

Plastics piping systems for water supply — Unplasticized poly (vinyl chloride) (PVC-U) —

Part 3: Fittings

ICS 23.040.45; 91.140.60

National foreword

This British Standard is the UK implementation of EN 1452-3:1999. Collectively, Parts 1, 2, 3, 4 and 5 of BS EN 1452 supersede BS 3505:1986, BS 4346-1:1969 and BS 4346-2:1970. Since those British Standards are the basis of piping systems with a design life of at least 50 years, it is intended that they will be declared obsolescent, by 26 June 2001. With BS EN 14814:2007, collectively Parts 1 to 5 of BS EN 1452 also supersede BS 4346-3:1982, which is withdrawn to exclude requirements for joints for pressure pipes for water supply.

NOTE 1 The UK Water Industry has indicated that this British Standard is to be regarded as superseding the following Water Industry Specifications:
WIS 4-31-06, Issue 2: March 1994 *Blue unplasticised PVC pressure pipes, integral joints and post-formed bends for cold potable water (underground use)*
WIS 4-31-07, Issue 2: March 1994 *Unplasticised PVC pressure fittings and assemblies for cold potable water (underground use)*

The UK participation in its preparation was entrusted by Technical Committee PRI/61, Plastics piping systems and components, to Subcommittee PRI/61/2, Thermoplastics piping systems and components for pressure applications.

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

The responsible UK committee gives the following advice concerning the selection and installation of piping systems and components conforming to this British Standard.

- a) Water supply companies and other entities are obliged to use Parts 1 to 5 of this suite of European Standards, produced under EC/U mandate, if they wish to purchase PVC-U pipe systems or components within its scope.

NOTE 2 Parts 6 and 7 have each been prepared as an ENV (pre-standard), to allow further development, and their use is voluntary unless invoked contractually.

- b) The range of nominal diameters, dn, covered by EN 1452-3 extends from 12 to 710 inclusive. UK water company purchasers may wish to note that when the industry adopted the metric ISO fitting dimensions (as used in BS EN 1452-3) in 1990, for WIS 4-31-07 (withdrawn), it was decided to rationalize on six nominal diameters, specifically 63, 90, 110, 160, 200, 250 and 315 (out of a possible 27 diameters). This decision was reconfirmed in 1994.

This British Standard was published under the authority of the Standards Committee and comes into effect on 15 May 2000

© BSI 2009

Amendments/corrigenda issued since publication

Amd. No.	Date	Comments
11012 Corrigendum No. 1	July 2000	Indicated by a sideline
12006 Corrigendum No. 2	October 2000	Correction to National foreword supersession details
	31 August 2009	Correction to National foreword supersession details, and alignment of BSI and CEN publication details

ISBN 978 0 580 68175 2

Purchasers still wishing to order imperial (inch)-sized fittings should refer to normative annex A.

c) In Table 1, since reference is made to a specific type of end cap as specified in the current edition of EN 921, the UK Technical Committee considers that the reference here and in clause 2 should be to EN 921:1994.

d) Whereas previously either blue or grey fittings were acceptable in accordance with WIS 4-31-07 for use in conjunction with blue metric PVC-U pipes, EN 1452-3, 5.2 requires fittings to be grey, except where the fittings are fabricated from blue (or cream) pipe.

e) In 6.3.2 and Figure 2, reference is made to a 45° tee. In the UK this would usually be described as a “branch fitting”.

f) Attention is drawn to 6.3.2 where the use in the text and figures of “Z-length” with an upper case “Z” for the symbol is not covered by the definitions/symbols/abbreviations clause in this standard or in EN 1452-1 and is inconsistent with that established by ISO 265-1:1988, which uses a lower case “z” for this purpose. Its use in this standard is inconsistent, because in figures where comparison with other symbols such as “r”, “d_n” or “L” is possible a lower case “z” is usually found.

