction with IEC 60730-1. It was established on the basis of the fifth edition (2013) including Amendment 1 (2015) of that publication.

This part 2-8 supplements or modifies the corresponding clauses in IEC 60730-1 so as to convert that publication into the IEC standard: *Safety requirements for electrically operated water valves, including mechanical requirements.*

Where this part 2-8 states "addition", "modification" or "replacement", the relevant requirement, test specification or explanatory matter in part 1 should be adapted accordingly.

Where no change is necessary, part 2-8 indicates that the relevant clause or subclause applies.

In the development of a fully international standard, it has been necessary to take into consideration the differing requirements resulting from practical experience in various parts of the world and to recognize the variation in national electrical systems and wiring rules.

The "in some countries" notes regarding differing national practices are contained in the following elements:

- Table 1, footnotes ab and ac
- Table 13, footnote aa
- 1.1.4
- 16.2.1
- 18.101.3
- 27.2.3.1
- 27.101
- Table DD.1, footnote a
- Table DD.2, footnote a

In this publication:

- 1) The following print types are used:
 - Requirements proper: in roman type.
 - *Test specifications: in italic type.*
 - Notes: in smaller roman type.
 - Defined terms: in **bold type**
- 2) Subclauses, notes, tables or figures which are additional to those in part 1 are numbered starting from 101, additional annexes are lettered AA, BB, etc.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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AUTOMATIC ELECTRICAL CONTROLS –

Part 2-8: Particular requirements for electrically operated water valves, including mechanical requirements

1 Scope and normative references

This clause of Part 1 is applicable except as follows:

1.1 Scope

Replacement:

This part of IEC 60730 applies to electrically operated water valves for use in, on or in association with equipment for household and similar use, including heating, air-conditioning and similar applications. The equipment can use electricity, gas, oil, solid fuel, solar thermal energy, etc., or a combination thereof.

NOTE 1 Throughout this document, the word "equipment" means "appliances and equipment."

This document is applicable to electrically operated water valves for building automation within the scope of ISO 16484.

This document also applies to automatic electrically operated water valves for equipment that can be used by the public, such as equipment intended to be used in shops, offices, hospitals, farms and commercial and industrial applications.

EXAMPLE 1: Electrically operated water valves for commercial catering, heating and air-conditioning equipment.

This document does not apply to electrically operated water valves intended exclusively for industrial process applications unless explicitly mentioned in the relevant equipment standard.

This document applies to electrically operated water valves powered by primary or secondary batteries, requirements for which are contained within the standard, including Annex V.

This document does not cover the prevention of contamination of drinking water as a result of contact with materials.

1.1.1 This document applies to the inherent safety, to the operating values, operating times and operating sequences where such are associated with equipment safety, and to the testing of automatic electrical control devices used in, on or in association with, household and similar equipment.

This document contains requirements for electrical features of water valves and requirements for mechanical features of valves that affect their intended operation.

This document is also applicable to electrically operated water valves for appliances within the scope of the IEC 60335 series of standards.

This document does not apply to:

- electrically operated water valves of nominal connection size above DN 50;
- electrically operated water valves for admissible nominal pressure rating above 1,6 MPa;

- food dispensers;
- detergent dispensers;
- steam valves;
- electrically operated water valves designed exclusively for industrial applications.

Throughout this document, where it can be used unambiguously, the term:

- "valve" is used to denote an electrically operated water valve (including actuator and valve body assembly);
- "actuator" means "electrically operated mechanism or prime mover";
- "valve body" means "valve body assembly";
- "equipment" includes "appliance" and "control system".

1.1.2 This document applies to electrically operated water valves, responsive to or controlling such characteristics as temperature, pressure, passage of time, humidity, light, electrostatic effects, flow, or liquid level, current, voltage, acceleration, or combinations thereof.

1.1.3 This document also applies to actuators and to valve bodies which are designed to be fitted to each other.

1.1.4 This document applies to individual valves, valves utilized as part of a system and valves mechanically integral with multi-functional controls having non-electrical outputs.

NOTE Attention is drawn to the fact that, in many countries, additional test requirements and by-laws have been established by the water authorities or companies.

1.1.5 This document applies to AC or DC powered electrically operated water valves with a rated voltage not exceeding 690 V AC or 600 V DC.

1.1.6 This document does not take into account the **response value** of an **automatic action** of a valve, if such a **response value** is dependent upon the method of mounting the valve in the equipment. Where a **response value** is of significant purpose for the protection of the **user**, or surroundings, the value defined in the appropriate equipment standard or as determined by the manufacturer shall apply.

1.1.7 This document applies also to electrically operated water valves incorporating **electronic devices**, requirements for which are contained in Annex H.

1.1.8 This document applies also to electrically operated water valves using NTC or PTC **thermistors**, requirements for which are contained in Annex J.

1.1.9 This document applies to the electrical and **functional safety** of electrically operated water valves capable of receiving and responding to communications signals, including signals for power billing rate and demand response.

The signals can be transmitted to or received from external units being part of the valve (wired), or to and from external units which are not part of the valve (wireless) under test.

