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INTERNATIONAL STANDARD

ISO 4422-4

First edition
1997-10-15

Pipes and fittings made of unplasticized poly(vinyl chloride) (PVC-U) for water supply — Specifications —

Part 4:
Valves and ancillary equipment

Tubes et raccords en poly(chlorure de vinyle) non plastifié (PVC-U) pour l'adduction d'eau — Spécifications —

Partie 4: Robinets et accessoires

Reference number
ISO 4422-4:1997(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 4422-4 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 2, *Plastics pipes and fittings for water supplies*.

Together with the other parts, this part of ISO 4422 cancels and replaces ISO 4422:1990, which has been technically revised.

ISO 4422 consists of the following parts, under the general title *Pipes and fittings made of unplasticized poly(vinyl chloride) (PVC-U) for water supply — Specifications*:

— *Part 1: General*

— *Part 2: Pipes (with or without integral sockets)*

— *Part 3: Fittings and joints*

— *Part 4: Valves and ancillary equipment*

— *Part 5: Fitness for purpose of the system*

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ISO 4422 is one of a series of system standards for plastics piping systems which are being prepared within ISO/TC 138. Each system standard is based on a specific material for a specific application.

They conform to a standard multi-part format, each part dealing with a specific aspect of the overall system.

NOTE — At the present time, the reference document for the installation code is ISO/TR 4191, and this document will ultimately form part 6 of this International Standard.

Pipes and fittings made of unplasticized poly(vinyl chloride) (PVC-U) for water supply — Specifications —

Part 4:
Valves and ancillary equipment

1 Scope

This part of ISO 4422 specifies the characteristics and properties of valves and ancillary equipment made of unplasticized poly(vinyl chloride) (PVC-U), to be used for buried water mains and services and for water supplies above ground, both inside and outside buildings.

The valves and ancillary equipment covered by this part of ISO 4422 are intended for the conveyance of cold water under pressure at temperatures up to 20 °C, for general purposes and for the supply of drinking water. This part of ISO 4422 is also applicable to water up to and including 45 °C (see figure 1 in ISO 4422-2:1996).

The following ancillaries are included:

— tapping saddles.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 4422. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 4422 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

ISO 580:1990, *Injection-moulded unplasticized poly(vinyl chloride) (PVC-U) fittings — Oven test — Test method and basic specification.*

ISO 2507-2:1995, *Thermoplastics pipes and fittings — Vicat softening temperature — Part 2: Test conditions for unplasticized poly(vinyl chloride) (PVC-U) or chlorinated poly(vinyl chloride) (PVC-C) pipes and fittings and for high impact resistance poly(vinyl chloride) (PVC-HI) pipes.*

ISO 2536:1974, *Unplasticized polyvinyl chloride (PVC) pressure pipes and fittings, metric series — Dimensions of flanges.*

ISO/TR 4191:1989, *Unplasticized polyvinyl chloride (PVC-U) pipes for water supply — Recommended practice for laying.*

ISO 4422-1:1996, *Pipes and fittings made of unplasticized poly(vinyl chloride) (PVC-U) for water supply — Specifications — Part 1: General.*

ISO 4422-2:1996, *Pipes and fittings made of unplasticized poly(vinyl chloride) (PVC-U) for water supply — Specifications — Part 2: Pipes (with or without integral sockets).*

ISO 4422-3:1996, *Pipes and fittings made of unplasticized poly(vinyl chloride) (PVC-U) for water supply — Specifications — Part 3: Fittings and joints.*

ISO 5752:1982, *Metal valves for use in flanged pipe systems — Face-to-face and centre-to-face dimensions.*

ISO 6708:1995, *Pipework components — Definition and selection of DN (nominal size).*

ISO 7349:1983, *Thermoplastics valves — Connection references.*

ISO 7508:1985, *Unplasticized polyvinyl chloride (PVC-U) valves for pipes under pressure — Basic dimensions — Metric series.*

ISO 8233:1988, *Thermoplastics valves — Torque — Test method.*

ISO 8659:1989, *Thermoplastics valves — Fatigue strength — Test method.*

ISO 9393-1:1994, *Thermoplastics valves — Pressure test methods and requirements — Part 1: General.*

ISO 9393-2:1997, *Thermoplastics valves — Pressure test methods and requirements — Part 2: Test conditions and basic requirements for PE, PP, PVC-U and PVDF valves.*

ISO 9853:1991, *Injection-moulded unplasticized poly(vinyl chloride) (PVC-U) fittings for pressure pipe systems — Crushing test.*

3 Definitions

For the purposes of this part of ISO 4422, the definitions given in ISO 4422-1 apply.

