INTERNATIONAL STANDARD

ISO 1452-2

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Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized poly(vinyl chloride) (PVC-U) —

Part 2:
Pipes

Systèmes de canalisations en plastique pour l'alimentation en eau, pour branchements et collecteurs d'assainissement enterrés et aériens avec pression — Poly(chlorure de vinyle) non plastifié (PVC-U) —

Partie 2: Tubes

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Foreword

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

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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

ISO 1452-2 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 155, *Plastics piping systems and ducting systems*, in collaboration with ISO 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*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition cancels and replaces ISO 4422-2:1996 and ISO 2045, which have been technically revised.

ISO 1452 consists of the following parts, under the general title *Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized poly(vinyl chloride) (PVC-U)*:

— *Part 1: General*

— *Part 2: Pipes*

— *Part 3: Fittings*

— *Part 4: Valves*

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

Guidance for the assessment of conformity is to form the subject of a part 7.

Introduction

The System Standard, of which this is Part 2, specifies the requirements for a piping system and its components made from unplasticized poly(vinyl chloride) (PVC-U). The piping system is intended to be used for water supply and for buried and above-ground drainage and sewerage under pressure.

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the products covered by this part of ISO 1452, the following are relevant.

a) This part of ISO 1452 provides no information as to whether or not the products can be used without restriction.

b) Existing national regulations concerning the use and/or the characteristics of these products remain in force.

Requirements and test methods for material and components, other than pipes, are specified in ISO 1452-1, ISO 1452-3 and ISO 1452-4. Characteristics for fitness for purpose (mainly for joints) are established in ISO 1452-5.

This part of ISO 1452 specifies the characteristics of pipes.

Guidance for installation is given in ISO/TR 4191[1].

Guidance for assessment of conformity is provided in ENV 1452-7[2].

Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized poly(vinyl chloride) (PVC-U) —

Part 2:
Pipes

1 Scope

This part of ISO 1452 specifies the characteristics of solid-wall pipes made from unplasticized poly(vinyl chloride) (PVC-U) for piping systems intended for water supply and for buried and above-ground drainage and sewerage under pressure.

It also specifies the test parameters for the test methods referred to in this part of ISO 1452.

In conjunction with ISO 1452-1 and ISO 1452-5, it is applicable to extruded PVC-U pipes without a socket and pipes with a socket (integral or not), intended to be used for the following:

a) water mains and services buried in the ground;

b) conveyance of water above ground for both outside and inside buildings;

c) buried and above-ground drainage and sewerage under pressure.

It is applicable to piping systems intended for the supply of water under pressure up to and including 25 °C (cold water) intended for human consumption and for general purposes as well as for waste water under pressure.

This part of ISO 1452 specifies pipes for the conveyance of water and waste water up to and including 45 °C. For temperatures between 25 °C and 45 °C, Figure A.1 applies.

NOTE 1 The producer and the end-user can come to agreement on the possibilities of use for temperatures above 45 °C on a case-by-case basis.

This part of ISO 1452 specifies a range of pipe sizes and pressure classes, and gives requirements concerning colours.

NOTE 2 It is the responsibility of the purchaser or specifier to make the appropriate selections from these aspects, taking into account their particular requirements and any relevant national regulations and installation practices or codes.

2 Normative references

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

ISO 1167-1, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 1: General method*

ISO 1167-2, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 2: Preparation of pipe test pieces*

ISO 1183-1:2004, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pyknometer method and titration method*

ISO 1452-1:2009, *Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized poly(vinyl chloride) (PVC U) — Part 1: General*

ISO 1452-5, *Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized poly(vinyl chloride) (PVC U) — Part 5: Fitness for purpose of the system*

ISO 2505, *Thermoplastics pipes — Longitudinal reversion — Test method and parameters*

ISO 2507-1:1995, *Thermoplastics pipes and fittings — Vicat softening temperature — Part 1: General test method*

ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions*

ISO 6259-1, *Thermoplastics pipes — Determination of tensile properties — Part 1: General test method*

ISO 6259-2, *Thermoplastics pipes — Determination of tensile properties — Part 2: Pipes made of unplasticized poly(vinyl chloride) (PVC-U), chlorinated poly(vinyl chloride) (PVC-C) and high-impact poly(vinyl chloride) (PVC-HI)*

ISO 7387-1, *Adhesives with solvents for assembly of PVC-U pipe elements — Characterization — Part 1: Basic test methods*

ISO 7686, *Plastics pipes and fittings — Determination of opacity*

ISO 9311-1, *Adhesives for thermoplastic piping systems — Part 1: Determination of film properties*

ISO 9852, *Unplasticized poly(vinyl chloride) (PVC-U) pipes — Dichloromethane resistance at specified temperature (DCMT) — Test method*

ISO 18373-1, *Rigid PVC pipes — Differential scanning calorimetry (DSC) method — Part 1: Measurement of the processing temperature*

EN 681-1:1996, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber*

EN 744:1995, *Plastics piping and ducting systems — Thermoplastics pipes — Test method for resistance to external blows by the round-the-clock method*

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the terms, definitions, symbols and abbreviated terms given in ISO 1452-1 and the following apply:

L length of socket

m depth of engagement

4 Material

4.1 Pipe material

The material to be used shall conform to ISO 1452-1 and to the requirements given in 4.2 and 4.3.