1.1.10 This document does not address the integrity of the output signal to the network devices, such as interoperability with other devices unless it has been evaluated as part of the **control system**.

1.2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

ISO 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads – Part 1: Dimensions, tolerances and designation*

ISO 65:1981, *Carbon steel tubes suitable for screwing in accordance with ISO 7-1*

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

ISO 630,¹ *Structural steels – Plates, wide flats, bars sections and profiles*

ISO 1179-1, *Connections for general use and fluid power – Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing – Part 1: Threaded ports*

ISO 4144, *Pipework – Stainless steel fittings threaded in accordance with ISO 7-1*

2 Terms and definitions

This clause of Part 1 is applicable, except as follows:

2.2 Definitions of types of control according to purpose

2.2.17 electrically operated valve

Addition:

Note 1 to entry: A semi-automatic valve that is opened manually and closes automatically or vice versa is also covered by this definition.

Additional definitions:

2.2.17.101 valve

device consisting of an actuator connected to a valve body assembly and used to stop or regulate the flow of fluid by the closure or partial closure of an orifice

2.2.17.102 water valve

valve intended to be connected to a water supply and to control water flow

2.2.17.103 heating-water valve

valve intended to control the water circulation in heating systems

2.2.17.104 actuator

electrically operated mechanism or prime mover used to effect the opening or closing action of a valve

¹ ISO 630 has been withdrawn.

Note 1 to entry: An actuator may be integral with the valve, fixed to the valve body assembly or delivered as a separate component.

Note 2 to entry: An actuator may also include the valve and closure member.

2.2.17.105
valve body assembly

assembly comprising the valve body, inlet and outlet end connections, the valve seat, closure member and stem or shaft

Note 1 to entry: In some cases, the stem and closure member may be part of the actuator.

2.2.17.106
valve body

part of the valve body assembly which is the main pressure boundary

Note 1 to entry: It provides the water flow passage-ways with end connections.

2.2.17.107
nominal size

numerical designation of size which is common to all components in a fluid-conducting system other than components designated by outside diameter or by thread size

Note 1 to entry: It may be designated by "DN" followed by a convenient round number, for reference purposes only.

Note 2 to entry: Some older international standards refer to nominal size as nominal diameter but, for the purpose of this document, the two terms are synonymous.

2.2.17.108
nominal pressure rating

numerical designation of pressure rating

Note 1 to entry: It may be designated by the letters "PN" (also referred to as the pressure number) followed by a convenient round number, for reference purposes only.

2.2.17.109
end connection

valve body configuration provided to make a pressure-tight joint to the fluid-conducting system

2.2.17.110
valve seat

surface of the orifice within the valve which makes full contact with the closure member

2.2.17.111
closure member

movable part of the valve which is positioned in the flow path to modify the rate of flow through the valve

Note 1 to entry: A closure member may be a plug, ball, disc, vane, gate, etc.

2.2.17.112
stem

component which connects the actuator to, and positions, the closure member

Note 1 to entry: For rotary valves, the word "shaft" should be used in place of "stem".

Note 2 to entry: In some controls, the stem may be part of the actuator.

2.2.17.113**fitting**

any device such as a reducer, expander, elbow, or T-piece which is attached directly to an end-connection of the valve body assembly

2.3 Definitions relating to the function of controls**2.3.29****maximum working pressure**

Modification:

Delete “maximum rated pressure”.

Additional definitions:

2.3.101**on-off valve**

valve which is open or closed, without any intermediate positions

2.3.102**normally closed valve**

valve which is closed when not electrically energized

2.3.103**normally open valve**

valve which is open when not electrically energized

2.3.104**modulating valve**

valve which has a variable flow rate between predetermined flow limits

2.3.105**diverting valve**

valve with one or more inputs and outputs which may permit flow from any combination of inputs to outputs

2.3.106**closed position**

position of the closure member when there is no water flow from the outlet side of the valve

2.3.107**travel**

displacement of the closure member from the closed position

2.3.108**rated travel**

displacement of the closure member from the closed position to the full open position

2.3.109**open position**

position of the closure member when there is a flow of water from the outlet side of the valve

2.3.110**fully open position**

position of the closure member so that the amount of water flowing through the valve is in accordance with the rated flow rate

2.3.111

flow rate

volume of water flowing through the valve in unit time

2.3.112

rated flow rate

flow rate at the rated travel under standard reference conditions of temperature and pressure declared at a given pressure difference

2.3.113

flow factor

factor specifying the amount of water which can pass through the valve at a specified pressure difference

Note 1 to entry: The flow factor may be referred to as flow coefficient.

Note 2 to entry: The relationship between the different flow factors in use is indicated in Annex AA.