4 Material

4.1 Valve bodies and ancillaries

The material from which the valve bodies and the main components of the ancillaries which are in contact with the conveyed water are made shall be PVC-U and shall comply with the requirements specified in ISO 4422-3.

4.2 Use of reworked material

Clean reworked material produced during the manufacture and works testing of products conforming to this part of ISO 4422 may be used in limited amounts, provided it is derived from the same compound as used for the relevant production, and does not prevent conformity to this part of ISO 4422.

5 General requirements

5.1 Appearance

When viewed without magnification, the internal and external surfaces of valves and ancillaries shall be smooth, clean and free from scoring, cavities and other surface defects which would prevent conformity with this part of ISO 4422.

5.2 Temperature derating

The temperature derating factor for working temperatures between 25 °C and 45 °C shall be the same as that specified for pipes in 5.4 of ISO 4422-2:1996.

6 Geometrical characteristics

6.1 Design of valves and ancillaries

6.1.1 Diameter

The nominal outside diameter d_n of valves and ancillaries shall correspond to and be designated by the nominal outside diameter of the pipes for which they are designed.

6.2 Valves

6.2.1 Types of valve

Valves covered by this part of ISO 4422 shall be categorized by the valve design, i.e. "gate", "ball", "diaphragm", "plug" or "butterfly", and by the type of connection, i.e. solvent-cementing, elastomeric sealing ring joints or flange joints.

6.2.2 Joint dimensions

6.2.2.1 Sockets and spigots for solvent cement type valves

The socket and spigot dimensions of the valves and ancillary equipment shall be the same as for pipes and fittings conforming to ISO 4422-2 or ISO 4422-3, as applicable.

6.2.2.2 Sockets and spigots for sealing ring type valves

The socket and spigot dimensions of the valves shall be the same as for pipes and fittings conforming to ISO 4422-2 or ISO 4422-3, as applicable.

6.2.2.3 Mating dimensions for flange type valves

The mating dimensions of the flanges used on valves shall be in accordance with ISO 2536.

6.2.3 Laying lengths

Recommended laying lengths are given in manufacturers' catalogues.

6.2.3.1 Valves with plain socket ends

See figure 1.

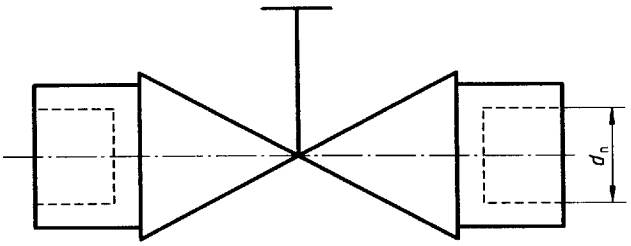

Figure 1 — Valve with plain socket ends

6.2.3.2 Valves with plain spigot ends

See figure 2.

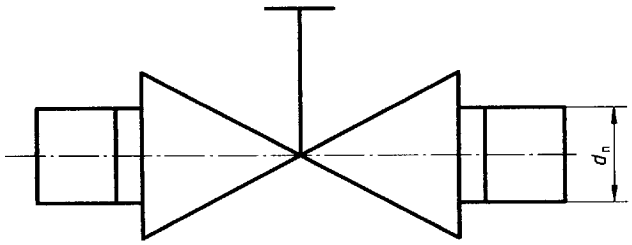

Figure 2 — Valve with plain spigot ends

6.2.3.3 Valves with sealing ring type sockets

See figure 3.

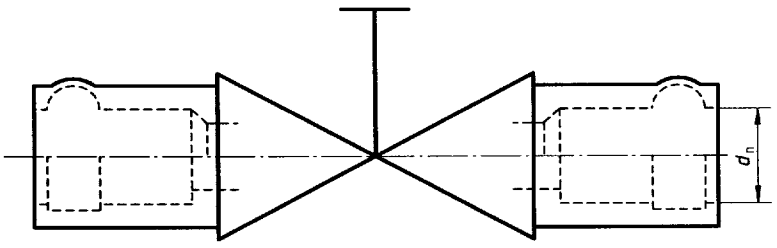

Figure 3 — Valve with sealing ring type sockets

6.2.3.4 Valves with flanged ends

6.2.3.4.1 Gate valves

See figure 4 and table 1.

