

SLOVENSKI STANDARD
oSIST prEN 1401-1:2018
01-julij-2018

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, fittinge 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 systems

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

Systèmes 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 système

Ta slovenski standard je istoveten z: prEN 1401-1

ICS:

23.040.05	Cevovodi za zunanje sisteme za odpadno vodo in njihovi deli	Pipeline and its parts for external sewage systems
91.140.80	Drenažni sistemi	Drainage systems
93.030	Zunanji sistemi za odpadno vodo	External sewage systems

oSIST prEN 1401-1:2018

en,fr,de

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 1401-1

May 2018

ICS 23.040.01

Will supersede EN 1401-1:2009

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
systems**

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Weichmacherfreies Polyvinylchlorid (PVC-U) - Teil 1:
Anforderungen an Rohre, Formstücke und das
Rohrleitungssystem

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 155.

If this draft becomes a European Standard, 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.

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SIST EN 1401-1:2019
<https://standards.iteh.ai/catalog/standards/sist/bb1398d7-2d21-4b2b-a182-9df1a29a9d3e/sist-en-1401-1-2019>

prEN 1401-1:2018 (E)**European foreword**

This document (prEN 1401-1:2018) has been prepared by Technical Committee CEN/TC 155 "Plastics piping systems and ducting systems", the secretariat of which is held by NEN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1401-1:2009.

This revision of the EN1401 series is proposed by CEN/TC155/WG6 members in order to improve the 'level of sustainability' and the 'environmental impact' of PVC piping systems, whilst improving the recommendations and safe use of recycled material. Regarding this specific target, some superfluous requirements and inconsistencies existing in the old version of EN 1401-1 were deleted, and more focus was given to the control of applied formulation and to the final characteristics and performance of products

Compared to the previous version, the main changes are listed below:

- a) clarification of product covered (Clause 1);
- b) introduction of a new pipe series SN 16 (SDR 27,6) (7.2.5 and 7.4.1.2);
- c) deletion of former clause on dimension of "o-ring type joints";
- d) complete review of non-virgin (recyclates) material use (Clause 5 and Annex A);
- e) addition of a footnote e) to Table 13 for DSC to lower the minimum B-onset temperature to 180 °C for formulation with CaZn stabilizers.

This document 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: Specifications for pipes, fittings and the system* (this document)
- *Part 2: Guidance for assessment of conformity* (under revision)

1 Scope

This document specifies the requirements for solid wall pipes with smooth internal and external surfaces, extruded from the same formulation throughout the wall, fittings and the system of unplasticized poly(vinyl chloride) (PVC-U) piping systems in the field of non-pressure underground drainage and sewerage:

- buried in ground 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 document.

NOTE 1 Solid wall multilayer pipes with different formulations throughout the wall and foamed core pipes are covered by EN 13476-2 [1] (see also CEN ISO/TR 27165 [2]).

This document 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 2 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 prCEN/TS 1401-2 [3], 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.

NOTE 3 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 document, provided they conform to the requirements for joint dimensions given in Clause 7 and to the requirements of Table 15.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

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

EN 681-2, *Elastomeric Seals - Materials requirements for pipe joint seals used in water and drainage applications - Part 2: Thermoplastic elastomers*

EN 1905, *Plastics piping systems - Unplasticized poly(vinyl chloride) (PVC-U) pipes, fittings and material - Method for assessment of the PVC content based on total chlorine content*

EN 14680, *Adhesives for non-pressure thermoplastics piping systems - Specifications*

EN 14814, *Adhesives for thermoplastic piping systems for fluids under pressure - Specifications*

EN 15346:2014, *Plastics - Recycled plastics - Characterization of poly(vinyl chloride) (PVC) recyclates*

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EN ISO 472:2013, *Plastics - Vocabulary (ISO 472:2013)*

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

EN ISO 1043-1:2011, *Plastics - Symbols and abbreviated terms - Part 1: Basic polymers and their special characteristics (ISO 1043-1:2011)*