2.3.114

maximum operating pressure differential

declared maximum difference in pressure between inlet and outlet ports of the valve against which the actuator can operate the closure member

2.3.115

minimum operating pressure differential

declared minimum pressure difference at which the valve opens or closes

2.3.116

Void

2.3.117

water hammer

excessive transient pressure which can occur in some water supply systems as a result of closing a valve as intended

2.3.118

transient pressure

short-time pressure surge exceeding the normal stable supply pressure in the closed condition of the valve

2.3.119

valve with anti-water-hammer characteristics

valve that does not cause an excessive pressure drop when opening and no excessive transient pressure when closing if connected directly, without special precautions to water supply mains applications where water-hammer may occur

2.13 Miscellaneous definitions

Additional definitions:

2.13.101

Void

2.13.102

Void

2.13.103

water for tap and shower outlets

water intended to supply a bath, shower, bidet, wash basin, kitchen sink, or other such taps that discharge in to a drainage system

3 General requirements

This clause of Part 1 is applicable.

4 General notes on tests

This clause of Part 1 is applicable, except as follows:

4.1 Conditions of test

4.1.2 Addition:

Unless otherwise specified in this document, water temperature for the tests shall be maintained at a temperature of (20 ± 5) °C.

4.2 Samples required

4.2.1 Addition:

One sample is required for each test of Clause 27.

NOTE 101 By agreement between manufacturer and testing authority, one sample can be submitted to more than one test.

5 Rating

This clause of Part 1 is applicable.

6 Classification

This clause of Part 1 is applicable, except as follows:

6.3.12 – electrically operated valve;

Additional subclause:

6.3.12.101 – water valve;

6.5.2 According to degree of protection provided by enclosures against harmful ingress of water (see IEC 60529)

Replacement of the second Note as follows:

NOTE 2 Preferred degrees of protection provided by enclosures are: IP20, IP30, IP40, IP54, IP65.

Values differing from these preferred values are allowed.

6.7 According to ambient temperature limits of the switch head

Modification:

In 6.7.1 and 6.7.2, read "valve" for "control" and "actuator" for "switch head".

6.8 According to protection against electric shock

6.8.3 Replacement:

For an independently mounted valve or a valve integrated or incorporated in an assembly utilizing a non-electrical source:

6.10 Not applicable.

6.11 According to number of automatic cycles 6.11 (A) of each automatic action

Addition:

Water valves shall be subjected to a minimum of 6 000 automatic cycles.

Additional subclauses:

6.101 According to type of end-connections

6.101.1 Valves provided with internally threaded end-connections with either:

- a) ISO 7-1 or NPT thread when pressure-tight joints are made on the thread, or
- b) ISO 228-1 thread when pressure-tight joints are not made on the thread, but via an additional sealing washer.

6.101.2 Valves provided with externally threaded end-connections for:

- a) compression fittings, or
- b) washered union connection, or
- c) cone seated union connection, or
- d) threaded pipe connections either according to ISO 7-1, ISO 228-1 or NPT thread.

6.101.3 Valves provided with flanged end-connections suitable for connection to flanges with or without adaptors.

6.101.4 Valves provided with end-connections with neck-end for soldered or welded connections.

6.101.5 Valves provided with end-connections with hose tails for use with flexible tubing.

6.102 According to features of electrically operated water valves

6.102.1 According to the size and capacity:

Size and capacity to be specified in dimension of inlet and outlet connections and flow factor.

6.102.2 According to the type of operation:

Direct or pilot controlled with or without minimum pressure differential limit.

6.102.3 According to function:

Description of function regarding the number of water connections and the valve position when de-energized.

6.102.4 According to material of wetted parts:

Includes the material identification of all internal parts in contact with water such as the body and the sealing material.

6.102.5 According to construction of the closure member:

The valve may be a direct operated or pilot valve controlled diaphragm or piston-operated poppet type or spool type closing member.

6.102.6 According to construction of the actuator:

Examples are: electromagnetic; electric motor; electrically heated wax or bi-metal controlled actuator with actuator stem in contact with or shielded from the water.

6.103 According to temperature, pressure and type of the water controlled

Valves for controlling:

6.103.1 Cold water supply with a maximum temperature of 25 °C;

6.103.2 Hot water supply with a maximum temperature of 90 °C;

6.103.3 Void

6.103.4 Void

6.103.5 Circulation heating water with a maximum temperature of between 50 °C and 120 °C;

6.103.6 Water with a maximum rated temperature other than indicated above;

6.103.7 Water flow in systems with a maximum pressure of 0,1 MPa;

6.103.8 Water flow in systems with a maximum pressure of 0,6 MPa;

6.103.9 Water flow in systems with a maximum pressure of 0,86 MPa;

6.103.10 Water flow in systems with a maximum pressure of 1,0 MPa;

6.103.11 Water flow in systems with a maximum pressure of 1,6 MPa;

6.103.12 Water flow in systems with a maximum system pressure other than indicated above.

6.104 According to nominal size and thread size of end connections

The nominal size and the thread size of end connections are given in Table 101.

Table 101 – Nominal size and thread size of end connections

Designation of thread (inch)	Nominal size
1/8	DN 6
1/4	DN 8
3/8	DN 10
1/2	DN 15
3/4	DN 20
1	DN 25
1 ¼	DN 32
1 ½	DN 40
2	DN 50

NOTE The designation "DN" followed by the appropriate convenient round number is normally only loosely related to manufacturing dimensions and corresponds for reference purposes only approximately to the internal diameter expressed in millimetres of the water system.

