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**Cevni sistemi iz polimernih materialov za odpadno vodo in kanalizacijo, ki delujejo po težnostnem principu in so položeni v zemljo - Nemehčan polivinilklorid (PVC - U) - 1. del: Specifikacije za cevi, fitinge in sistem**

Plastics piping systems for non-pressure underground drainage and sewerage - Unplasticized poly(vinyl chloride) (PVC-U) - Part 1: Specifications for pipes, fittings and the system

**Kunststoff-Rohrleitungssysteme für erdverlegte drucklose Abwasserkanäle und -leitungen - Weichmacherfreies Polyvinylchlorid (PVC-U) - Teil 1: Anforderungen an Rohre, Formstücke und das Rohrleitungssystem**

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Systemes de canalisations en plastique pour les branchements et les collecteurs d'assainissement enterrés sans pression - Poly(chlorure de vinyle) non plastifié (PVC-U) - Partie 1: Spécifications pour tubes, raccords et le systeme

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English version

## Plastics piping systems for non-pressure underground drainage and sewerage - Unplasticized poly(vinyl chloride) (PVC-U) - Part 1: Specifications for pipes, fittings and the system

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This European Standard was approved by CEN on 3 August 1997.

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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  
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## 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 in liaison with CEN/TC 165 "Waste water engineering".

This standard 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.

EN 1401 consists of the following Parts, under the general title *Plastics piping systems for non-pressure underground drainage and sewerage - Unplasticized poly(vinyl chloride) (PVC-U)*

- Part 1: *Requirements for pipes, fittings and the system (the present standard)*
- Part 2: *Guidance for the assessment of conformity (under preparation)*
- Part 3: *Guidance for installation (under preparation)*

This Part of EN 1401 includes the following annexes:

- Annex A (normative): Utilisation of non-virgin material
- Annex B (informative): General characteristics of PVC-U pipes and fittings
- Annex C (informative): Bibliography.

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 July 1998, and conflicting national standards shall be withdrawn at the latest by July 1998.

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.

## 1 Scope

This Part of EN 1401 specifies the requirements for pipes, fittings and the system of unplasticized poly(vinyl chloride) (PVC-U) piping systems in the field of non-pressure underground drainage and sewerage

- outside the building structure (application area code "U"), and
- both buried in ground within the building structure (application area code "D") and outside the building.

This is reflected in the marking of products by "U" and "UD".

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

This standard covers a range of nominal sizes, a range of pipes and fittings series and a range of stiffness classes and gives recommendations concerning colours.

NOTE 1: It is the responsibility of the purchaser or specifier to make the appropriate selection from these aspects, taking into account their particular requirements and any relevant national regulations and installation practices or codes.

In conjunction with Part 2 and Part 3 of EN 1401 it is applicable to PVC-U pipes and fittings, their joints and to joints with components of other plastics and non-plastics materials intended to be used for buried piping systems for non-pressure underground drainage and sewerage.

This standard is applicable to PVC-U pipes without a socket as well as pipes with an integral socket.

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The fittings can be manufactured by injection-moulding or be fabricated from pipes and/or mouldings.

Requirements and limiting values for application area code "D" are given in table 4, table 6, table 13 and table 15.

NOTE 2: Pipes, fittings and other components conforming to any of the plastics product standards listed in annex C can be used with pipes and fittings conforming to this standard, provided they conform to the requirements for joint dimensions given in clause 6 and to the requirements of table 15.

## 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<sup>1)</sup>

*Plastics piping systems – Plastics pipes and fittings – Measurement of dimensions and visual inspection of surfaces*

<sup>1)</sup> This document is under revision.

- EN 580 *Plastics piping systems – Unplasticized poly(vinyl chloride)(PVC-U) pipes – Test method for the resistance to dichloromethane at a specified temperature (DCMT)*
- EN 681-1 *Elastomeric seals – Material requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanized rubber*
- prEN 681-2 *Elastomeric seals – Material requirements for pipe joint seals used in water and drainage applications – Part 2: Thermoplastics elastomers*
- EN 727 *Plastics piping and ducting systems – Thermoplastics pipes and fittings – Determination of Vicat softening temperature (VST)*
- EN 743 *Plastics piping and ducting systems – Thermoplastics pipes – Determination of the longitudinal reversion*
- EN 744 *Plastics piping and ducting systems – Thermoplastics pipes – Test method for resistance to external blows by the round-the-clock method*
- EN 763 *Plastics piping and ducting systems – Injection-moulded thermoplastics fittings – Test method for visually assessing effects of heating*
- EN 921 *Plastics piping systems – Thermoplastics pipes – Determination of resistance to internal pressure at constant temperature*
- EN 922 *Plastics piping and ducting systems – Pipes and fittings of unplasticized poly(vinyl chloride) (PVC-U) – Specimen preparation for determination of the viscosity number and calculation of the K-value*
- EN 1053 *Plastics piping systems – Thermoplastics piping systems for non-pressure applications – Test method for watertightness*
- EN 1055 *Plastics piping systems – Thermoplastics piping systems for soil and waste discharge inside buildings – Test method for resistance to elevated temperature cycling*
- EN 1277 *Plastics piping systems – Thermoplastics piping systems for buried non-pressure applications – Test method for leaktightness of elastomeric sealing ring type joints*
- EN 1411 *Plastics piping and ducting systems – Thermoplastics pipes – Determination of resistance to external blows by the staircase method*
- prEN 1905 *Plastics piping systems – Unplasticized poly(vinylchloride) (PVC-U) pipes and fittings and material – Method for assessment of the PVC content based on total chlorine content*
- prEN 1989 *Thermoplastics piping and ducting systems – Joints for buried non-pressure applications – Test method for long-term sealing performance of joints with thermoplastics elastomer (TPE) seals by estimating the sealing pressure*
- EN 10204:1991 *Metallic products – Types of inspection documents*
- prEN 12061 *Plastics piping systems – Thermoplastics fittings – Test method for impact strength*