4.2 Density

The density, ρ, at 23 °C of the pipe, when measured in accordance with ISO 1183-1, shall be within the following limits:

$$1\ 350\ \text{kg/m}^3 \leqslant \rho \leqslant 1\ 460\ \text{kg/m}^3$$

4.3 MRS-value

The pipe material shall have a minimum required strength, MRS, as defined in ISO 1452-1:2009, 4.4.1, of at least 25 MPa.

The manufacturer of the compound or formulation shall confirm the MRS by testing as described in ISO 1452-1:2009, 4.4.1 or 4.4.2, respectively.

5 General characteristics

5.1 Appearance

When viewed without magnification the internal and external surfaces of pipes shall be smooth, clean and free from scoring, cavities and other surface defects to an extent that would prevent conformity to this part of ISO 1452. The material shall not contain any impurities visible without magnification. The ends of the pipe shall be cut cleanly and square to the axis of the pipe.

5.2 Colour

The colour of the pipes shall be either grey, blue or cream for water supply, and grey or brown for drainage and sewerage under pressure. The colour of the pipes shall be uniform throughout the wall.

NOTE Attention is drawn to the fact that the colouring of pipes for the supply of water for human consumption can be part of national regulation.

5.3 Opacity of pipes intended for the above-ground conveyance of water

The wall of the pipe shall be opaque and shall not transmit more than 0,2 % of visible light when measured in accordance with ISO 7686.

6 Geometrical characteristics

6.1 Measurement of dimensions

Dimensions shall be measured in accordance with ISO 3126.

6.2 Nominal outside diameters

The nominal outside diameter, d_n, of a pipe shall conform to Table 1.

6.3 Mean outside diameters and their tolerances

The mean outside diameter, d_{em}, of a pipe shall conform to the applicable nominal outside diameter, d_n, within the tolerance given in Table 1.

The tolerance for out-of-roundness shall conform to Table 1.

Table 1 — Nominal outside diameters and tolerances

Dimensions in millimetres

Nominal outside diameter d_n	Tolerance for mean outside diameter, d_{em}[a] x	Tolerance for out-of-roundness[b] S 20 to S 16[c]	S 12,5 to S 5[d]
12	0,2	—	0,5
16	0,2	—	0,5
20	0,2	—	0,5
25	0,2	—	0,5
32	0,2	—	0,5
40	0,2	1,4	0,5
50	0,2	1,4	0,6
63	0,3	1,5	0,8
75	0,3	1,6	0,9
90	0,3	1,8	1,1
110	0,4	2,2	1,4
125	0,4	2,5	1,5
140	0,5	2,8	1,7
160	0,5	3,2	2,0
180	0,6	3,6	2,2
200	0,6	4,0	2,4
225	0,7	4,5	2,7
250	0,8	5,0	3,0
280	0,9	6,8	3,4
315	1,0	7,6	3,8
355	1,1	8,6	4,3
400	1,2	9,6	4,8
450	1,4	10,8	5,4
500	1,5	12,0	6,0
560	1,7	13,5	6,8
630	1,9	15,2	7,6
710	2,0	17,1	8,6
800	2,0	19,2	9,6
900	2,0	21,6	—
1 000	2,0	24,0	—

[a] The tolerance conforms to grade D of ISO 11922-1[3] for $d_n \leqslant 50$ and to grade C for $d_n > 50$. The tolerance is expressed in the form $^{+x}_{\ 0}$ mm, where x is the value of the tolerance.

[b] The tolerance is expressed as the difference between the largest and the smallest outside diameter in a cross-section of the pipe (i.e. $d_{e,\,max} - d_{e,\,min}$).

[c] For $d_n \leqslant 250$, the tolerance conforms to grade N of ISO 11922-1[3].

For $d_n > 250$, the tolerance conforms to grade M of ISO 11922-1[3]. The requirement for out-of-roundness is only applicable prior to storage.

[d] For a d_n of 12 to 1 000, the tolerance conforms to 0,5 grade M of ISO 11922-1[3]. The requirement for out-of-roundness is only applicable prior to the pipe leaving the manufacturer's premises.

6.4 Wall thickness and their tolerances

The nominal wall thickness, e_n, is classified with the pipe series S. The nominal wall thickness corresponds to the minimum allowable wall thickness.

The nominal wall thickness shall conform to Table 2, as appropriate to the pipe series.

The tolerance for wall thickness, e, shall conform to Table 3.