The UK Technical Committee considers that the lower case italic “z” should be used consistently for the laying length (z-length).

g) In 6.3.2.1, for calculation of the Z-length of a 45° tee, the equation introduces a symbol “t” for which no definition or units are defined in this clause or in the definitions and symbols clause of this standard or in EN 1452-1:1999 or EN 1452-2:1999. Generally in plastics piping standards the basic symbol “t” is used to signify a period of time, but in this case it would seem to be either an angle or a length.

h) In 6.3.2.1, and in Figures 3 to 6, the symbol “r” is used for the radius of a bend. However, in Figures 9 and 10, the symbol “r” is used in a conventional fashion for the radius at a change of surface profile, thus resulting in a conflict of meanings for this symbol within this standard. The UK Technical Committee has recommended that to resolve this conflict the symbol “r_B” should be used for the radius of a bend.

i) For Table 11, attention is drawn to the note at the end of 6.5.2, which states that the values for $L_{\min}$ given in Table 11 are for guidance, which is not apparent from the headings or notes within Table 11.

j) In 6.5.4, the requirements place no limit on the minimum wall thickness for a sealing ring groove. The UK Technical Committee considers that the requirements should be no less stringent than those applied for integral pipe sockets in EN 1452-2:1999, 6.6.2, i.e. not less than 0,8 times the minimum wall thickness of the connecting pipe. The UK Technical Committee recommends however that the minimum wall thickness of the sealing ring groove should be not less than the nominal (minimum) wall thickness for the pipe. This may be achieved by e.g. local thickening of the socket wall or by using an external sleeve.

k) Through clause 9 and Table 21, the examination of razor-cut surfaces for defects following oven testing (introduced in WIS 4-31-07) has been adopted in EN 1452-3.

l) For the purposes of note 2 to Table 21, Figure 21 is unclear as to what sets the position of either boundary for zone “L” for a ring gate. It is also not clear whether the “maximum value of 50 mm” applies to the total length for inspection in respect of a diaphragm gate or to each dimension “L”, i.e. as shown in Figure 21 is the maximum overall length for inspection 50 mm or 100 mm?

m) In Table 21, because of the specific reference to method A as specified in the current edition of EN 763, the UK Technical Committee considers that the reference here and in clause 2 should be taken to mean EN 763:1994.

The UK Technical Committee requests opinions on whether and how clarification may be necessary to avoid differences of interpretation or conflict of results.

WARNING This British Standard, which is identical with EN 1452-3:1999, does not necessarily detail all the precautions necessary to meet the requirements of the Health and Safety at Work etc. Act 1974 and subsequent regulations. Attention should be paid to any appropriate safety precautions and the test methods should be performed only by trained personnel.

Regulation 25 of the Water Supply (Water Quality) Regulations 1989 specified the circumstances in which Water Utilities must introduce water fittings in contact with public water supplies in England and Wales. Regulations 25(1)(b) permits Water Utilities to make unapproved use of small surface area products such as fittings. Nevertheless, Water Utilities have to ensure that the fitting complies with BS 6920 or equivalent national standard in order to ensure that its use will not cause adverse effect on water quality or risk to health of consumers. Similar provisions apply in Scotland and Northern Ireland.

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

Compliance with a British Standard cannot confer immunity from legal obligations.

English version

Plastics piping systems for water supply – Unplasticized poly(vinyl chloride) (PVC-U) – Part 3: Fittings

Systèmes de canalisations en plastique pour alimentation
en eau – Poly(chlorure de vinyle) non plastifié (PVC-U) -
Partie 3: Raccords

Kunststoff-Rohrleitungssysteme für die Wasserversorgung
– Weichmacherfreies Polyvinylchlorid (PVC-U) – Teil 3:
Formstücke

This European Standard was approved by CEN on 2 July 1998.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Contents

