BRITISH STANDARD

BS EN 1852-1:1998
Incorporating Amendment No. 1

Plastic piping systems for non-pressure underground drainage and sewerage — Polypropylene (PP) —

Part 1: Specifications for pipes, fittings and the system

The European Standard EN 1852-1:1997, with the incorporation of amendment A1:2002, has the status of a British Standard

ICS 83.140.30; 91.140.80; 93.030

BSI British Standards

National foreword

This British Standard is the English language version of EN 1852-1:1997, including amendment A1:2002, published by the European Committee for Standardization (CEN).

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] ⟨A1⟩. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by [A1] ⟨A1⟩.

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 3a and Table 6a).

From the viewpoint of installation, the SN 8 class has to be used if the system is to be installed in accordance with BS EN 1610, BS EN 752-1, BS EN 752-2, BS EN 752-3, BS EN 752-4 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 or SN 4), classes 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 1250 MPa and 350 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* as published by the Foundation for Water Research, Allen House, The Listons, Liston Road, Marlow, Bucks SL7 1FD, under reference WSA/FWR-04.

2. Marking requirements

For the marking requirements given in Clause **11**, 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.

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 March 1998

Amendments issued since publication

Amd. No.	Date	Comments
14514	6 August 2003	See national foreword

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For the purposes of **11.1.1**, 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 **11.1.1**a), 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 **11.1.1**b), 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 **11.1.2**, 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.

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 1852-1 by CEN (1997-01-27).

EN 743:1994	(separate references to methods A and B in Table 10);
EN 744:1995	(reference to type d 90 striker in Table 7);
EN 763:1994	(reference to method A in Table 11);
EN 921:1994	(reference to types a or b end caps in table 1);
EN 1055:1996	(reference to test assembly b) (Figure 2 ...) in Table 12);
EN 1277:1996	(separate references to condition B and condition C in Table 12);
EN 1411:1996	(reference to type d 90 striker in Table 8).

Warning note. This British Standard, which is identical with EN 1852-1:1997, 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 32, an inside back cover and a back cover.

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1852-1

August 1997
+ A1
August 2002

ICS 83.140.30; 91.140.80

Descriptors: Plastics, thermoplastics, polypropylene PP, piping system, pipes, pipe fittings, system, drainage, sewerage, non-pressure, specifications

English version

Plastics piping systems for non-pressure underground drainage and sewerage — Polypropylene (PP) — Part 1: Specifications for pipes, fittings and the system

(includes amendment A1:2002)

Systèmes de canalisations en plastique pour les branchements et les collecteurs enterrés d'assainissement sans pression — Polypropylène (PP) —
Partie 1: Spécifications pour les tubes, les raccords et le système
(inclut l'amendement A1:2002)

Kunststoff-Rohrleitungssysteme für erdverlegte Abwasserkanäle und -leitungen — Polypropylen (PP) —
Teil 1: Anforderungen an Rohre, Formstücke und das Rohrleitungssystem
(enthält Änderung A1:2002)

This European Standard was approved by CEN on 1997-01-27. Amendment A1 was approved by CEN on 2002-05-30. 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

Ref. No. EN 1852-1:1997 + A1:2002 E

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 155, Plastics piping systems and ducting systems, in liaison with CEN/TC 165, Waste water engineering, the Secretariat of which is held by NNI.

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 1852 consists of the following parts, under the general title, *Plastics piping systems for non-pressure underground drainage and sewerage — Polypropylene (PP)*:

— *Part 1: Specifications for pipes, fittings and the system (the present standard)*[1)];

— *Part 2: Guidance for the assessment of conformity*;

— *Part 3: Guidance for installation.*

This part of EN 1852 includes the following annexes.

— Annex A (informative) General characteristics of PP pipes and fittings.

— Annex B (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 February 1998, and conflicting national standards shall be withdrawn at the latest by February 1998.

For pipes and fittings which have conformed to the relevant national standard before January 1997, as shown by the manufacturer or by a certification body, the national standard may continue to be applied until January 1999.