7 Information

This clause of Part 1 is applicable, except as follows:

Table 1 – Required information and methods of providing information

Modification:

Replace the following items by:

	Information	Clause or subclause	Method
7	The type of load controlled by each circuit (for valves with switching devices) ^b	6.2, 14, 17, 23.1.1	C
22	Temperature limits of the actuator, if T_{min} lower than 0 °C, or T_{max} other than 55 °C	6.7, 14.5, 14.7, 17.3	D
26	Not applicable		
28	Not applicable		
29	Type of disconnection or interruption provided by each circuit (for valves with switching devices)	6.9, 2.4	X
36 to 38	Not applicable		
39	Type 1 or type 2 action (for valves with switching devices) ^{aa}	6.4	D or E
40	Additional features of type 1 or type 2 actions (for valves with switching devices) ^{aa}	6.4.3, 11.4	D or E
41	Manufacturing deviation and condition of test appropriate to deviation (for valves with switching devices)	11.4.3, 15, 17.14, 2.11.1	X
42	Drift (for valves with switching devices)	11.4.3, 15, 2.11.2	X
43 to 44	Not applicable		
47	Not applicable		
49	Control pollution situation of actuator	6.5.3	D or E

Add the following additional items:

Information		Clause or subclause	Method
101	Power consumption in watts or in VA or current rating		C
102	Maximum operating pressure differential in MPa (or in bar)	2.3.114	D
103	Minimum operating pressure differential in MPa (or in bar)	2.3.115	D
104	Maximum working pressure in MPa (or in bar)	2.3.29, 6.103	D
105	Flow direction indicated by an arrow (on valve body)		C
106	Maximum water temperature in °C	6.103	D
107	Void		
108	For valves intended to be cleaned in normal use, the method of disassembling, cleaning, reassembling and maintenance	18.1.101	D
109	If valve is intended to be used in water supply installations where water hammer may occur	18.101.3	X
110	Material identification of wetted parts	6.102.4	X
111	Valve features	6.101, 6.102	D
112	Plastic valves intended to be hand-tightened	18.103.5	D
113	Valves incorporated in those household appliances covered by the IEC 60335 series where the loss of water supply or dry valve is considered as an abnormal use condition ^{ab}	14.5.107, 27.101	D
114	For valves identified under item 113, details of any limitation of operating time (duty cycle) ^{ac}	27.101.2	D
115	Water valve intended to be used in accordance with IEC 60335	18.101.3	D
116	If the valve is intended to be used for the control of water for tap and shower outlets	2.13.103 18.101.4	D
^{aa} The water valve itself is type 1 action. ^{ab} Not applicable in Canada, Japan and the USA. ^{ac} Not applicable in Canada, Japan, and the USA.			

7.4 Additional requirements for marking

This clause of Part 1 is applicable except as follows:

7.4.4 Not applicable.

8 Protection against electric shock

This clause of Part 1 is applicable, except as follows:

8.1.4 *Addition:*

For class II water valves, reinforced insulation shall not be in direct contact with the water.

Additional subclause:

8.1.101 Valves which are declared capable of being cleaned in normal use shall be so constructed that there is adequate protection against accidental contact with live parts during cleaning.

Compliance is checked by inspection and by a simulated cleaning operation as described below:

If the actuator can be removed from the valve body assembly without disconnecting the electrical wiring, the removed actuator shall still meet the requirements for its class of construction. Removal shall not affect electrical characteristics.

If the actuator can only be removed from the valve body assembly after removing the electrical wiring:

- a) *the inspection and simulated cleaning operation shall be made in accordance with the manufacturer's instructions in the documentation;*
- b) *if a plug connector is used, this removal shall be impossible before the plug connector is disconnected. Plug connectors for actuators with earth connection shall be so designed that the disconnection of the electrical supply takes place prior to the disconnection of the earthed wire.*

NOTE For plug connectors, reference is made to ISO 4400 and ISO 6952.

9 Provision for protective earthing

This clause of Part 1 is applicable.

10 Terminals and terminations

This clause of Part 1 is applicable, except as follows:

10.1 Terminals and terminations for external copper conductors

10.1.1.1 *Delete Note 2.*

10.1.16 Flying leads (pig tails)

Modification:

Replace the first sentence by:

Where flying lead (pig tail) connections are used, the lead or leads shall be no smaller than 0,75 mm² with an insulation having a nominal thickness not less than 0,6 mm and shall be a minimum of 450 mm long as measured from the coil to the end of the lead, except if the flying lead is intended to be connected to the wiring within the valve enclosure, in which case the flying lead shall be at least 150 mm long.

10.1.16.1 Replacement:

Flying leads shall be provided with strain relief for attachment method Z to prevent mechanical stress from being transmitted to terminals for internal wiring.

Compliance is checked by inspection and by applying a pull of 44 N for 1 min.

During the pull, the lead shall not be damaged and shall not have been displaced longitudinally by more than 2 mm after the test. Creepage distances and clearances shall not have been reduced to less than the value specified in Clause 20.