Page

Foreword.....	4
Introduction	5
1 Scope	6
2 Normative references	6
3 Definitions, symbols and abbreviations	7
3.1 Definitions	7
3.2 Symbols	7
4 Material.....	8
4.1 Fitting material	8
4.2 MRS-value	8
4.3 Designation of fittings material.....	8
4.4 Strength of injection-moulded material	8
4.5 Material strength of fittings made from pipe.....	9
5 General characteristics	10
5.1 Appearance.....	10
5.2 Colour.....	10
5.3 Opacity.....	10
6 Geometrical characteristics.....	10
6.1 Measurement of dimensions.....	10
6.2 Nominal diameters	10
6.3 Fittings for solvent cementing	10
6.4 Flange adapters and flanges	19
6.5 Elastomeric ring seal fittings	22
6.6 End-load-bearing double-sockets with elastomeric seals	33
7 Classification and operating conditions	34
7.1 Classification	34
7.2 Determination of the allowable operating pressure PFA for water up to 45 °C.....	34
8 Mechanical characteristics	35
8.1 Resistance to internal pressure of fittings or parts of fittings.....	35
8.2 Crushing test.....	35
9 Physical characteristics	36
10 Chemical characteristics	37
11 Sealing rings.....	37
12 Adhesives	37
13 Performance requirements	37
14 Marking	37

14.1 General 37

14.2 Minimum required marking 37

14.3 Additional marking 38

Annex A (normative) Imperial(inch)-sized fittings 39

Annex B (informative) Bibliography 42

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 155, Plastics piping systems and ducting systems, the Secretariat of which is held by NNI. It has been prepared with the cooperation of Eureau and in liaison with CEN/TC 164, Water supply.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 1999, and conflicting national standards shall be withdrawn at the latest by June 2001.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This standard forms part of a System Standard for plastics piping systems of a particular material for a specified application. There are a number of such System Standards.

System Standards are based on the results of the work undertaken in ISO/TC 138, Plastics pipes, fittings and valves for the transport of fluids, which is a Technical Committee of the International Organization for Standardization (ISO).

They are supported by separate standards on test methods to which references are made throughout the System Standard.

The System Standards are consistent with general standards on functional requirements and on recommended practice for installation.

EN 1452 consists of the following Parts, under the general title, *Plastics piping systems for water supply — Unplasticized poly(vinyl chloride) (PVC-U)*:

- Part 1: General;
- Part 2: Pipes;
- Part 3: Fittings (this standard);
- Part 4: Valves and ancillary equipment;
- Part 5: Fitness for purpose of the system;
- Part 6: Guidance for installation (ENV);
- Part 7: Guidance for the assessment of conformity (ENV).

This part of EN 1452 includes the following annexes:

- Annex A (normative): Imperial(inch)-sized fittings;
- Annex B (informative): Bibliography.

At the date of publication of this standard, System Standards for piping systems of other plastics materials used for the same application are the following:

NOTE All listed System Standards have reached the Enquiry stage or are in preparation.

EN 1796, *Plastics piping systems for water supply with or without pressure — Glass-reinforced thermosetting plastics (GRP) based on polyester resin (UP)*;

EN 12201, *Plastics piping systems for water supply — Polyethylene (PE)*.

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.

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the products covered by this standard:

- 1) this standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA;
- 2) it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

For material and components, other than fittings, requirements and test methods are specified in Part 1, Part 2 and Part 4 of the System Standard. Characteristics for fitness for purpose (mainly for joints) are covered in Part 5. Guidance for installation is given in ENV 1425-6. ENV 1452-7 covers guidance for the assessment of conformity.

This part of EN 1452 covers the characteristics of fittings.

1 Scope

This part of EN 1452 specifies the characteristics of fittings made from unplasticized poly(vinyl chloride) (PVC-U) for piping systems in the field of water supply.

It also specifies the test parameters for the test methods referred to in this standard.

In conjunction with Parts 1, 2, and 5 of EN 1452 and ENV 1452-7 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 ground;
 - b) conveyance of water above ground for both outside and inside buildings;
- for the supply of water under pressure at approximately 20 °C (cold water) intended for human consumption and for general purposes.

This standard is also applicable to fittings for the conveyance of water up to and including 45 °C. For temperatures between 25 °C and 45 °C figure A.1 in annex A of EN 1452-2:1999 applies.

Depending on the jointing method, this standard is applicable to the following types of fittings:

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

This standard is applicable to PVC-U flange adapters and to the corresponding flanges made from various materials.

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

NOTE Fittings for mechanical joints, made from various materials are described in ENV 1452-6.

