

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

The European Standard EN 1401-1:1998 has the status of a
British Standard

ICS 83.140.30; 91.140.80

National foreword

This British Standard is the English language version of EN 1401-1:1998. It supersedes BS 5481:1977 which will be withdrawn on 3 October 1999. It partially supersedes BS 4660:1989, which will be withdrawn on 3 October 1999. BS 4660 will be revised to continue to cover rodding eyes and other surface fittings not included in this standard.

The UK participation in its preparation was entrusted by Technical Committee PRI/61, Plastics piping systems and components, to Subcommittee PRI/61/1, Thermoplastics piping systems and components for non-pressure applications, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

The responsible UK technical committee offers the following advice in respect of the contents of this standard.

1. Selection and application of stiffness classes

This document specifies three classes of pipes and fittings of differing stiffness, designated SN 8, SN 4 and SN 2 (see Table 4 and Table 6).

From the viewpoint of installation, the SN 8 or SN 4 classes have to be used if the system is to be installed in accordance with BS 8301 or BS 5955-6 in order to achieve the intended resistance to long-term deformation.

If it is intended to use the other, less stiff (SN 2), class of pipe or fitting, the installation should first be subject to a structural design soil load calculation and the installation technique modified to suit the results of that calculation.

The appropriate calculation method is given in the national annex for BS EN 1295-1. The *E* modulus for the material should be taken as 3 000 MPa and 1 500 MPa for the short-term and long-term values respectively.

Attention is also drawn to the “*Materials selection manual for sewers, pumping mains and manholes*” (reference WSA/FWR-04)¹⁾

2. Marking requirements

For the marking requirements given in clause 12, some aspects lack an objective basis for assessment of conformity, and this may lead to dispute unless manufacturers and purchasers declare or agree on the implications of the requirements as applicable.

¹⁾ Published by the Foundation for Water Research, Allen House, The Listons, Liston Road, Marlow, Bucks SL7 1FD.

This British Standard, having been prepared under the direction of the Sector Board for Materials and Chemicals, was published under the authority of the Standards Board and comes into effect on 15 June 1998

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Amendments issued since publication

Amd. No.	Date	Comments
13794	10 December 2002	Additions to National foreword

For the purposes of **12.1.1**, pending issue of and reference to a related document giving the intended limits of storage/weathering/handling/installation conditions, the extent to which legibility has to be maintained is unclear.

For item a) of **12.1.1**, there is no basis for assessment of conformity to “durable in use”, which is subjective in the absence of any constraints or guidance on the conditions or period of use.

Likewise, for item b) of **12.1.1**, there are no time limits set for the interval between sale and installation, and therefore uncertainty as to how much resistance to light exposure or other weathering aspects is considered necessary, prior to burial of the marked component or label.

In **12.1.2**, the wording “not ... adversely influence the performance of the pipe or fitting” could be argued as a reason to reject piping components which exhibited any measurable deterioration, unless this requirement is clearly related to the ability or otherwise of the component to continue to conform to the requirements of the standard for the intended or agreed period and conditions of service.

Additional information

For swept bends and branches the dimensional characteristics should also conform to the relevant parts of BS 4514 and in addition the Building Regulations 2000 (amended 2002) approved document H1, **1.17** (equal bends and branches), **1.26** (long radius bends) and diagram 2.

When pipe conforming to EN 1401 is perforated for drainage applications, the perforations should additionally meet the requirements for UPVC in accordance with BS 4660, given in the DETR Manual of Contract Documents for Highway Works (Volume 1) Specification for Highway Works — Series 500.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

Where reference is made to specific details in a reference document, the date of the relevant edition should be provided, since the detail may not be consistent with a later edition. The responsible UK Technical Committee has noted that for the following standards the editions cited here were those available at the date of ratification of EN 1401-1 by CEN (1997-08-03).

EN 743:1994 (separate references to methods A and B in Table 12);

EN 744:1995 (reference to type d 90 striker in Table 9);

EN 763:1994 (reference to method A in Table 13);

EN 921:1994 (reference to types a or b end caps in Table 1 and Table 2);

EN 1055:1998 (reference to test assembly b) (Figure 2...) in Table 15;

EN 1277:1996 (separate references to condition B and condition C in Table 15);

EN 1411:1996 (reference to type d 90 striker in Table 10).

Warning note. This British Standard, which is identical with EN 1401-1:1998, does not necessarily detail all the precautions necessary to meet the requirements of the Health and Safety at Work etc. Act 1974. Attention should be paid to any appropriate safety precautions and the test methods should be operated only by trained personnel.

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 does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 31 and a back cover.

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Descriptors: Sanitation, drainpipes, sewers, collecting drain, pipe units, buried pipes, non-pressure pipes, plastic tubes, unplasticized polyvinyl chloride, pipe fittings, designation, dimensions, geometrical characteristics, symbols, specifications, creep properties, chemical resistance

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

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

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

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

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.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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

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 for 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): Utilization of non-virgin material;

— Annex B (informative): General characteristics of PVC-U pipes and fittings;

— Annex C (informative): Bibliography.

For pipes and fittings which have conformed to the relevant national standard before the ratification of this standard, as shown by the manufacturer or by a certification body, the national standard may continue to apply as follows:

— for pipes and fabricated fittings until 1999-10-03;

— for injection-moulded fittings until 2002-10-03.

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.

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.

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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.

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 496²⁾, *Plastics piping systems — Plastics pipes and fittings — Measurement of dimensions and visual inspection of surfaces.*

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.*

²⁾ This document is under revision.

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(vinyl chloride) (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, *Plastics piping systems — Thermoplastics fittings — Test method for mechanical strength or flexibility of fabricated fittings.*

ISO 472:1988, *Plastics — Vocabulary.*

ISO 1043-1:1992, *Plastics — Symbols — Part 1: Basic polymers and their special characteristics.*

ISO 1183:1987, *Plastics — Methods for determining the density and relative density of non-cellular plastics.*

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_o)**

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 π ($\approx 3,142$), 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 (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
α	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.

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 1 — Material characteristics of pipes

Characteristic	Requirements	Test parameters		Test method
Resistance to internal pressure	No failure during the test period	End caps	Type a or b	EN 921
		Test temperature	60 °C	
		Orientation	Free	
		Number of test pieces	3	
		Circumferential (hoop) stress	10 MPa	
		Conditioning period	1 h	
		Type of test	Water-in-water	
		Test period	1 000 h	

Table 2 — Material characteristics of fittings

Characteristic	Requirements	Test parameters		Test method
Resistance to internal pressure	No failure during the test period	End caps	Type a or b	EN 921
		Dimensions	$50 \text{ mm} \leq d_n \leq 110 \text{ mm}$ $3 \text{ mm} \leq e \leq 5 \text{ mm}$	
		Free length for injection-moulded pipe	$\geq 140 \text{ mm}$	
		Test temperature	60 °C	
		Orientation	Free	
		Number of test pieces	3	
		Circumferential (hoop) stress	6,3 MPa	
		Conditioning period	1 h	
		Type of test	Water-in-water	
		Test period	1 000 h	

4.4 Utilization of non-virgin materials

Conditions and requirements for the utilization 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.