Table 2 — Nominal (minimum) wall thicknesses

Nominal outside diameter, d_n	**Pipe series S**						
	Nominal (minimum) wall thickness						
	S 20 (SDR 41)	S 16 (SDR 33)	S 12,5 (SDR 26)	S 10 (SDR 21)	S 8 (SDR 17)	S 6,3 (SDR 13,6)	S 5 (SDR 11)
	Nominal pressure PN based on design coefficient $C = 2{,}5$						
		PN 6	PN 8	PN 10	PN 12,5	PN 16	PN 20
12		—	—	—	—	—	1,5
16		—	—	—	—	—	1,5
20		—	—	—	—	1,5	1,9
25		—	—	—	1,5	1,9	2,3
32		—	1,5	1,6	1,9	2,4	2,9
40		1,5	1,6	1,9	2,4	3,0	3,7
50		1,6	2,0	2,4	3,0	3,7	4,6
63		2,0	2,5	3,0	3,8	4,7	5,8
75		2,3	2,9	3,6	4,5	5,6	6,8
90		2,8	3,5	4,3	5,4	6,7	8,2
	Nominal pressure PN based on design coefficient $C = 2{,}0$[a]						
	PN 6	PN 8	PN 10	PN 12,5	PN 16	PN 20	PN 25
110	2,7	3,4	4,2	5,3	6,6	8,1	10,0
125	3,1	3,9	4,8	6,0	7,4	9,2	11,4
140	3,5	4,3	5,4	6,7	8,3	10,3	12,7
160	4,0	4,9	6,2	7,7	9,5	11,8	14,6
180	4,4	5,5	6,9	8,6	10,7	13,3	16,4
200	4,9	6,2	7,7	9,6	11,9	14,7	18,2
225	5,5	6,9	8,6	10,8	13,4	16,6	—
250	6,2	7,7	9,6	11,9	14,8	18,4	—
280	6,9	8,6	10,7	13,4	16,6	20,6	—
315	7,7	9,7	12,1	15,0	18,7	23,2	—
355	8,7	10,9	13,6	16,9	21,1	26,1	—
400	9,8	12,3	15,3	19,1	23,7	29,4	—
450	11,0	13,8	17,2	21,5	26,7	33,1	—
500	12,3	15,3	19,1	23,9	29,7	36,8	—
560	13,7	17,2	21,4	26,7	—	—	—
630	15,4	19,3	24,1	30,0	—	—	—
710	17,4	21,8	27,2	—	—	—	—
800	19,6	24,5	30,6	—	—	—	—
900	22,0	27,6	—	—	—	—	—
1 000	24,5	30,6	—	—	—	—	—

[a] To apply a design coefficient of 2,5 (instead of 2,0) for pipes with nominal diameters above 90 mm, the next higher pressure rating, PN, shall be chosen.

NOTE 1 The nominal wall thicknesses conform to ISO 4065[4].

NOTE 2 The PN 6 values for S 20 and S 16 are calculated with the preferred number 6,3.

Table 3 — Tolerance on wall thicknesses at any point

Dimensions in millimetres

Nominal (minimum) wall thickness e_n		Tolerance for wall thickness x	Nominal (minimum) wall thickness e_n		Tolerance for wall thickness x
>	⩽		>	⩽	
1,0	2,0	0,4	21,0	22,0	2,4
2,0	3,0	0,5	22,0	23,0	2,5
3,0	4,0	0,6	23,0	24,0	2,6
4,0	5,0	0,7	24,0	25,0	2,7
5,0	6,0	0,8	25,0	26,0	2,8
6,0	7,0	0,9	26,0	27,0	2,9
7,0	8,0	1,0	27,0	28,0	3,0
8,0	9,0	1,1	28,0	29,0	3,1
9,0	10,0	1,2	29,0	30,0	3,2
10,0	11,0	1,3	30,0	31,0	3,3
11,0	12,0	1,4	31,0	32,0	3,4
12,0	13,0	1,5	32,0	33,0	3,5
13,0	14,0	1,6	33,0	34,0	3,6
14,0	15,0	1,7	34,0	35,0	3,7
15,0	16,0	1,8	35,0	36,0	3,8
16,0	17,0	1,9	36,0	37,0	3,9
17,0	18,0	2,0	37,0	38,0	4,0
18,0	19,0	2,1			
19,0	20,0	2,2			
20,0	21,0	2,3			

NOTE 1 The tolerance applies to the nominal (minimum) wall thickness and is expressed in the form $^{+x}_{\ 0}$ mm, where x is the value of tolerance for the mean wall thickness, e_m.

NOTE 2 The tolerance for wall thickness, e, at any point, conforms to grade W of ISO 11922-1[3].

6.5 Length of pipe

The nominal pipe length, l, shall be a minimum length which does not include the depth of the socketed portions, as shown in Figure 1.

NOTE The preferred nominal length of pipe is 6 m. Other lengths are subject to agreement between the manufacturer and the purchaser.