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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 3:
Fittings**

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*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) —*

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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 1452-3 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 4422-3:1996, ISO 264:1976, ISO 264:1976/Add.1:1982, ISO 2045:1988, ISO 2048:1990, ISO 3460:1975, ISO 4434:1977 and ISO 6455:1983, 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.

This corrected version of ISO 1452-3:2009 incorporates the correction of Figure 8 c).

Introduction

The System Standard, of which this is Part 3, 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 the products may 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 fittings, are specified in ISO 1452-1, ISO 1452-2 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 fittings.

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

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

For the convenience of users of this part of ISO 1452, marking on fittings and flanges according to withdrawn International Standards (e.g. ISO 4422-3:1996) may be considered valid for a period, e.g. up to three years from the date of publication of this part of ISO 1452.

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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 3: Fittings

1 Scope

This part of ISO 1452 specifies the characteristics of fittings 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, ISO 1452-2 and ISO 1452-5, it is applicable to PVC-U fittings and to joints with components of PVC-U, other plastics and non-plastics materials 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 fittings in 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 is also applicable to components 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 of ISO 1452-2:2009 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.

Depending on the jointing method, this part of ISO 1452 is applicable to the following types of fittings:

- fittings for solvent cementing;
- elastomeric ring seal fittings.

PVC-U fittings can be manufactured by injection-moulding and/or be fabricated from pipe.

This part of ISO 1452 is also applicable to PVC-U flange adapters and to the corresponding flanges made from various materials.

This part of ISO 1452 covers a range of fitting 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 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 580, *Plastics piping and ducting systems — Injection-moulded thermoplastics fittings — Methods for visually assessing the effects of heating*

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 1167-3, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 3: Preparation of components*

ISO 1183-1:2004, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer 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 1452-2:2009, *Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized poly(vinyl chloride) (PVC-U) — Part 2: Pipes*

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

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

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

ISO 13783, *Plastics piping systems — Unplasticized poly(vinyl chloride) (PVC-U) end-load-bearing double-socket joints — Test method for leaktightness and strength while subjected to bending and internal pressure*

EN 802, *Plastics piping and ducting systems — Injection-moulded thermoplastics fittings for pressure piping systems — Test method for maximum deformation by crushing*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

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

3.1.1

laying length

Z-length

〈socketed outlet〉 distance from the inserted tube or spigot end to the intersection point of the fitting/valve axis (fitting or valve centre)

3.1.2

laying length

Z-length

〈spigot outlet〉 distance from the outlet end to the intersection point of the fitting/valve axis (fitting or valve centre)

3.1.3

laying length

Z-length

〈socket with parallel outlets〉 distance between the ends of the inserted tubes or spigots

3.1.4

laying length

Z-length

〈one socket and one spigot with parallel outlets〉 distance from the inserted tube or spigot end to the end of the spigot outlet

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3.1.5

design length of bends

Z_d -length

length of an outlet, excluding any socket length or insert length of spigot

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3.2 Symbols

Z Laying length (Z-length)

Z_d Z-design length (Z_d -length)

r bend radius

4 Material

4.1 Fitting material

The fitting material 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 fitting, when measured in accordance with ISO 1183-1, shall be between the following limits:

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

4.3 MRS-value

The fitting material shall have a minimum required strength, MRS, as defined in ISO 1452-1:2009, 4.4.1.

The manufacturer of the compound or formulation shall confirm the MRS by testing as described in ISO 1452-1:2009, 4.4.1, 4.4.2 or 4.4.3, respectively.

The MRS value of the fitting material shall be declared by the fitting manufacturer in its technical file.

5 General characteristics

5.1 Appearance

When viewed without magnification, the internal and external surfaces of fittings 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.

Each end of a fitting shall be square to its axis.

5.2 Colour

The colour of injection-moulded fittings shall be grey throughout the wall for water supply, and grey or brown for drainage and sewerage under pressure.

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

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

The wall of the fittings 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 diameters

The nominal inside diameter(s), d_n , of a fitting shall correspond to, and be designated by, the nominal outside diameter(s) of the pipe(s) for which the fitting is designed.

6.3 Fittings for solvent cementing

6.3.1 Socket and spigot dimensions

The socket dimensions of the fittings shall be the same as for sockets on pipes and shall conform to ISO 1452-2:2009.

The spigot length(s) shall be at least equal to the corresponding socket length(s).

The tolerance on the diameter of the spigot ends, d_2 , of reducing bushes (see Table 7) shall always be positive and be as follows:

- maximum 0,2 mm for diameters equal to or less than 90 mm;
- maximum 0,3 mm for diameters 110 mm to 160 mm;
- maximum 0,4 mm for diameters 180 mm to 225 mm;
- maximum 0,5 mm for diameters 250 mm to 315 mm.