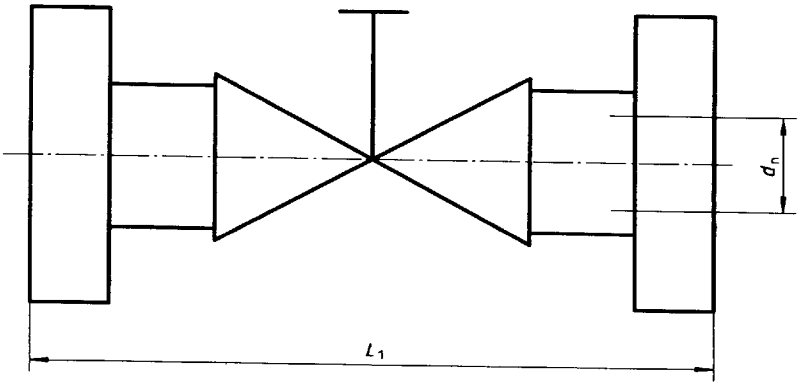

Figure 4 — Gate valve with flanged ends

Table 1 — Laying lengths of gate valves

Dimensions in millimetres

Nominal outside diameter of pipe d_n	Nominal size DN	Face-to-face length [1] L_1	
		short	long
50	40	165	240
63	50	178	250
75	65	190	270
90	80	203	280
110	100	229	300
140	125	254	325
160	150	267	350
225	200	292	400
280	250	300	450
315	300	356	500

1) Conforming to table 3 of ISO 5752:1982.

6.2.3.4.2 Butterfly valves

See figures 5 and 6 and table 2.

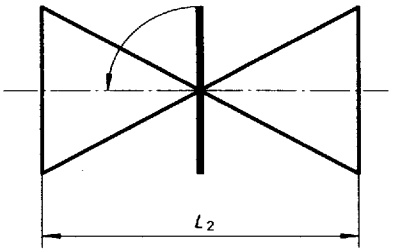

Figure 5 — Butterfly valve with flangeless (wafer) body

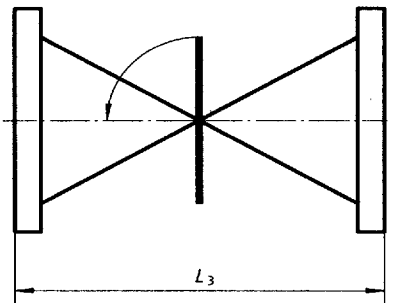

Figure 6 — Butterfly valve with double-flanged body

Table 2 — Laying lengths of butterfly valves

Dimensions in millimetres

Nominal outside diameter of pipe d_n	Nominal size[1] DN	Butterfly valves				Tolerance on L_2 and L_3
		Flangeless			Double-flanged	
		Face-to-face length				
		L_2 [2]			L_3 [3]	
		short	medium	long	short	
50	40	33	33	33	106	±2
63	50	43	43	43	108	
75	65	46	46	46	112	
90	80	46	49	64	114	
110	100	52	56	64	127	
140	125	56	64	70	140	
160	150	56	70	76	140	
225	200	60	71	89	152	
280	250	68	76	114	165	
315	300	78	83	114	178	±3

1) Conforming to ISO 6708.

2) Conforming to table 5 of ISO 5752:1982 and table 2 of ISO 7508:1985 (see also figure 5).

3) Conforming to table 4 of ISO 5752:1982 and table 2 of ISO 7508:1985 (see also figure 6).

6.2.3.4.3 Plug, ball and diaphragm valves

See figure 7 and table 3.

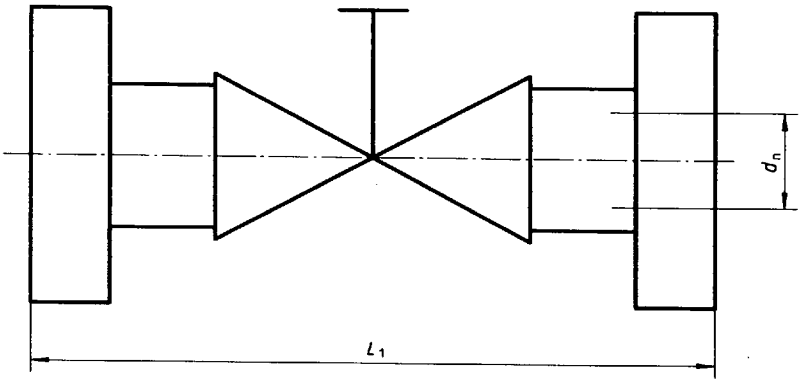

Figure 7 — Plug, ball or diaphragm valve with flanged ends

Table 3 — Laying lengths of plug, ball and diaphragm valves

Dimensions in millimetres

Nominal outside diameter of pipe d_n	Nominal size[1] DN	Face-to-face length[2), 3)] L_1	
		nom.	tol.
16	10	130	±2
20	15	130	
25	20	150	
32	25	160	
40	32	180	
50	40	200	
63	50	230	
75	65	290	±3
90	80	310	
110	100	350	
125	100/125	400	
140	125	400	
160	150	480	

1) Conforming to ISO 7349.

