SLOVENSKI STANDARD
SIST ENV 1452-6:2002

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Cevni sistemi iz polimernih materialov za oskrbo z vodo - Nemehļ an polivinilklorid (PVC-U) - 6. del: Navodilo za vgradnjo

Plastics piping systems for water supply - Unplasticized poly(vinyl chloride) (PVC-U) - Part 6: Guidance for installation

Kunststoff-Rohrleitungssysteme für die Wasserversorgung - Weichmacherfreies Polyvinylchlorid (PVC-U) - Teil 6: Empfehlungen für die Verlegung

Systemes de canalisations en plastique pour l'alimentation en eau - Poly(chlorure de vinyle) non plastifié (PVC-U) - Partie 6: Guide pour la pose

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Plastics piping systems for water supply - Unplasticized poly(vinyl chloride) (PVC-U) - Part 6: Guidance for installation

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This European Prestandard (ENV) was approved by CEN on 14 November 1999 as a prospective standard for provisional application.

The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into a European Standard.

CEN members are required to announce the existence of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

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Foreword

This European Prestandard has been prepared by Technical Committee CEN/TC 155 "Plastics piping systems and ducting systems", the secretariat of which is held by NEN. It has been prepared in collaboration with Eureau and in liaison with CEN/TC 164 "Water supply".

This prestandard is a 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.

This European Prestandard is a guidance document and gives a recommended practice for the installation of PVC-U piping systems conveying water under pressure.

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*
- *Part 4: Valves and ancillary equipment*
- *Part 5: Fitness for purpose of the system*
- *Part 6: Guidance for installation (this prestandard)*
- *Part 7: Guidance for the assessment of conformity (ENV).*

This prestandard includes the following:

- Annex A (informative): Hydraulic flow chart
- Annex B (normative): Figures and tables
- Bibliography

At the date of publication of this prestandard, Systems 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 under 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)*

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

Introduction

The System Standard, of which this is Part 6, specifies the requirements for a piping system and its components when made from unplasticized poly(vinyl chloride) (PVC-U). The piping system is intended to be used for water supply.

The System Standard also includes guidance for installation (this Part) and for the assessment of conformity.

1 Scope

This European prestandard gives recommended practices for installation of unplasticized poly(vinyl chloride) (PVC-U) pipes, fittings, valves and ancillaries when used in piping systems conveying water under pressure.

The recommendations are intended to give practical guidance for the best methods of design and installation of piping systems incorporating pipes, fittings, valves and ancillary equipment made from PVC-U materials and used for the following purposes:

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 prestandard is also applicable to components for the conveyance of water up to and including 45 °C. For temperatures between 25 °C and 45 °C Figure A.1 of EN 1452-2:1999 applies.

In addition, recommendations are given for the connection to fittings, valves and ancillary equipment made from materials other than PVC-U.

2 Normative references

This Prestandard 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 Prestandard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amentments).

ENV 1046, *Plastics piping and ducting systems — Systems outside building structures for the conveyance of water or sewage — Guidance for installation above and below ground*

EN 1452-1:1999, *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*

3 Definitions, symbols and abbreviations

For the purposes of this prestandard, the definitions, symbols and abbreviations given in ENV 1046 together with those given in EN 1452-1:1999 apply.

4 Parameters influencing design

4.1 Allowable operating pressure

4.1.1 Where pipe material temperatures do not exceed 25 °C, and where no extra safety considerations are applicable (see 4.1.2), nominal pressures are given in Table A.1 of EN 1452-2:1999 using an overall service (design) coefficient, *C*, of 2,5 for d_n up to and including 90 mm and 2,0 for d_n greater than 90 mm. These nominal pressures have been calculated on the basis of well-established data taking into account a service life of at least 50 years of continuous operation. For common water supply systems up to 25 °C the allowable operating pressure PFA in bars [1)], is equal to the nominal pressure PN.

[1)] 1 bar = 10^5 N/m^2 = 0,1 MPa

4.1.2 In order to satisfy special users' requirements, an overall service (design) coefficient, *C*, other than 2,5 and 2,0 but not lower than 1,6 may be applied.

4.1.3 Where the water service temperature is between 25 °C and 45 °C, then EN 1452-2:1999 requires that the maximum allowable pressure is reduced by applying a derating factor, f_T, as shown in Figure A.1 of EN 1452-2:1999.

Figure A.1 of EN 1452-2:1999 shows that for temperatures up to and including 25 °C the derating factor to be applied is 1,0 and for temperatures above 25 °C the derating factor reduces from 1,0 to 0,63 at 45 °C.