6.3.2 Diameters, laying lengths, bend radii and angles

6.3.2.1 For the following types of injection-moulded fittings, the Z -lengths shall be calculated using one of Equations (1), (2), (3), (4), (5), (6), (7) or (8), as applicable, where α is the angle of the elbow and r is the radius of the bend.

a) 90° elbows, 90° tees (see Table 1):
$$Z = \frac{d_n}{2} + 1 \quad (1)$$

b) 45° elbows (see Table 1):
$$Z = \frac{d_n}{2} \tan \frac{\alpha}{2} + 1 \quad (2)$$

c) 45° tee (see Table 1):
$$Z = \frac{d_n}{2} \cot \frac{\alpha}{2} + t \quad (3)$$

with $d_n \leq 90$ mm, 110 mm, 125 mm, 140 mm, 160 mm and $t = 3, 4, 6, 6, 7$

$$Z_1 = \frac{d_n}{2} \tan \frac{\alpha}{2} + 1 \quad (4)$$

d) bends (see Table 2)
$$Z = r = 2d_n \quad (5)$$

e) short bends (see Table 5)
$$Z = r = 0,75d_n \quad (6)$$

f) reducing bushes, long (see Table 6)
$$Z = 0,75 d_2 + 6 \quad (7)$$

g) reducing bushes, short (see Table 7)
$$Z = \left(\frac{d_2}{2} + 6 \right) - \left(\frac{d_1}{2} + 6 \right) \quad (8)$$

The calculated values are given in Table 1 to Table 7. The calculated values may be adapted by the manufacturer.

The manufacturer's information (e.g. catalogues) shall state the exact value(s) of the Z -length(s).

The deviation from the calculated values are recommended to be not greater than the values given in Table 1, Table 2, Table 5, Table 6 and Table 7, as applicable.

6.3.2.2 For bends made from pipe, the Z_d -design-lengths, Z_d , and the bend radii shall be equal to or greater than the values given in Table 3 and Table 4, as applicable.

NOTE 1 The Z_d -lengths are always greater than the corresponding socket lengths.

The wall thickness in the bend area of bends made from pipe shall be not less than the specified minimum wall thickness for the corresponding pipe given in ISO 1452-2.

NOTE 2 If needed, the next pipe series with the smaller S-number can be used. See also 7.2.

6.3.2.3 The following are the figures and tables for fittings for solvent cementing.

The types of fittings are shown in Figure 1.

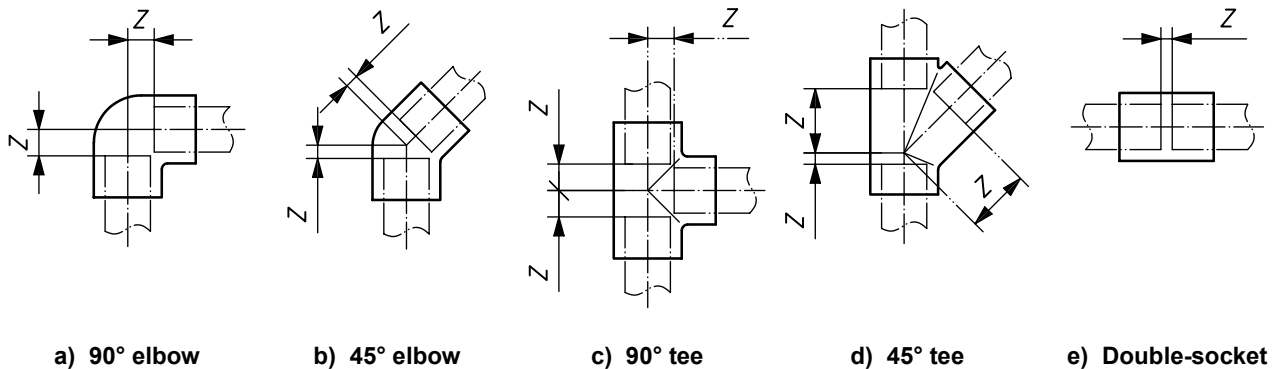


Figure 1 — Types of fittings: Typical elbows, tees and double-socket

Table 1 — Calculated Z-lengths and recommended deviations for elbows, tees and double-sockets