10.2 Terminals and terminations for internal conductors

Additional notes:

NOTE 101 The requirements of 10.2 also apply to terminals and terminations of water valves which are intended to be used for internal wiring which is external to the equipment.

NOTE 102 The requirements of 10.2 apply to terminals and terminations deliberately designed to accept special connectors such as the plug connectors described in ISO 4400 and ISO 6952.

NOTE 103 The requirements of 10.2 apply to terminals and terminations deliberately designed for connection of pilot duty loads.

11 Constructional requirements

This clause of Part 1 is applicable, except as follows:

11.3 Actuation and operation

Modification:

For "controls" read "valves with auxiliary switches" throughout entire Subclause 11.3 and its subdivisions.

Replacement:

11.3.9 Manually actuated mechanisms

11.3.9.1 Operation of a manually actuated mechanism of a valve shall not subject parts to distortion or damage to the extent that their intended function is impaired.

Compliance is checked by operation and inspection.

11.3.9.2 Operating parts shall be separated from conductors to be connected to the valve by barriers or by their physical location so that such operating parts are not obstructed by stowed wiring.

Compliance is checked by operation and inspection.

Additional subclause:

11.101 Separation of wetted parts from electrical parts

There shall be no leakage of water to the electrical parts.

Compliance is checked by inspection after the pressure test of 18.101.1.

12 Moisture and dust resistance

This clause of Part 1 is applicable.

13 Electric strength and insulation resistance

This clause of Part 1 is applicable.

14 Heating

This clause of Part 1 is applicable, except as follows:

14.4.3.1 Not applicable.

Additional subclauses:

14.4.101 *If stalling of the motorized electric actuator drive shaft is part of normal operation, then the drive shaft of motorized actuators shall be stalled and temperatures measured after steady-state conditions are reached. The temperatures shall comply with the values of Table 13. In addition, if any protective device provided does not cycle under stalled conditions, then the electric actuator is also considered to comply with the requirements of 27.2.3 and 27.2.101 if applicable.*

14.4.102 *If stalling of the motorized electric actuator drive shaft is not part of normal operation, then the values of Table 13 do not apply during stalling. The electric actuator shall comply with the requirements of 27.2.3 and 27.2.101 if applicable.*

14.5 *Replacement:*

Actuators of valves are tested at room temperature or in appropriate heating and/or refrigerating apparatus and fitted such that the conditions in 14.5.1, 14.5.2, 14.5.101 to 14.5.104, and 14.5.107 are obtained.

14.5.1 *Replacement:*

For the test of 14.5.105, the ambient temperature of the actuator is maintained in the range of 15 °C to 30 °C, the resulting measured temperature being corrected to a 25 °C reference.

14.5.2 *Replacement:*

For the test of 14.5.106, the ambient temperature of the actuator is maintained at T_{\max} .

Additional subclauses:

14.5.101 *If the valve includes switching devices or other auxiliary circuits, all such circuits shall be loaded to carry rated current during the temperature test.*

14.5.102 *A modulating valve shall be caused to execute successive complete cycles of the modulating action for which it is designed until constant temperatures are reached. The time between successive cycles is chosen in accordance with the manufacturer's specifications.*

14.5.103 *A valve intended for rapid repeated operation shall be energized and de-energized at the maximum rate of operation for which it is intended until constant temperatures are reached.*

14.5.104 *The temperature rise of the motor of a motor-operated valve when stalled shall not exceed the values specified in Table 13 if stalling is part of normal operation.*

14.5.105 *For valves intended for use at room temperature and for valves handling cold water up to 25 °C, a 30 cm length of iron or copper pipe of the correct size shall be fitted in the inlet and outlet openings of the valve under test. The pipe shall be arranged as a framework so that the valve will be mounted or suspended away from other heat-conduction bodies. The end of the pipes need not be plugged.*

NOTE This test does not apply to valves identified under requirement 113 of Table 1.

14.5.106 *Valves intended for handling hot water shall be tested with the hot water connected and with and without the hot water flowing through the valve at the highest declared temperature.*

NOTE This test does not apply to valves identified under requirement 113 of Table 1.

14.5.107 *Valves identified under requirement 113 of Table 1 are tested at their declared operating conditions (for instance: T_{\max} , maximum working pressure, considering any declared limitation of the operating time) with the water connected and flowing through the valve at its highest declared temperature.*

Table 13 – Maximum heating temperatures

Additional footnote:

Add "aa" to the third value of "85" in the last column of Table 13 against: "All accessible surfaces except those of actuating members, handles, knobs, grips and the like".

Add to the footnotes:

^{aa} This value is increased to 110 °C (120 °C in some countries) for the surface of valves and the like to be mounted on the pipes of central heating systems.

15 Manufacturing deviation and drift

This clause of Part 1 is applicable.

16 Environmental stress

This clause of Part 1 is applicable, except as follows:

16.1.1 Additional note:

NOTE 101 At the request of the manufacturer, the appropriate tests of 16.2 can be carried out before the tests of Clause 14.