Where water service temperatures are expected to exceed 45 °C, the manufacturer's advice should be obtained.

For an example of the application of a derating factor see Figure A.1 of EN 1452-2:1999.

4.2 Ring stiffness of pipes

Where a calculation of the initial pipe deflection is applied, the initial ring stiffness of the pipe shall be taken from Table 1.

Table 1 — Initial ring stiffness of pipes

	Pipe series							
	S 20 (SDR 41)	S 16,7 (SDR 34,4)	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 for $d_n \leq 90$ for $d_n > 90$	 – PN 6	 PN 6 PN 7,5	 PN 6 PN 8	 PN 8 PN 10	 PN 10 PN 12,5	 PN 12,5 PN 16	 PN 16 PN 20	 PN 20 PN 25
Calculated ring stiffness in kN/m^2 (S_{calc})	3,9	6,7	7,6	16	31,3	61	125	250
Nominal ring stiffness SN	4	8	–	16	32	–	–	–

The initial ring stiffness S_{calc} in Table 1 has been calculated using the following equation:

$$S_{calc} = \frac{E \times I}{(d_e - e_n)^3} = \frac{E}{96[S]^3}$$

where:

- S_{calc} is the calculated initial ring stiffness in kilonewtons per square metre;
- E is the modulus of elasticity in flexure, having the value of 3×10^6 kN/m^2;
- I is the moment of inertia in cubic millimetres with $\frac{1 \times e_n{}^3}{12}$ for 1 m pipe length;
- d_e is the nominal outside diameter in millimetres;
- e_n is the nominal wall thickness in millimetres;
- S is the pipe series.

NOTE 1 In practice the initial ring stiffness is always higher than calculated, because the average wall thickness is greater than the nominal wall thickness used for the calculation.

NOTE 2 When pipes with nominal ring stiffness SN ≤ 4 are installed below ground, care should be taken to avoid excessive ovalization (see also 10.2.4 and ENV 1046).

4.3 Precautions

4.3.1 For selecting pipe stiffness for different soil conditions, the recommendations given in ENV 1046 apply.

4.3.2 Components of the pipeline systems shall not be exposed to flames or to radiant heat which is likely to raise their surface temperatures.

4.3.3 Where regulations authorise the use of metal pipes for earthing and such pipes are replaced by PVC-U, arrangements should be made to ensure that the electrical earth is maintained (see 4.3.4).

4.3.4 PVC-U does not conduct electricity and thus cannot be used for earthing; neither can these pipes be thawed by electrical means using the pipe as a conductor. If a network exists of metal pipes with a cathodic protection system and part of the network is replaced with PVC-U pipes, electrical continuity shall be maintained by bridging the PVC-U pipes.

4.3.5 Because of the high electrical resistance of PVC-U pipes, precautions should be taken where hazards would arise through static electricity.

4.3.6 Joints and bends shall not be post formed on site by the application of heat. For cold bending of pipes, see clause 7.

4.3.7 Reasonable precautions should be taken when laying pipes made from any material. Because PVC-U pipes become less ductile at low temperatures, additional care should be taken when handling and installing pipes at 0 °C and below.

4.3.8 Pipes should not be coated or painted with solvent-containing or aggressive paints.

5 Hydraulic properties

5.1 Loss of head

See Annex A of this prestandard for the relevant flow chart, showing the head losses in PVC-U pipes.

For head losses through fittings, the manufacturer's advice should be obtained.

5.2 Internal diameter

PVC-U pressure pipes are specified by nominal diameters, d_n. Internal diameters vary according to pipe series (see Table 2 of EN 1452-2:1999). This shall be taken into account when calculating the flow characteristics of pipes.

6 Assembly methods

6.1 General

6.1.1 PVC-U pressure pipes conforming to EN 1452-2:1999 are manufactured by a continuous extrusion process. Pipes are supplied in nominal lengths as described in EN 1452-2:1999 and with one of the following three end conditions:

- plain, for jointing by means of separate couplers;
- integral elastomeric ring socket (one end), for push-fit jointing;
- integral socket (one end), for solvent cement jointing.

(See also 6.1.3.)

6.1.2 Fittings of PVC-U for use with PVC-U pipes are specified in EN 1452-3 [1] and can either have socket type joints for solvent cementing or elastomeric ring joints for push-fit jointing. Valves and ancillaries of PVC-U are specified in EN 1452-4 [2]. See also 6.1.3 as follows.