Dimensions in millimetres

Nominal diameter d_n	Calculated Z-length and recommended deviations				
	Type of fitting				
	90° elbow Z	45° elbow Z	90° tee Z	45° tee Z_1	Double-socket Z
12	7 ± 1	$3,5 \pm 1$	7 ± 1	—	3 ± 1
16	9 ± 1	$4,5 \pm 1$	9 ± 1	—	3 ± 1
20	11 ± 1	5 ± 1	11 ± 1	6^{+2}_{-1}	3 ± 1
25	$13,5^{+1,2}_{-1}$	$6^{+1,2}_{-1}$	$13,5^{+1,2}_{-1}$	33 ± 3	7^{+2}_{-1}
32	$17^{+1,6}_{-1}$	$7,5^{+1,6}_{-1}$	$17^{+1,6}_{-1}$	42^{+4}_{-3}	8^{+2}_{-1}
40	21^{+2}_{-1}	$9,5^{+2}_{-1}$	21^{+2}_{-1}	51^{+5}_{-3}	10^{+2}_{-1}
50	$26^{+2,5}_{-1}$	$11,5^{+2,5}_{-1}$	$26^{+2,5}_{-1}$	63^{+6}_{-3}	12^{+2}_{-1}
63	$32,5^{+3,2}_{-1}$	$14^{+3,2}_{-1}$	$32,5^{+3,2}_{-1}$	79^{+7}_{-3}	14^{+2}_{-1}
75	$38,5^{+4}_{-1}$	$16,5^{+4}_{-1}$	$38,5^{+4}_{-1}$	94^{+9}_{-3}	17^{+2}_{-1}
90	46^{+5}_{-1}	$19,5^{+5}_{-1}$	46^{+5}_{-1}	112^{+11}_{-3}	20^{+3}_{-1}
110	56^{+6}_{-1}	24^{+6}_{-1}	56^{+6}_{-1}	137^{+13}_{-4}	24^{+3}_{-1}
125	$63,5^{+6}_{-1}$	27^{+6}_{-1}	$63,5^{+6}_{-1}$	157^{+15}_{-4}	27^{+3}_{-1}
140	71^{+7}_{-1}	30^{+7}_{-1}	71^{+7}_{-1}	175^{+17}_{-5}	30^{+4}_{-1}
160	81^{+8}_{-1}	34^{+8}_{-1}	81^{+8}_{-1}	200^{+20}_{-6}	35^{+4}_{-1}
180	91^{+8}_{-1}	39^{+8}_{-1}	91^{+8}_{-1}	—	—
200	101^{+9}_{-1}	43^{+9}_{-1}	101^{+9}_{-1}	—	—
225	114^{+10}_{-1}	48^{+10}_{-1}	114^{+10}_{-1}	—	—
250	—	53^{+10}_{-1}	126^{+10}_{-1}	—	—
280	—	59^{+10}_{-1}	141^{+10}_{-1}	—	—
315	—	63^{+10}_{-1}	159^{+10}_{-1}	—	—

See Figure 1.

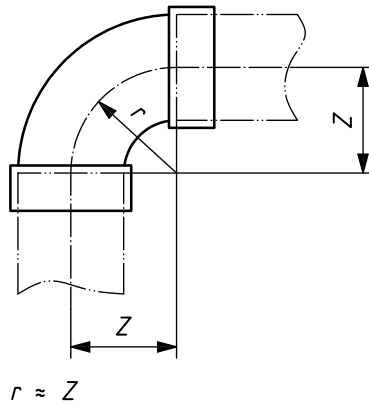


Figure 2 — Bends, injection-moulded

Table 2 — Calculated Z-lengths and recommended deviations for bends, injection-moulded

Dimensions in millimetres

Calculated Z-lengths and recommended deviations						
Nominal diameter						
12	16	20	25	32	40	50
24 ± 1	32 ± 1	40 ± 1	$50^{+1,2}_{-1}$	$64^{+1,6}_{-1}$	80^{+2}_{-1}	$100^{+2,5}_{-1}$
Nominal diameter						
63	75	90	110	125	140	160
$126^{+3,2}_{-1}$	150^{+4}_{-1}	180^{+5}_{-1}	220^{+6}_{-1}	250^{+6}_{-1}	280^{+7}_{-1}	320^{+8}_{-1}

See Figure 2.

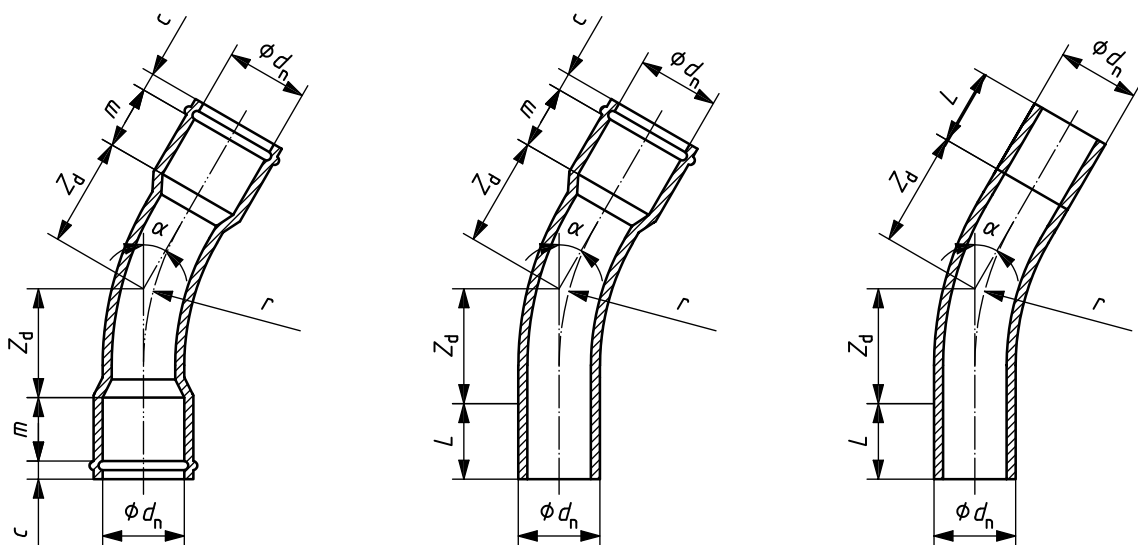


Figure 3 — Bends made from pipes