prEN 12256	<i>Plastics piping systems – Thermoplastics fittings – Test method for mechanical strength or flexibility of fabricated fittings</i>
ISO 472:1988	<i>Plastics – Vocabulary</i>
ISO 1043-1:1992	<i>Plastics – Symbols – Part 1: Basic polymers and their special characteristics</i>
ISO 1183:1987	<i>Plastics – Methods for determining the density and relative density of non-cellular plastics</i>

### 3 Definitions, symbols and abbreviations

#### 3.1 Definitions

For the purpose of this standard, the following definitions and those given in ISO 472:1988 and ISO 1043-1:1992 apply.

**3.1.1 application area code:** A code used in the marking of pipes and fittings to indicate the application area for which they are intended, as follows:

U: application area code for the area more than 1 m from the building to which the buried piping system is connected;

D: application area code for the area under and within 1 m from the building where the pipes and the fittings are buried in ground and are connected to the soil and waste discharge system of the building.

NOTE: In code D application areas, the existence of hot water discharge in addition to the external forces from the surroundings is usual.

**3.1.2 nominal size DN:** A numerical designation of the size of a component, other than a component designated by thread size, which is approximately equal to the manufacturing dimension, in millimetres (mm).

**3.1.3 nominal size DN/OD:** Nominal size, related to the outside diameter.

**3.1.4 nominal outside diameter ( $d_n$ ):** The specified outside diameter, in millimetres, assigned to a nominal size DN/OD.

**3.1.5 outside diameter ( $d_e$ ):** The value of the measurement of the outside diameter through its cross section at any point of a pipe or spigot, rounded to the next greater 0,1 mm.

**3.1.6 mean outside diameter ( $d_{em}$ ):** The value of the measurement of the outer circumference of a pipe or spigot end of a fitting in any cross section, divided by  $\pi$  ( $\approx 3,142$ ), rounded to the next greater 0,1 mm.

**3.1.7 mean inside diameter of a socket ( $d_{sm}$ ):** The arithmetical mean of a number of measurements of the inside diameter of a socket in the same cross section.

**3.1.8 out-of-roundness (ovality):** The difference between the measured maximum and the measured minimum outside diameter in the same cross section of a component.



**3.1.9 wall thickness ( $e$ ):** The value of the measurement of the wall thickness at any point around the circumference of a component.

**3.1.10 mean wall thickness ( $e_m$ ):** The arithmetical mean of a number of measurements of the wall thickness, regularly spaced around the circumference and in the same cross section of a component, including the measured minimum and the measured maximum values of the wall thickness in that cross section.

**3.1.11 standard dimension ratio (SDR):** A numerical designation of a pipe series, which is a convenient round number, approximately equal to the dimension ratio of the nominal outside diameter,  $d_n$ , and the nominal wall thickness,  $e_n$ .

**3.1.12 nominal ring stiffness (SN):** A numerical designation, of the ring stiffness of a pipe or fitting, which is a convenient round number, relative to the determined stiffness in kilonewtons per square metre ( $\text{kN/m}^2$ ), indicating the minimum ring stiffness of a pipe or fitting.

### 3.2 Symbols

$A$  : length of engagement

$a$  : circumferential side cover of a saddle branch

$B$  : length of lead-in

$C$  : depth of sealing zone

DN : nominal size

DN/OD : nominal size, outside diameter related

$d_e$  : outside diameter

$d_{em}$  : mean outside diameter

$d_n$  : nominal outside diameter

$d_{sm}$  : mean inside diameter of a socket

$d_3$  : internal diameter of the groove

$e$  : wall thickness

$e_m$  : mean wall thickness

$e_2$  : wall thickness of a socket

$e_3$  : wall thickness in the groove area

$f$  : groove width

$H$  : length of chamfer

$L$  : axial cover of a saddle branch

$l$  : effective length of a pipe

$L_1$  : length of spigot

$L_2$  : length of the solvent cement socket

$M$  : length of spigot of a plug

$R$  : radius of swept fittings

$Z$  : design length of a fitting

$\alpha$  : nominal angle of a fitting

### 3.3 Abbreviations

PVC-U : Unplasticized poly(vinyl chloride)  
 SDR : Standard dimension ratio  
 SN : Nominal ring stiffness  
 TIR : True impact rate

## 4 Material

### 4.1 Raw material

The raw material shall be PVC-U to which are added those additives that are needed to facilitate the manufacture of components conforming to the requirements of this standard.