2 Normative references

This standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

prEN 496, *Plastics piping and ducting systems — Plastics pipes and fittings — Measurement of dimensions and visual inspection of surfaces*

EN 578, *Plastics piping systems - Plastics pipes and fittings — Determination of the opacity*

EN 727, *Plastics piping and ducting systems — Thermoplastics pipes and fittings — Determination of Vicat softening temperature (VST)*

EN 763, *Plastics piping and ducting systems — Injection-moulded thermoplastics fittings — Test method for visually assessing effects of heating*

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

EN 921, *Plastics piping systems — Thermoplastics pipes — Determination of resistance to internal pressure at constant temperature*

EN 1452-1, *Plastics piping systems for water supply — Unplasticized poly(vinyl chloride) (PVC-U) — Part 1: General*

EN 1452-2:1999, *Plastics piping systems for water supply — Unplasticized poly(vinyl chloride) (PVC-U) — Part 2: Pipes*

EN 1452-5, *Plastics piping systems for water supply — Unplasticized poly(vinyl chloride) (PVC-U) — Part 5: Fitness for purpose of the system*

ENV 1452-7, *Plastics piping systems for water supply — Unplasticized poly(vinyl chloride) (PVC-U) — Part 7: Guidance for the assessment of conformity*

EN 12107, *Plastics piping systems — Injection-moulded thermoplastics fittings, valves and ancillary equipment — Determination of the long-term hydrostatic strength of thermoplastics materials for injection-moulding of piping components*

EN ISO 12162, *Thermoplastics materials for pipes and fittings for pressure applications — Classification and designation — Overall service (design) coefficient (ISO 12162:1995)*

EN ISO 13783:1997, *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*

ISO/TR 9080:1992, *Thermoplastics pipes for the transport of fluids — Methods of extrapolation of hydrostatic stress rupture data to determine the long-term hydrostatic strength of thermoplastics pipe materials*

ISO/DIS 12092:1994, *Fittings, valves and other piping system components of unplasticized poly(vinyl chloride) (PVC-U) for pipes under pressure — Resistance to internal pressure — Test method*

3 Definitions, symbols and abbreviations

For the purposes of this standard, the definitions, symbols and abbreviations given in EN 1452-1 apply, together with the following.

3.1 Definitions

3.1.1

laying length (Z-length)

- a) Laying length of fittings and valves with angled outlets:
 - 1) for socketed outlet, the laying length is the distance from the inserted tube or spigot end to the intersection point of the fitting/valve axis (fitting or valve centre);
 - 2) for spigot outlet, the laying length is the distance from the outlet end to the intersection point of the fitting/valve axis (fitting or valve centre).
- b) Laying length of fittings and valves with parallel outlets:
 - 1) in the case of sockets, the laying length is the distance between the ends of the inserted tubes or spigots;
 - 2) in the case of one socket and one spigot, the laying length is the distance from the inserted tube or spigot end to the end of the spigot outlet.

3.1.2

design length of bends (Z_d-length)

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

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 to be used shall conform to EN 1452-1 and to the requirements given in 4.2 to 4.5 of this standard.

4.2 MRS-value

The fittings material shall be evaluated according to ISO/TR 9080:1992 method II ¹⁾, where the pressure test is made in accordance with EN 12107 (together with EN 921), to find the LCL. The MRS-value shall be derived from the LCL and the fitting material shall be classified by the compound manufacturer in accordance with EN ISO 12162.

Where there is available long-term experience with the effect of a change in material/compound, it is not necessary to re-evaluate the MRS. In this case the values determined with 5 test pieces at 20 °C and 60 °C during 1000 h to 5000 h shall be located on or above the 97,5 % LCL long-term characteristic curve established prior to the material/compound change.

4.3 Designation of fittings material

The fittings material shall be designated as PVC-U, unless the material has an MRS of not less than 25 MPa, in which case the material shall be designated as PVC-UH.

4.4 Strength of injection-moulded material

When pressure tested in accordance with the procedure described in EN 12107, using injection-moulded tubular test pieces conforming to figure 1, the material shall conform to the requirements given in table 1.