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.

Foreword to amendment A1

This amendment EN 1852-1:1997/A1:2002 to the EN 1852-1:2002 has been prepared by Technical Committee CEN/TC 155, Plastics piping systems and ducting systems, the Secretariat of which is held by NEN.

This amendment to the European Standard EN 1852-1:2002 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2003, and conflicting national standards shall be withdrawn at the latest by February 2003.

According to the CEN/CENELEC International 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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

The amendment contains addition of a new wall thickness series for class SN 8 (see Table 3b, Table 6b and Table 7). In **A.2** a higher modulus of elasticity is specified for information. In **A.3**, the relation between the S-series and the ring stiffnesses are informed about.

The reason for this amendment is the development of a new generation of polypropylene materials having higher moduli. The moduli of elasticity on these materials are 1 700 MPa or higher.

[1)] This standard does not cover ancillary components. For ancillary components a separate standard is foreseen.

Contents

1 Scope

This part of EN 1852 specifies the requirements for pipes, fittings and the system of polypropylene (PP) piping systems in the field of:

— non-pressure underground drainage and sewerage outside the building structure (application area code "U"); and

— non-pressure underground drainage and sewerage for both buried in ground within the building structure (application area code "D") and outside the building structure.

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.

〈A1〉 This standard covers PP materials both with normal E-moduli and with higher E-moduli, designated as HM (higher modulus), and gives a range of nominal sizes, and pipe series and gives recommendations concerning colours.

NOTE 0 PP materials with normal E-moduli have an E-modulus between 1 250 MPa and 1 700 MPa; PP materials with higher moduli (PP-HM materials) have an E-modulus ≥ 1 700 MPa. 〈A1〉

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 1852 it is applicable to PP 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 PP pipes with or without an integral socket.

NOTE 2 The fittings can be manufactured by injection moulding or be fabricated from pipes and/or mouldings.

NOTE 3 Requirements and limiting values for application area code "D" are given in Table 3a, Table 6a and Table 12.

NOTE 4 Pipes, fittings and other components conforming to any of the plastics product standards listed in Annex B may be used with pipes and fittings conforming to this standard when they conform to the requirements for joint dimensions given in Clause **6** and to the requirements of Table 12.

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 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: Thermoplastic elastomers.*

EN 728, *Plastics piping and ducting systems — Polyolefin pipes and fittings — Determination of oxidation induction time.*

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 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 methods for leaktightness of elastomeric sealing ring type joints.

prEN 1401-1, 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.

EN 1411, Plastics piping and ducting systems — Thermoplastics pipes — Determination of resistance to external blows by the staircase method.

prEN 1852-2, Plastics piping systems for non-pressure underground drainage and sewerage — Polypropylene (PP) — Part 2: Guidance for the assessment of conformity.

prEN 1989, Thermoplastics piping and ducting systems — Joints for buried non-pressure applications — Test method for long-term sealing performance of joints with thermoplastic elastomer (TPE) seals by estimating the sealing pressure.

EN 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.

EN ISO 9969, Thermoplastics pipes — Determination of ring stiffness.

ISO 472:1988, Plastics — Vocabulary.

ISO 1043-1:1997, Plastics — Symbols — Part 1: Basic polymers and their special characteristics.

ISO 1133:1992, Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics.

ISO 4440-1:1994, Thermoplastics pipes and fittings — Determination of melt mass-flow rate — Part 1: Test method.