6.1.3 The principal types of joints and their characteristics (See Annex B for typical details) are as follows:

a) elastomeric ring seal joints (see Figure B.1)

An elastomeric sealing ring is compressed and forms a pressure tight seal when a spigot is inserted into a socket. These joints do not sustain axial thrust (non end-load-bearing).

b) solvent cement joints (see Figure B.2)

A solvent-based adhesive is applied to a spigot and to a socket and the two components are pushed together. Solvent-cemented joints sustain axial thrust (end-load-bearing).

c) mechanical joints (see Figure B.3)

These joints, also known as compression joints, use separate couplers made from PVC-U or metal. A pressure-tight seal is achieved when an elastomeric sealing ring is compressed by tightening backing ring(s) of various designs. These joints do not sustain axial thrust (non-end-load-bearing).

d) flanged joints (see Figure B.4)

A flange is incorporated onto the end of a pipe or fitting in a variety of ways. A pressure-tight seal is achieved by compressing a sealing gasket between the mating faces of flanges on adjacent pipes, fittings or valves made from plastics or metals. These joints can be either end-load-bearing or non-end-load-bearing.

e) union couplers and adaptors (see Figure B.5)

For unions an elastomeric seal is compressed between mating faces, which are held together by means of a threaded back nut. Union couplers and adaptors can be used for jointing PVC-U pipes to PVC-U pipes and PVC-U pipes to metal pipe threads. Union couplers and adaptors sustain axial thrust (end-load-bearing).

Special elastomeric ring couplers are available that sustain axial thrust (see Figure B.6).

Where pipe installations include non-end-load-bearing jointing systems (above or below ground), it is essential to consider the probability of joint separation due to axial thrust.

In below-ground applications, joint separation can be prevented by means of end-load-bearing joints or concrete anchor blocks (see Figure B.7). In certain circumstances the frictional resistance at the interface of pipe and compacted backfill material might be sufficient to resist the axial forces generated.

Joint separation in above ground applications can be prevented by properly designed anchor brackets or more easily by use of end-load-bearing jointing systems.

Where large diameter pipes operating at high pressures are involved, axial thrusts of several tens of kilonewtons can be developed, particularly during pressure testing operations (see Table B.1).

6.1.4 When it is known at the design stage that the pipeline will be required to be dismantled during the course of its functional lifetime then an appropriate type of joint should be used.

6.2 Integral rubber ring joints

6.2.1 An integral rubber ring joint consists of an elastomeric sealing element located in a groove in the socket formed integrally with the pipe or fitting. The sealing element (sealing ring) is compressed to form a pressure-tight seal when the spigot end of a pipe or fitting is inserted into the socket. Profiles of the ring and of the socket depend on individual manufacturers' designs. The rings to be used shall be those supplied by the manufacturer for his own assembly system. If the sealing ring is not in place at the time of delivery, the groove should be cleaned, any foreign bodies removed and the ring located into the groove as directed by the manufacturer.

6.2.2 In order to meet water quality and biodegradation requirements, elastomeric sealing rings are usually made from synthetic materials, e.g. ethylene-propylene-diene (EPDM) copolymer, styrene-butadiene (SB) rubber or a combination of synthetic and natural rubber.

6.2.3 Integral elastomeric ring joints do not normally sustain end thrust. Particular attention should be paid to the correct design of anchor blocks and to their location in the pipeline system (see 10.2.8). Anchorage blocks should be designed to sustain the maximum thrust developed due to internal pressure when the test pressure is applied. Examples of anchor block design, location and construction are shown in Figure B.7. A table of forces generated is given in Table B.1.

In some European countries it is common practice to provide restraint against thrust by the inclusion of end-load-bearing joints at strategic points within the system. Where this practice is acceptable, the pipe and/or fittings manufacturer's advice should be sought to help identify the places where end-load-bearing joints should be applied. See 10.2.8.

6.2.4 Correct assembly of an elastomeric ring seal joint requires that the spigot end of the pipe be chamfered and correctly lubricated prior to insertion into the socket. Lubricant should also be applied to the elastomeric ring once this is fitted into the ring groove.

The lubricant used should not have any detrimental effect on the pipe, fittings, ancillaries or elastomeric sealing ring and shall not be toxic, shall not impart any taste or odour to the water and shall not encourage the growth of bacteria.

In conformity to 4.2 of EN 1452-1:1999, the lubricant shall have no influence on water quality. Only lubricants recommended by the pipe or fittings supplier should be used.

As soon as the pipe spigot and elastomeric ring have been lubricated, the spigot should be introduced into the socket so as to avoid any risk of soiling or pollution.

After aligning the pipes in both horizontal and vertical planes, the spigot end should be inserted into the socket up to the reference mark on the spigot.