16.2 Environmental stress of temperature

16.2.1 Replacement:

The effect of temperature is tested as follows:

The valve body and actuator being repacked for dispatching as delivered by the valve manufacturer shall be maintained at a temperature of (-10 ± 2) °C for a period of 24 h, and then at a temperature of (50 ± 5) °C for a period of 4 h.

NOTE In some countries, a temperature of (-40 ± 2) °C is used instead of (-10 ± 2) °C.

During the environmental stress, the valve or actuator is not energized.

16.2.2 Replacement:

The valve or actuator is considered to withstand the environmental stress if it functions in the intended and declared manner after this test.

17 Endurance

This clause of Part 1 is applicable, except as follows:

17.1.1 Addition:

Compliance is checked by the tests of 17.16.

17.1.2 Not applicable.

17.1.2.1 Not applicable.

17.7 Overvoltage test (or overload test in Canada, the USA, and all countries using an overload test) of automatic action at accelerated rate

17.7.1 Replacement:

The electrical conditions shall be 1,06 times the rated voltage or 1,06 times the upper limit of the rated voltage range when performing an overvoltage test or as indicated in 17.2.3.1 and 17.2.3.2 when performing an overload test.

17.7.2 Replacement:

The valve shall be tested at:

- a) *the maximum declared ambient temperature. During the test, the heating or cooling effect of the water flow temperature shall not be allowed to cause the ambient temperature to exceed the maximum declared ambient temperature or fall below the minimum declared ambient temperature;*
- b) *the highest declared water flow temperature;*
- c) *the declared maximum operating pressure differential.*

17.7.3 Replacement:

The rate of operation and the method of operation shall be agreed between the testing authority and the manufacturer.

A cycle rate of about 6 cycles/min for a water valve can be used as guidance.

17.7.4 Not applicable.

17.7.5 Not applicable.

17.7.6 Replacement:

The number of automatic cycles for the test shall be a minimum of 6 000 or any higher number as required by the application and declared by the manufacturer in Table 1, requirement 27.

17.7.7 Not applicable.

17.16 Test for particular purpose controls

Replacement:

The tests for electrically operated valves are as follows:

- 17.1 is applicable.
- 17.2 to 17.4 inclusive are applicable to auxiliary switching devices integrated or incorporated in a valve.
- 17.5 is applicable.
- 17.6 is not applicable.
- 17.7 is applicable as modified in this document.
- 17.8 to 17.13 inclusive are applicable to auxiliary switching devices integrated or incorporated in the valve.
- 17.14 is applicable.
- 17.15 is not applicable.

18 Mechanical strength

This clause of Part 1 is applicable, except as follows:

Additional subclauses:

18.101 Valves shall withstand the water pressure occurring in normal use.

Compliance is checked by the following tests:

18.101.1 Test at 1,5 times maximum rated working pressure (test for external leakage)

After the endurance test of 17.7, the valve in open position with the outlet sealed is subjected on the inlet side during 1 h to a static water pressure equal to 1,5 times the declared maximum working pressure.

In the case of diaphragm elements that, in normal usage, are subjected to water pressure on both sides of the diaphragm, the pressure shall be applied slowly and without shock to avoid excessively stressing the diaphragm. After the test, inspection shall show that no leakage of water of more than 5 cm³/h has occurred and that the valve is still operating as intended.

18.101.2 Test at 5 times maximum rated working pressure (hydrostatic strength test)

For metal valves, this test shall be carried out after the torque test of 18.103.

This test is conducted on a sample other than the one used for 18.101.1, this sample is subjected for 1 min to a water pressure 5 times the declared maximum working pressure under the same conditions as indicated in 18.101.1.

External water leakage observed during this test is acceptable if, following this hydrostatic test, the valve complies with the external leakage requirements of 18.101.1.

18.101.3 Anti-water hammer characteristics

Water valves with declared anti-water hammer characteristics intended to be connected directly to water supply mains shall not cause an excessive pressure drop when opening, or an excessive transient pressure when closing.

Compliance is checked by carrying out the tests of 18.101.3.1 to 18.101.3.3 according to the method of Annex BB or Annex EE. Annex EE is applied to water valves connected to water supply mains with maximum working pressure up to and including 1,0 MPa (10 bar) within the scope of IEC 60335-1 (see Table 1, requirement 115).

NOTE 1 In most countries, water hammer does not usually occur due to water installation requirements and special precautions based on plumbing practices.

NOTE 2 In general, water valves with end-connection sizes up to DN 15 used in equipment connected via a hose to the water supply mains piping will not cause a water hammer that can damage water conducting systems or equipment.

18.101.3.1 Pressure drop at low supply pressure

For determining the pressure drop at low supply pressure, the pressure at the valve inlet with the water valve under test (see Annex BB, item 15 of Figure BB.1 or Annex EE, item 10 of Figure EE.1) in the open position, is adjusted to 0,1 MPa (1 bar) by regulating the pump or the by-pass valve (see Annex BB, items 2 and 3 of Figure BB.1 or Annex EE, items 2 and 3 of Figure EE.1). The water valve under test is then closed and after 20 s opened again. The pressure shall at no time become negative.