2) Conforming to tables 6 and 7 of ISO 5752:1982 and table 1 of ISO 7508:1985.

3) The centre-to-face dimension of a three-way valve shall be $0{,}5L_1$.

6.3 Ancillary equipment

6.3.1 Tapping saddles

Tapping saddles with or without shut-off devices are connected to the water supply mains by solvent-cementing or mechanically with an elastomeric seal. Typical tapping-saddle types are shown in figures 8 to 11 and their dimensions given in table 4. Other designs are allowed.

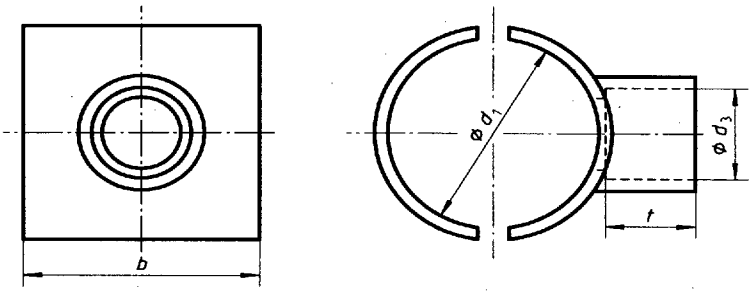

Figure 8 — Socket saddle (solvent-cementing type)

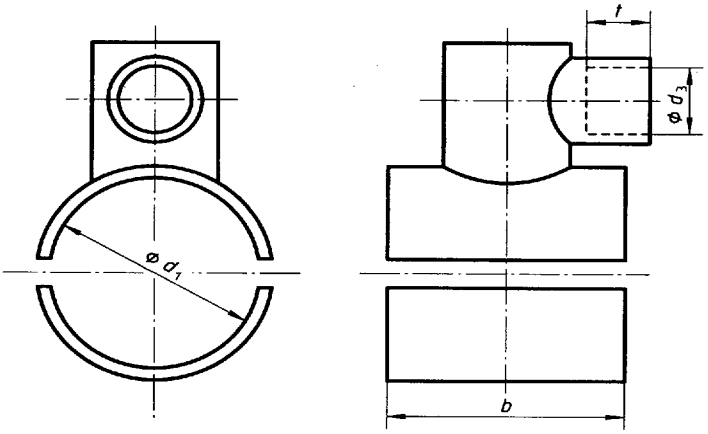

Figure 9 — Tee saddle (parallel-connection, solvent-cementing type)

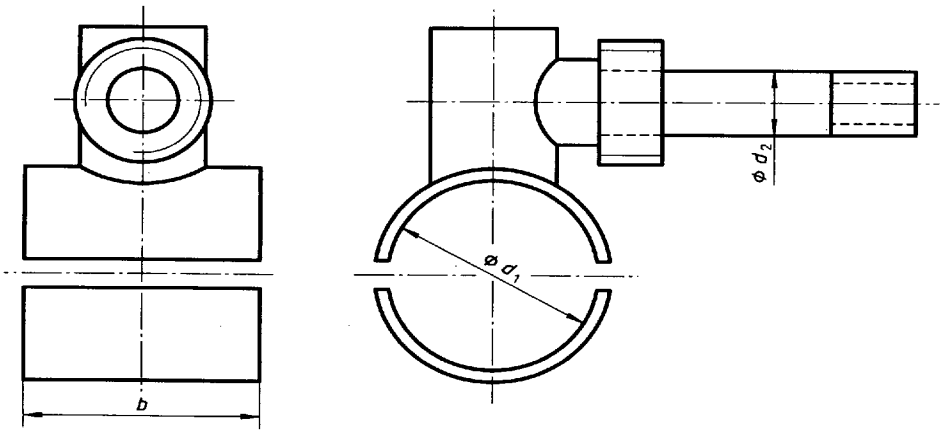

Figure 10 — Tee saddle (right-angled connection, mechanical-joint type)