EN ISO 1167-1:2006, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids - Determination of the resistance to internal pressure - Part 1: General method (ISO 1167-1:2006)*

EN 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 1167-2)*

EN ISO 1183-1, *Plastics - Methods for determining the density of non-cellular plastics - Part 1: Immersion method, liquid pycnometer method and titration method (ISO 1183-1)*

EN ISO 2505, *Thermoplastics pipes - Longitudinal reversion - Test method and parameters (ISO 2505)*

EN ISO 2507-1, *Thermoplastics pipes and fittings - Vicat softening temperature - Part 1: General test method (ISO 2507-1)*

EN ISO 3126, *Plastics piping systems - Plastics components - Determination of dimensions (ISO 3126)*

EN ISO 3127, *Thermoplastics pipes - Determination of resistance to external blows - Round-the-clock method (ISO 3127)*

EN ISO 3451-5, *Plastics - Determination of ash - Part 5: Poly(vinyl chloride) (ISO 3451-5)*

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

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

EN ISO 9969, *Thermoplastics pipes - Determination of ring stiffness (ISO 9969)*

EN ISO 11173, *Thermoplastics pipes - Determination of resistance to external blows - Staircase method (ISO 11173)*

EN ISO 13254, *Thermoplastics piping systems for non-pressure applications - Test method for watertightness (ISO 13254)*

EN ISO 13257, *Thermoplastics piping systems for non-pressure applications - Test method for resistance to elevated temperature cycling (ISO 13257)*

prEN ISO 13259, *Thermoplastics piping systems for underground non-pressure applications - Test method for leaktightness of elastomeric sealing ring type joints (ISO/DIS 13259)*

EN ISO 13263, *Thermoplastics piping systems for non-pressure underground drainage and sewerage - Thermoplastics fittings - Test method for impact strength (ISO 13263)*

EN ISO 13264, *Thermoplastics piping systems for non-pressure underground drainage and sewerage - Thermoplastics fittings - Test method for mechanical strength or flexibility of fabricated fittings (ISO 13264)*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 472:2013 and EN ISO 1043-1:2011 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

application area code

code used in the marking of pipes and fittings to indicate the application area(s) for which they are intended, as follows:

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

D: 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 1 to entry: In "D" application areas, the existence of hot water discharge in addition to external forces from the surroundings is usual.

Note 2 to entry: Components intended for use for both code U and code D application areas are marked UD.

Note 3 to entry: Other application area codes B and BD not covered by this standard are defined elsewhere, e.g. in EN 1329-1 [4].

3.1.2

nominal size

DN

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, outside diameter related

DN/OD

nominal size, related to the outside diameter

prEN 1401-1:2018 (E)**3.1.4****nominal outside diameter** d_n

specified outside diameter, in millimetres, assigned to a nominal size DN/OD

3.1.5**outside diameter** d_e

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}

value of the measurement of the outer circumference of a pipe or spigot end of a fitting in any cross section, divided by π ($\approx 3,142$), rounded to the next greater 0,1 mm

3.1.7**mean inside diameter of a socket** d_{sm}

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**

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

value of the measurement of the wall thickness at any point of a component rounded up to the next higher 0,1 mm

3.1.10**mean wall thickness** e_m

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**

numerical designation of a pipe series, which is a convenient round number, approximately equal to the ratio of the nominal outside diameter d_n of a pipe to its nominal wall thickness e_n

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3.1.12**ring stiffness class****SN**

numerical designation of the ring stiffness of the pipe or fitting which is a convenient round number, indicating the minimum required ring stiffness of the pipe or stiffness of the fitting

3.1.13**solid wall pipe**

pipe with smooth internal and external surfaces extruded from the same formulation throughout the wall

3.1.14**fabricated fittings**

fittings produced from pipe and/or from injection-moulded fittings by thermoforming, adhesive joint or welding

Note 1 to entry: Fabricated fittings need an additional fabrication step.