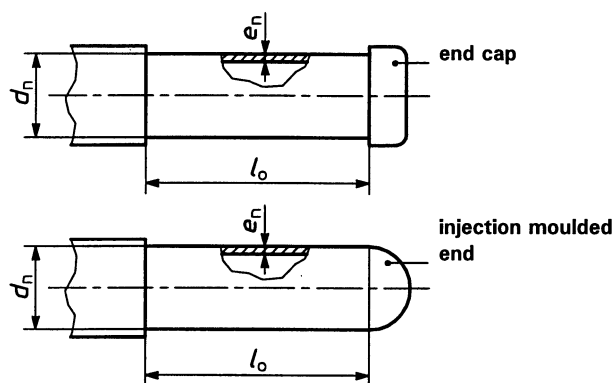


Figure 1 — Free length, l_0 , of injection-moulded test pieces

¹⁾ In ISO/TC 138/SC 5 a new extrapolation method is under development, which is intended to replace ISO/TR 9080.

Table 1 — Material characteristics

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Long-term strength	No break during the test period	Diameter	$d_n \geq 50 \text{ mm}$	EN 12107 (together with EN 921)
		Free length (see figure 1)	$l_0 \geq 3 d_n^*)$	
		Wall thickness	e_n of pipe series $6,3 \leq S \leq 10$	
		Test temperature	60 °C	
		Sampling procedure	Shall conform to ENV 1452-7	
		Number of test pieces	Shall conform to ENV 1452-7	
		Circumferential (hoop) stress	10,0 MPa	
		Type of test	Water-in-water type a)	
		Type of end caps		
		Test period	$\geq 1000 \text{ h}$	
*) For the d_n of 50 mm a minimum free length of 140 mm may be used.				

4.5 Material strength of fittings made from pipe

If the fitting is made from pipe, the pipe material shall conform to EN 1452-2:1999.

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 standard.

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.

The colour of fittings made from pipes shall be grey, blue or cream throughout the wall. For above ground application, cream fittings shall not be used.

5.3 Opacity

The wall of the fittings shall be opaque and shall not transmit more than 0,2 % of visible light when measured in accordance with EN 578.

This requirement does not apply to cream fittings (see 5.2).

6 Geometrical characteristics

6.1 Measurement of dimensions

Dimensions shall be measured in accordance with prEN 496.

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 EN 1452-2:1999.

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 bushing (see table 7 and table 8) 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 to 160 mm;
- maximum 0,4 mm for diameters 180 to 225 mm;
- maximum 0,5 mm for diameters 250 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 the following equations 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 2):

$$Z = \frac{d_n}{2} + 1$$

b) 45° elbows (see table 2):

$$Z = \frac{d_n}{2} \tan \frac{\alpha}{2} + 1$$

c) 45° tee (see table 2):

$$Z = \frac{d_n}{2} \cot \frac{\alpha}{2} + t$$

with	d_n	t
	≤ 90	3
	110	4
	125	6
	140	6
	160	7

$$Z_1 = \frac{d_n}{2} \tan \frac{\alpha}{2} + 1$$

d) Bends (see table 3)

$$Z = r = 2d_n$$

e) Short bends (see table 6)

$$Z = r = 0,75d_n$$

f) Reducing bushes long (see table 7)

$$Z = 0,75 d_2 + 6$$

g) Reducing bushes short (see table 8)

$$Z = \left(\frac{d_2}{2} + 6 \right) - \left(\frac{d_1}{2} + 6 \right)$$

The calculated values are given in table 2 to table 8. 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).

NOTE The deviation from the calculated values are recommended to be not greater than the values given in the table 2, table 3, table 6, table 7 and table 8 as applicable.

6.3.2.2 For bends made from pipe the Z-design-lengths, Z_d , and the bend radii shall be equal to or greater than the values given in table 4 and table 5, as applicable.

NOTE 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 EN 1452-2:1999.

NOTE If needed the next pipe series with the smaller S-number can be used.

6.3.2.3 Other fittings, in particular adapter- and connection-fittings, are shown in ENV 1452-6.

6.3.2.4 Figures and tables for fittings for solvent cementing