ISO 4440-2:1994, Thermoplastics pipes and fittings — Determination of melt mass-flow rate — Part 2: Test conditions.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of this standard, the following definitions and those given in ISO 472:1988 and ISO 1043-1:1997 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 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 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 Geometrical definitions

3.1.2.1
nominal size (DN)
a numerical designation of the size of a component, which is a convenient round number approximately equal to the manufacturing dimension, in millimetres

3.1.2.2
nominal size (DN/OD)
nominal size, related to the outside diameter

3.1.2.3
nominal outside diameter (dn)
the specified outside diameter, in millimetres, assigned to a nominal size (DN/OD)

3.1.2.4
outside diameter (de)
the value of the measurement of the outside diameter through its cross-section at any point of a pipe or spigot end of a fitting, rounded up to the next greater 0,1 mm

3.1.2.5
mean outside diameter (dem)
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

3.1.2.6
mean inside diameter of a socket (dsm)
the arithmetic mean of a number of measurements of the inside diameter of a socket in the same cross-section

3.1.2.7
wall thickness (e)
the value of the measurement of the wall thickness at any point around the circumference of a component

3.1.2.8
mean wall thickness (em)
the arithmetic 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

3.1.2.9
pipes series S
a number for pipe designation (see ISO 4065:1996)

3.1.2.10
standard dimension ratio (SDR)
a numerical designation of a pipe series, which is a convenient round number approximately equal to the ratio of the nominal outside diameter, d_n, and the minimum wall thickness, e_{min}

3.1.2.11
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

3.1.2.12
design length (Z)
the length of a fitting (e.g. the main pipe of a branch), excluding any spigot or socket length. In case of a change in direction (e.g. in case of a bend or the service pipe of a branch), it is the length from one end to the intersection of the straight axis of this end with the straight axis of the other end of the fitting, excluding any spigot or socket length (see the dimensions Z_1 and Z_2 in, e.g. Figure 7, Figure 8, Figure 9, Figure 10 and Figure 11)

3.1.3 Material definitions

3.1.3.1
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 reprocessable or recyclable material has been added

3.1.3.2
own reprocessable material
material prepared from rejected unused pipes or fittings, including trimmings from the production of pipes or fittings, 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

3.1.3.3
external reprocessable material
material comprising either one of the following forms:

a) material from rejected unused pipes or fittings or trimmings therefrom, that will be reprocessed and that were originally processed by another manufacturer;

b) material from the production of unused PP products other than pipes and fittings, regardless of where they are manufactured

3.1.3.4
recyclable material
material comprising either one of the following forms:

a) material from used pipes or fittings which have been cleaned and crushed or ground;

b) material from used PP products other than pipes or fittings which have been cleaned and crushed or ground

3.2 Symbols

A	length of engagement
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
e	wall thickness
e_m	mean wall thickness
e_2	wall thickness of a socket
e_3	wall thickness in the groove area
l	effective length of a pipe
L_1	length of spigot
M	length of spigot of a plug
R	radius of swept fittings
Z	design length of (a part of) a fitting
α	nominal angle of a fitting

3.3 Abbreviations

CT	close tolerance
PP-HM	polypropylene with high E-modulus
MFR	melt mass-flow rate
OIT	oxidation induction time
PP	polypropylene
SDR	standard dimension ratio
SN	nominal ring stiffness
TIR	true impact rate

4 Material

4.1 PP compound

The compound for pipes and fittings shall be PP base material to which are added those additives that are needed to facilitate the manufacture of components conforming to the requirements of this standard.

A1 NOTE It is not the intention of this standard to allow fillers in order to increase the value of the modulus of elasticity of the PP material. A1

4.2 Reprocessable and recyclable material

In addition to virgin material the use of the manufacturer's own reprocessable material obtained during the production and testing of products conforming to this standard is permitted. External reprocessable or recyclable material shall not be used.

4.3 Melt mass-flow rate

Pipes and fittings shall be made from materials with an MFR as follows:

MFR (230/2,16) $\leq$ 1,5 g/10 min.

The MFR of the base material shall be tested in accordance with ISO 1133:1992, condition 12 (temperature: 230 °C; loading mass: 2,16 kg).

Materials for pipes and fittings for butt fusion joints shall be designated by the following classes with regard to the MFR:

class A: MFR $\leq$ 0,3 g/10 min;
class B: 0,3 g/10 min < MFR $\leq$ 0,6 g/10 min;
class C: 0,6 g/10 min < MFR $\leq$ 0,9 g/10 min;
class D: 0,9 g/10 min < MFR $\leq$ 1,5 g/10 min.