18.101.3.2 Pressure drop at rated inlet pressure

For determining the pressure drop at rated inlet pressure, the pressure at the valve inlet, with the water valve under test (see Annex BB, item 15 of Figure BB.1 or Annex EE, item 10 of Figure EE.1) in the open position is adjusted to 0,6 MPa (6 bar) by regulating the pump or the by-pass valve (see Annex BB, items 2 and 3 of Figure BB.1 or Annex EE, items 2 and 3 of Figure EE.1). The water valve under test is then closed and after 20 s opened again. When the water valve is opened, the pressure shall at no time become negative.

18.101.3.3 Transient pressure at high pressure

Valves intended to be connected to the water supply mains shall not cause an excessive transient pressure.

Compliance is checked by the following:

The pressure at the valve inlet, with the water valve under test (see Annex BB, item 15 of Figure BB.1 or Annex EE, item 10 of Figure EE.1) in the closed position, is adjusted to 0,6 MPa (6 bar) by regulating the pump or the by-pass valve (see Annex BB, items 2 and 3 of Figure BB.1 or Annex EE, items 2 and 3 of Figure EE.1). The water valve under test is then

opened and after the flow has become constant closed again. When the water valve is closed, the pressure shall at no time exceed 0,9 MPa (9 bar).

NOTE This is to reflect the increasing usage of smaller pipe sizes in the household water installation system.

18.101.4 Test on valve bodies of thermoplastic material

Valve bodies of thermoplastic material shall withstand the thermal conditions to which they may be subjected when used as intended.

Compliance is checked by the following tests:

18.101.4.1 Valve bodies of thermoplastic material intended to be connected to the water supply mains and intended for other uses than control of **water for tap and shower outlets** shall be checked by carrying out the test as indicated in Annex CC, Clause CC.1.

18.101.4.2 Void.

18.101.4.3 Valve bodies of thermoplastic material intended to be connected to the water supply mains for the control of **water for tap and shower outlets** shall be checked by carrying out the test as indicated in Annex CC, Clause CC.2.

18.102 Void.

18.103 Torque

18.103.1 Valves and their joints shall withstand the stresses to which they may be subjected during installation and servicing.

Compliance is checked by the applicable torque tested, as indicated in the following subclauses and in Annex DD. After the tests of Annex DD, the hydrostatic strength test of 18.101.2 is carried out. There shall be no evidence of loosening of joints, distortion, external leakage beyond the limits of 18.101.2, or other damage.

18.103.2 Valves with internal threaded end-connections

18.103.2.1 Metal valves with internal threaded end-connections shall be subjected to the appropriate torque test of Annex DD as indicated in Table 102.

Table 102 – Torque test requirement for metal valves with internal threaded end-connections

Thread type	Clause
ISO 7-1	DD.1
ISO 228-1	DD.2
ISO metric for compression fittings	DD.3
NPT	DD.7
SAE	DD.8

NOTE Torque values for plastic valves with internal threaded end-connections are under consideration.

18.103.3 Valves with external threaded end-connections

18.103.3.1 Metal valves with external threaded end-connections shall be subjected to the appropriate torque test of Annex DD as indicated in Table 103.

Table 103 – Torque test requirement for metal valves with external threaded end-connections

Thread type	Clause
ISO 7-1	DD.4
ISO 228-1	DD.5
ISO metric for compression fittings	DD.5
NPT	DD.7
SAE	DD.8

NOTE Torque values for plastic valves with external threaded end-connections are under consideration.

18.103.4 Valves with end-connections for adaptors

Metal valves with end-connections for use with adaptors are subjected to the torque test specified in Clause DD.6.

18.103.5 Types of valves that do not require a torque test

The following valves are not subjected to a torque test:

- plastic valves with internal or external threaded end-connections intended to be hand-tightened (see Table 1, requirement 112);
- metal valves with flanged end-connections;
- valves with end-connections for hose tail or slip-fit connections and for use with flexible tubing;
- metal valves with end-connections for soldered or brazed connections.

19 Threaded parts and connections

This clause of Part 1 is applicable.

20 Creepage distances, clearances and distances through insulation

This clause of Part 1 is applicable.

21 Resistance to heat, fire and tracking

This clause of Part 1 is applicable.

22 Resistance to corrosion

This clause of Part 1 is applicable.

23 Electromagnetic compatibility (EMC) requirements – Emission

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable.

25 Normal operation

This clause of Part 1 is applicable, except as follows:

25.2 Overvoltage and undervoltage test

Replacement:

A valve shall operate as intended at any voltage within the range of 85 % of the minimum rated voltage and 110 % of the maximum rated voltage, inclusive.

Compliance is checked by subjecting the valve to the following tests at T_{max} , maximum water temperature (see Table 1, requirement 106) and maximum operating pressure differential (see Table 1, requirement 102). For this test, any declared limitation of operating time (see Table 1, requirement 34) is considered.

The valve is subjected to $0,85 V_{Rmin}$ until equilibrium temperature is reached and then tested immediately for operation at $0,85 V_{Rmin}$.

The valve is also subjected to $1,1 V_{Rmax}$ until equilibrium temperature is reached and then tested immediately for operation at $1,1 V_{Rmax}$ and at rated voltage.