When calculated on the basis of a known formulation, or in case of dispute or unknown formulation, determined in accordance with prEN 1905, the PVC-content shall be at least 80 % by mass for pipes and 85 % by mass for injection-moulded fittings.

### 4.2 Pipe material

When tested in accordance with the test method as specified in table 1, using the indicated parameters, the pipe material shall have characteristics conforming to the requirements given in table 1.

The pipe material shall be tested in the form of a pipe.

**Table 1: Material characteristics of pipes**

Characteristic	Requirements	Test parameters		Test method
Resistance to internal pressure	No failure during the test period	End caps Test temperature Orientation Number of test pieces Circumferential (hoop) stress Conditioning period Type of test Test period	Type a or b 60 °C Free 3 10 MPa 1 h Water-in-water 1000 h	EN 921

### 4.3 Fitting material

When tested in accordance with the test method as specified in table 2, using the indicated parameters, the fitting material shall have characteristics conforming to the requirements given in table 2.

The fitting material shall be tested, in the actual formulation, in the form of an extruded or injection-moulded pipe.

Fabricated fittings or parts of fabricated fittings shall be made from pipes conforming to this standard, except for the requirements for the wall thickness, and/or mouldings from PVC-U which conform to material, mechanical and physical characteristics as required in this standard.

Table 2: Material characteristics of fittings

Characteristic	Requirements	Test parameters		Test method
Resistance to internal pressure	No failure during the test period	End caps Dimensions  Free length for injection-moulded pipe Test temperature Orientation Number of test pieces Circumferential (hoop) stress Conditioning period Type of test Test period	Type a or b $50 \text{ mm} \leq d_n \leq 110 \text{ mm}$ $3 \text{ mm} \leq e \leq 5 \text{ mm}$ $\geq 140 \text{ mm}$  60 °C Free 3 6,3 MPa  1 h Water-in-water 1000 h	EN 921

#### 4.4 Utilisation of non-virgin materials

Conditions and requirements for the utilisation of non-virgin materials are given in annex A.

#### 4.5 Sealing ring retaining means

It is permitted that sealing rings are retained using means made from polymers other than PVC-U.

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### 5 General characteristics

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#### 5.1 Appearance

When viewed without magnification, the following requirements apply:

- the internal and external surfaces of pipes and fittings shall be smooth, clean and free from grooving, blistering, impurities and pores and any other surface irregularity likely to prevent their conformity to this standard;
- pipe ends shall be cleanly cut and the ends of pipes and fittings shall be square to their axis.

#### 5.2 Colour

The pipes and fittings shall be coloured through the wall.

The colour should preferably be orange-brown (approximately RAL 8023)<sup>1)</sup> or dusty grey (approximately RAL 7037)<sup>1)</sup>. Other colours may be used.

### 6 Geometrical characteristics

#### 6.1 General

Dimensions shall be measured in accordance with prEN 496.

NOTE: The figures are schematic sketches only, to indicate the relevant dimensions. They do not necessarily represent the manufactured components.

1) According to the colour register RAL 840-HR.

**6.2 Dimensions of pipes****6.2.1 Outside diameters**

The mean outside diameter,  $d_{em}$ , shall conform to table 3.

**Table 3: Mean outside diameters**

Dimensions in millimetres

Nominal size DN/OD 1)	Nominal outside diameter $d_n$	Mean outside diameter	
		$d_{em,min}$	$d_{em,max}$
110	110	110,0	110,3
125	125	125,0	125,3
160	160	160,0	160,4
200	200	200,0	200,5
250	250	250,0	250,5
315	315	315,0	315,6
(355)	355	355,0	355,7
400	400	400,0	400,7
(450)	450	450,0	450,8
500	500	500,0	500,9
630	630	630,0	631,1
(710)	710	710,0	711,2
800	800	800,0	801,3
(900)	900	900,0	901,5
1000	1000	1000,0	1001,6

1) Non-preferred sizes are indicated in parenthesis.

**6.2.2 Out-of-roundness**

The out-of-roundness, measured directly after production, shall be less than or equal to  $0,024d_n$ .

**6.2.3 Length of pipes**

The effective length of a pipe,  $l$ , shall be not less than that declared by the manufacturer when measured as shown in figure 1.