Pipes may be cut on site. If this is necessary the cut should be square and the cut end deburred and/or chamfered to the angle and dimensions given in EN 1452-2:1999.

6.3 Solvent cement joints

6.3.1 General

6.3.1.1 The dimensions of the sockets and spigots for solvent cement joints are given in EN 1452-2:1999.

6.3.1.2 The solvent cement adhesives should conform to the functional requirements of the appropriate standards and their identification characteristics should be specified by the manufacturer according to ISO 7387-1 [3].

6.3.1.3 In conformity to EN 1452-1:1999, the solvent cements shall have no influence on water quality.

6.3.2 Jointing operations

6.3.2.1 Solvent cement adhesives and cleaning fluids are flammable, therefore it is important that smoking be prohibited in the area in which these materials are being used. Solvent cement operations should be carried out in a well-ventilated area. Solvent cements and cleaning fluids can be detrimental to health if inhaled or in contact with the skin.

6.3.2.2 The solvent cement should have the appropriate viscosity, it should not be diluted or stirred unless otherwise instructed by the adhesive's manufacturer.

6.3.2.3 The pipe end to be jointed shall be cut square to its axis and free from irregularities such as burrs and swarf. It should be chamfered as specified in EN 1452-2:1999 to prevent excessive amounts of adhesive being scraped off the socket. When the chamfer is applied on site, the angle and dimensions should conform to EN 1452-2:1999.

6.3.2.4 Both the spigot and socket should be thoroughly cleaned and abraded with glass paper or emery cloth. Excessive abrasion shall be avoided.

6.3.2.5 The surfaces to be jointed should be clean, dry and free from grease. It is recommended that a degreasing agent is used for this purpose.

6.3.2.6 The solvent cement should be applied in an even layer and in a longitudinal direction to both spigot and socket mating surfaces.

6.3.2.7 The application of the solvent cement should be performed quickly. For diameters greater than 110 mm, two persons are necessary to apply the adhesive, one to the spigot end and one to the socket simultaneously.

6.3.2.8 Immediately and without twisting, the spigot should be pushed into the socket to the required depth. Excessive amounts of adhesive around the socket mouth should be removed as soon as the joint has been made. Once the joint is made, leave to dry without disturbing for at least 5 min for sizes up to and including 63 mm, and 30 min for all sizes greater than 63 mm.

6.3.2.9 The joint becomes resistant to pressure only after an additional period. Allow the required minimum time given by the solvent cement manufacturers (approximately 24 h) before applying the maximum recommended test pressure (see clause 11).

NOTE Solvent cements are slow to cure at low temperatures and cure fast at high temperatures. Solvent cementing is not recommended at temperatures of 0 °C and below.

6.4 Mechanical joints

6.4.1 Compression joints

Compression joints are normally separate fittings made from PVC-U or metal and can be in the form of a coupler for connecting pipes and fittings of the same material and of the same dimensions, or as an adaptor for connecting components of different materials and/or dimensions. Generally, compression fittings consist of four main elements:

— body;

— elastomeric sealing rings;

— backing (compression) rings;

— nuts or bolts.

Each element is positioned on the pipe separately and the sealing rings compressed between the body of the fitting and the pipe by tightening the backing rings. Nuts or bolts should not be overtightened and the manufacturer's recommendations followed at all stages of assembly.

6.4.2 Threaded joints

There is a range of threaded joints for assembly to metallic pipes, including the following:

— PVC-U and metal union adaptor [see Figure B.5b)];

— PVC-U adaptor fittings [see Figures B.5c) and B.5d)].

PVC-U pipes conforming to EN 1452-2:1999 are not suitable for threading.

6.4.3 Flanged joints

PVC-U pipes, fittings and ancillaries can be supplied with flanged ends. Although detailed flange designs vary considerably, all are suitable for connection to pipes, fittings and valves made from dissimilar materials, e.g. metals. A pressure-tight joint is obtained by compressing a gasket or ring between the mating faces of adjacent flanges.

7 Cold bending on site

It is permitted for pipes to deviate from one continuous straight line by either of the following techniques:

a) means of a slight deflection within a elastomeric ring joint;

b) the gradual curvature of each pipe length.

To ensure that the efficiency of the elastomeric ring seal is not impaired, deflection within the joint would normally be limited to a maximum of 1°. For greater deflections, special designs of joint should be used and the manufacturer's advice obtained. The radius of curvature, R, of a cold-formed bend over the length of a 6 m pipe shall not be less than 300 times the external diameter of the pipe (see Figure B.8). Table B.2 gives useful dimensions for cold-bent pipes up to and including a d_n of 160 mm.