After each test, the valve shall operate once as intended.

26 Electromagnetic compatibility (EMC) requirements – Immunity

This clause of Part 1 is applicable.

27 Abnormal operation

This clause of Part 1 is applicable, except as follows:

27.2 Burnout test

Replacement:

Valves incorporating solenoids and valves incorporating motors shall withstand the effects of blocking of the valve mechanism.

For valves where an external mechanical blockage will not cause an internal overload of the valve due to decoupling of the external blockage to the internal mechanical structure, e.g. a clutch, a blockage of the mechanical parts between the motor and the decoupling means shall be tested.

Compliance is checked by the tests of 27.2.1 and 27.2.2.

27.2.1 Replacement:

The valve mechanism is blocked in the position assumed when the valve is de-energized. If more than one position is possible, the position which produces the most onerous effects shall

be chosen. The valve is then energized at rated frequency, rated voltage, room temperature of $(20 \pm 5) ^\circ\text{C}$ without water and with no consideration of any limitation of the operating time (see Table 1, requirement 34).

The duration of the test is either 7 h; or until an internal protective device, if any, operates; or until burnout, whichever occurs first.

27.2.2 Replacement:

After this test, the valve shall comply with items a) to g) of H.27.1.1.3, where applicable.

NOTE The valve need not be operative following the test.

27.2.3 Blocked mechanical output test (abnormal temperature test)

Replacement:

Valves with motorized electrical actuators shall withstand the effects of blocked output without exceeding the temperatures indicated in Table 104. Temperatures are measured by the method specified in 14.7.1.

NOTE This test is not conducted on valves which meet the requirements of 14.4.101.

27.2.3.1 Replacement:

Valves are tested for 24 h or until thermal equilibrium has been reached with the output blocked in the most unfavorable position at rated voltage and in a room temperature in the range of $15 ^\circ\text{C}$ to $30 ^\circ\text{C}$, the resulting measured temperature being corrected to a $25 ^\circ\text{C}$ reference value.

NOTE 1 In Canada and the USA, the test is conducted at the voltages indicated in 17.2.3.1 and 17.2.3.2.

NOTE 2 This test is not applicable to valves identified under requirement 113 of Table 1.

Table 104 – Maximum winding temperature (for test of blocked output conditions and valves declared under Table 1, item 113)

Condition	Temperature of insulation by class ^d							
	°C							
	Class 105 (A)	Class 120 (E)	Class 130 (B)	Class 155 (F)	Class 180 (H)	Class 200 (N)	Class 220 (R)	Class 250
If impedance protected:	150	165	175	190	210	230	250	280
If protected by protective devices:								
during first hour								
– maximum value ^{a b}	200	215	225	240	260	280	300	330
after first hour								
– maximum value ^a	175	190	200	215	235	255	275	305
– arithmetic average ^{a c}	150	165	175	190	210	230	250	280
^a Applicable to actuators with thermal motor protection.								
^b Applicable to actuators protected by incorporated fuses or thermal cut-outs.								
^c Applicable to actuators with no protection.								
^d These classifications correspond to the thermal classes specified in IEC 60085.								

Additional subclauses:

27.2.101 Test on three phase valve

27.2.101.1 *With any one phase disconnected, the valve is operated under normal operation and supplied at rated voltage until thermal equilibrium has been reached.*

The temperature of the winding shall not exceed the temperatures indicated in Table 104. Temperatures are measured by the method specified in 14.7.1.

Additional subclauses:

27.101 Dry condition test

Valves identified under requirement 113 of Table 1 are subjected to the test of 27.101.1.

NOTE This clause is not applicable in Canada, Japan, and the USA.

27.101.1 Valves shall withstand the abnormal condition occurring in case of loss of the water supply.

Compliance is verified by the test of 27.101.2.

27.101.2 *The water valve, connected but without water, is energized at rated frequency and rated voltage. The valve is operated:*

- *at the ambient temperature, and*
- *considering any limitation of the operating time (duty cycle).*

The duration of the test is either 4 h or until the steady temperature state is reached, whichever occurs first.

The temperature measured shall comply with the temperatures indicated in Table 104.

27.102 Running overload

27.102.1 The running overload test is carried out on motorized electrical actuators that are intended to be remotely or automatically controlled or liable to be operated continuously in unattended mode. If overload protective devices relying on electronic circuits to protect the motor windings, other than those that sense winding temperatures directly, are also subjected to the running overload test.

27.102.2 The valve is operated under normal operation conditions and supplied at rated voltage until steady conditions are established. The load is then increased so that the current through the motor windings is raised by 10 % increments and the valve is operated again until steady conditions are established, the supply voltage being maintained at its original value.

27.102.3 During the test, the winding temperature shall not exceed

- 140 °C, for class 105 (A) winding insulation;
- 155 °C, for class 120 (E) winding insulation;
- 165 °C, for class 130 (B) winding insulation;
- 180 °C, for class 155 (F) winding insulation;
- 200 °C, for class 180 (H) winding insulation;
- 220 °C, for class 200 (N) winding insulation;