3.1.15**virgin material**

material in a form such as granules or powder that has not been subjected to use or processing other than that required for its manufacture and to which no reprocessed or recycled material has been added

Note 1 to entry: It is understood that the addition of additives such as stabilizers and pigments is still resulting into a virgin material.

3.1.16**own reprocessed material**

material prepared from rejected unused pipes, gutters, fittings and ancillaries, including trimmings from the production, that will be reprocessed in a manufacturer's plant after having been previously processed by the same manufacturer by a process such as moulding or extrusion and for which the complete formulation is known

3.1.17**external reprocessed material**

material prepared from unused thermoplastics products regardless of where those products were manufactured

3.1.18**recycled material**

material prepared from used thermoplastic products which have been cleaned and crushed or ground

3.1.19**agreed specification**

specification of the relevant material characteristics agreed between the supplier of the non-virgin material and the pipes and/or fittings manufacturer

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4 Symbols and abbreviations**4.1 Symbols**

A	length of engagement
a	circumferential side cover of a saddle branch
α	nominal angle of a fitting
C	depth of sealing zone
d_e	outside diameter
d_{em}	mean outside diameter
d_n	nominal outside diameter
d_s	inside diameter of a socket
d_{sm}	mean inside diameter of a socket
e	wall thickness
e_m	mean wall thickness
e_{min}	minimum wall thickness
e_2	wall thickness of a socket
e_3	wall thickness in the groove area
H	length of chamfer
L	axial cover of a saddle branch
L_1	length of spigot
L_2	length of the adhesive joint socket
l	effective length of a pipe
M	length of spigot of a plug
R	radius of swept fittings
Z	design length of a fitting

4.2 Abbreviations

DN	nominal size
DN/OD	nominal size, outside diameter related
PVC-U	unplasticized poly(vinyl chloride)
SDR	standard dimension ratio
SN	nominal ring stiffness
TIR	true impact rate

5 Material

5.1 General

The formulation shall be a mixture of PVC to which are added additives and if applicable non-virgin material that shall allow the final product to comply with the requirements of this document.

Non-virgin material (either supplied externally or own reprocessed or a mixture of both) may be used in the conditions given in 5.6.

The formulation (including non-virgin materials if applicable) shall comply with the requirements given in Table 1 and in 5.3 for pipes and 5.4 for fittings.

Table 1 — Requirements applicable for the formulation

Characteristics	Requirements	Test method
PVC content		
— for pipes	≥ 80 % by mass ^a	Calculation or EN 1905 ^b
— for injection-moulded fittings	≥ 85 % by mass	or EN ISO 3451-5, Method A ^b
Density	$1\,350\text{ kg/m}^3 \leq \text{density} \leq 1\,600\text{ kg/m}^3$	EN ISO 1183-1
^a A further reduction of the PVC content is permitted according to 5.2. ^b The measurement of filler content by ash rest is an alternative to the measurement of PVC content and is recommended when external non-virgin material is used.		

5.2 Use of mineral modifier

A reduction of the PVC content to ≥ 75 % by mass is permitted for pipes only provided the PVC is substituted by coated or uncoated CaCO_3 conforming to the following:

a) The composition of the CaCO_3 , before coating if any, shall conform to the following:

- 1) content of $\text{CaCO}_3 \geq 96$ % by mass;
- 2) content of $\text{MgCO}_3 \leq 4$ % by mass;
- 3) content of CaCO_3 and MgCO_3 in total ≥ 98 % by mass.

b) The physical properties of the material shall conform to the following:

- 4) mean particle size $D_{50} \leq 2,5\text{ }\mu\text{m}$;
- 5) top cut $D_{98} \leq 20\text{ }\mu\text{m}$.

5.3 Pipe material

When tested in accordance with the test method as specified in Table 2, using the indicated parameters, the pipe formulation shall have characteristics conforming to the requirements given in Table 2.

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