Only pipes and fittings made from materials of the same or an adjacent MFR-class may be fused together.

4.4 Resistance to internal pressure

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

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

4.5 Thermal stability (OIT)

When tested in accordance with EN 728 using a test temperature of 200 °C, the oxidation induction time of the material used for pipe or fittings shall not be less than 8 min.

4.6 Sealing ring retaining means

Sealing rings may be retained using means made from polymers other than PP.

Table 1 — Material characteristics (long-term behaviour)

Characteristic	Requirements	Test parameters		Test method
Resistance to internal pressure	No failure during the test period	End caps	Types a or b	EN 921
		Test temperature	80 °C	
		Orientation	Free	
		Number of test pieces	3	
		Circumferential (hoop) stress	4,2 MPa	
		Conditioning period	1 h	
		Type of test	Water-in-water	
		Test period	≥ 140 h	
		End caps	Types a or b	
		Test temperature	95 °C	
		Orientation	Free	
		Number of test pieces	3	
		Circumferential (hoop) stress	2,5 MPa	
		Conditioning period	1 h	
		Type of test	Water-in-water	
		Test period	≥ 1 000 h	

5 General characteristics

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 black, orange-brown (approximately RAL 8023)[2] or dusty grey (approximately RAL 7037)[2]. 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.

[2] See 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 2.

Table 2 — Mean outside diameters

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Mean outside diameter[1)]	
		$d_{em,\ min.}$	$d_{em,\ max.}$
110	110	110,0	110,4
125	125	125,0	125,4
160	160	160,0	160,5
200	200	200,0	200,6
250	250	250,0	250,8
315	315	315,0	316,0
355	355	355,0	358,2
400	400	400,0	403,6
450	450	450,0	454,1
500	500	500,0	504,5
630	630	630,0	635,7
800	800	800,0	807,2
1 000	1 000	1 000,0	1 009,0
1 200	1 200	1 200,0	1 210,0
1 400	1 400	1 400,0	1 410,0
1 600	1 600	1 600,0	1 610,0

[1)] The tolerances for mean outside diameters up to and including 315 mm conform to ISO 11922-1:1997, grade C. The tolerances for mean outside diameters greater than 315 mm conform to ISO 11922-1:1997, grade A.

6.2.2 *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.

6.2.3 *Chamfering*

If a chamfer is applied, the angle of chamfering shall be between 15° and 45° to the axis of the pipe. The remaining wall thickness of the end of the pipe shall be at least 1/3 of $e_{min.}$

6.2.4 *Wall thicknesses*

The wall thickness, e, shall conform to A1 Table 3a or 3b, as applicable A1, where a maximum wall thickness at any point of $1{,}25e_{min.}$ is permitted provided that the mean wall thickness, e_m, is less than or equal to the specified $e_{m,\ max.}$

6.3 Dimensions of fittings

6.3.1 *Outside diameters*

The mean outside diameter, d_{em}, of the spigot shall conform to Table 2.

6.3.2 *Outside diameters with close tolerances (type CT)*

For the purposes of this standard, in addition to the dimensions and tolerances given in Table 2 for spigot ends of fittings, tolerances which are in accordance with prEN 1401-1 may be used.

If these tolerances, classified as close tolerance (CT), are required, the mean outside diameter, d_{em}, and the tolerances shall conform to Table 4.