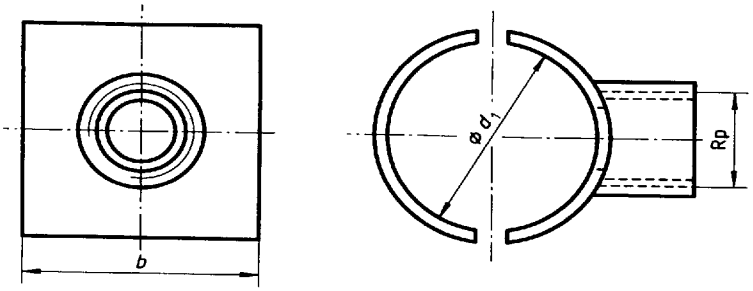

Figure 11 — Socket saddle (internal pipe thread connection type)

Table 4 — Tapping-saddle dimensions

Dimensions in millimetres

Water supply mains		Outlet connection			
Nominal outside diameter of pipe d_n	Inside diameter of saddle d_1	Diameter of connecting pipe d_2	Mean cement-welding diameter d_3 $^{+0,3}_{0}$	Cement-welding length t	Internal pipe thread[1] R_P
32	32	20	20	16	1/2
		25	25	19	3/4
40	40	20	20	16	1/2
		25	25	19	3/4
		32	32	22	1
50	50	20	20	16	1/2
		25	25	19	3/4
		32	32	22	1
63	63	20	20	16	1/2
		25	25	19	3/4
		32	32	22	1
		40	40	26	1 1/4
		50	50	31	1 1/2
75	75	20	20	16	1/2
		25	25	19	3/4
		32	32	22	1
		40	40	26	1 1/4
		50	50	31	1 1/2
90	90	20	20	16	1/2
		25	25	19	3/4
		32	32	22	1
		40	40	26	1 1/4
		50	50	31	1 1/2
110	110	20	20	16	1/2
		25	25	19	3/4
		32	32	22	1
		40	40	26	1 1/4
		50	50	31	1 1/2
		63	63	38	2
125	125	32	32	22	1
		50	40	31	1 1/2
		63	50	38	2
140	140	25	25	19	3/4
		32	32	22	1
		50	40	31	1 1/2
		63	50	38	2
160	160	20	20	16	1/2
		25	25	19	3/4
		32	32	22	1
		40	40	26	1 1/4
		50	50	31	1 1/2
		63	63	38	2

Table 4 — Tapping-saddle dimensions *(continued)*

Dimensions in millimetres

Water supply mains		Outlet connection			
Nominal outside diameter of pipe d_n	Inside diameter of saddle d_1	Diameter of connecting pipe d_2	Mean cement-welding diameter d_3 $^{+0,3}_{0}$	Cement-welding length t	Internal pipe thread[1] R_P
200	200	20	20	16	1/2
		25	25	19	3/4
		32	32	22	1
		40	40	26	1 1/4
		50	50	31	1 1/2
		63	63	38	2
		90	90	51	3
225	225	32	32	22	1
		40	40	26	1 1/4
		50	50	31	1 1/2
		63	63	38	2
		90	90	51	3
250	250	20	20	16	1/2
		25	25	19	3/4
		32	32	22	1
		40	40	26	1 1/4
		50	50	31	1 1/2
315	315	20	20	16	1/2
		25	25	19	3/4
		32	32	22	1
		40	40	26	1 1/4
		50	50	31	1 1/2

1) Internal pipe thread Rp in accordance with ISO 7-1.

7 Mechanical characteristics

7.1 Resistance of valve bodies to internal pressure

The mechanical strength of the valve body where hydrostatic pressure can be applied shall be verified by internal-pressure tests.

When tested in accordance with ISO 9393-1, using the test parameters given in table 5, the valve body shall not fail in less than the test times indicated in table 5.

Table 5 — Resistance of valve bodies to internal pressure

Test specimen	Test temperature °C	Test pressure[1), 2)] bar		Test time h
		PVC-UH	PVC-U	
Injection-moulded valve $d_n < 160$	20 ± 2	4,2 × PN		1
		3,2 × PN		1 000
Injection-moulded valve $d_n \geq 160$	20 ± 2	3,36 × PN	4,2 × PN	1
		2,56 × PN	3,2 × PN	1 000

1) The test pressure is defined by

$$p = \frac{\text{Test stress}}{\text{Design stress}} \times \text{PN}$$

The test stress is 42 MPa at 1 h and 32 MPa at 1 000 h.

The design stress is 10 MPa, with the exception of PVC-UH valves with $d_n \geq 160$ for which it is 12,5 MPa.

2) If a mould previously used to manufacture a valve body of a given nominal pressure PN from PVC-U is subsequently used to manufacture a valve body from PVC-UH, then the nominal pressure of the PVC-UH valve body shall be increased by a factor of 1,25. Alternatively, the nominal pressure may be retained at its original value and the original test pressure for the PVC-U valve body maintained.

7.2 Crushing test

Injection-moulded valve and ancillary-equipment parts to which hydrostatic pressure cannot be applied shall be tested in accordance with the test method laid down in ISO 9853. The tested parts shall not fail explosively under a deformation of 20 %.

7.3 Endurance test

7.3.1 Test method

Use the test method given in ISO 8659, which specifies a fatigue strength test, necessary to confirm the ability of valves to withstand prolonged use in plastics piping systems, with repeated opening and closure.

7.3.2 Test conditions

Carry out the test with water inside and air outside, with an internal pressure equal to the PN, with a flow velocity of approximately 1 m/s and at ambient test temperature.

7.3.3 Test requirements

No leakage or fracture shall occur during 250 cycles for manual valves and during 2 500 cycles for actuated valves. After the test, the seat and packing shall still be tight when checked using the seat and packing test (see 7.4.2).

7.4 Functional properties

7.4.1 Operating torque

Measure the operating torque, before and after the endurance test, in accordance with ISO 8233.

The closing and opening torque shall not exceed the values given in table 6.

Table 6 — Requirements for torque test

Operative lever-arm length mm	50	63	80	100	125	160	200	250	315	400	500	630	800	1 000
Torque N·m	6	9	13	18	25	38	54	75	110	160	200	450	580	720

7.4.2 Seat and packing test

7.4.2.1 Test method

The test method and general requirements shall be as given in ISO 9393-1 and ISO 9393-2.

These two documents specify the tightness of the valve seat when the valve is closed and the leakproofness of the complete valve assembly when the valve is partly or fully open.

7.4.2.2 Test conditions

Carry out the test before and after assembly testing at ambient temperature and also after the endurance test specified in 7.3.

The specimens (complete valves) shall be subject to the test conditions given in table 7.

Table 7 — Requirements for seat and packing test

Test	Test medium		Test pressure	Temperature	Minimum time
	inside	outside	bar	°C	min
Seat test, valve closed Packing test, valve opened	Water	Air	1,5 × PN[1)]	Ambient	1
1) The maximum test pressure shall be (PN + 5 bar), e.g. 21 bar for PN 16.					

7.4.2.3 Test requirements

There shall be no leakage through the valve seat and packing during the test period.

8 Physical characteristics

8.1 Vicat softening temperature

When determined in accordance with ISO 2507-2, the Vicat softening temperature shall be not less than 74 °C.

8.2 Oven test

When tested in accordance with ISO 580, valve bodies and ancillaries shall meet the requirements given in ISO 580, except that the requirement for the depth of any cracks or delaminations at the point of injection shall be not greater than 30 % of the wall thickness.

9 Marking

9.1 Marking details shall be either

a) printed or moulded directly on the valve in such a way that the marking does not initiate cracks or other types of failure, or

b) printed on a label/plate attached to the product,

in such a way that the marking legibility is maintained during storage, weathering, processing, installation in conformity with ISO/TR 4191 and use.

9.2 If printing is used, the colour of the printed information shall differ from the basic colour of the valve.

9.3 The marking details shall be easily legible without magnification.

9.4 The marking shall include the information listed in table 8.

Table 8 — Minimum required marking

Information	Marking or symbol
Manufacturer	Name and/or trade mark
Material	PVC-U
Nominal size or nominal outside diameter	DN or d_n ..... (e.g. DN 100 or d_n 110)
Nominal pressure/pipe series S[1)]	PN ..... (e.g. PN 16/S 10)
Manufacturing data [2)]	Date or code
ISO standard [3)]	ISO 4422-4
1) Indicating the pipe series S is optional. 2) For d_n < 50 mm, the code or date of manufacture may be put on a label attached to the valve. 3) This marking may be done on the packaging.	

ICS 83.140.30; 91.140.60

Descriptors: piping, water supply, plastics products, unplasticized polyvinyl chloride, pipe fittings, valves and fittings, valves, water supply valves, specifications, geometric characteristics, mechanical properties, physical properties, marking.

Price based on 12 pages