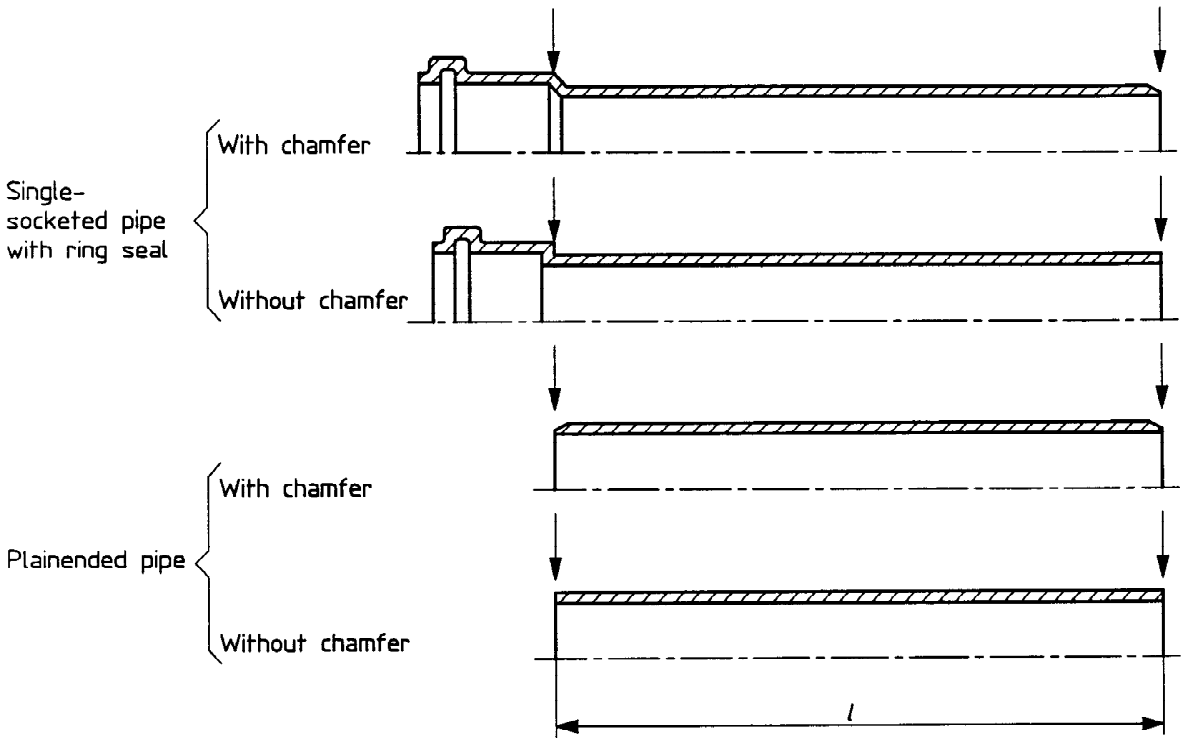

Figure 1 — Effective length of pipes

Table 3a — Wall thickness/normal PP materials

Dimensions in millimetres

Nominal size	Nominal outside diameter	Wall thickness					
		SN 2 S 20[1)]		SN 4 S 16		SN 8 S 11,2	
DN/OD	d_n	$e_{min.}$	$e_{m,\ max.}$	$e_{min.}$	$e_{m,\ max.}$	$e_{min.}$	$e_{m,\ max.}$
110	110	—	—	3,4	4,0	4,7	5,4
125	125	—	—	3,9	4,5	5,4	6,2
160	160	—	—	4,9	5,6	6,9	7,8
200	200	—	—	6,2	7,1	8,6	9,7
250	250	6,2	7,1	7,7	8,7	10,7	12,0
315	315	7,7	8,7	9,7	10,9	13,5	15,1
355	355	8,7	9,8	10,9	12,3	15,2	17,0
400	400	9,8	11,0	12,3	13,8	17,1	19,1
450	450	11,0	12,3	13,8	15,4	19,2	21,4
500	500	12,3	13,8	15,3	17,1	21,4	23,8
630	630	15,4	17,2	19,3	21,5	26,9	29,8
800	800	19,6	21,8	24,5	27,2	34,2	37,9
1 000	1 000	24,5	27,2	30,6	33,9	42,7	47,2
1 200	1 200	29,4	32,6	36,7	40,6	51,2	56,6
1 400	1 400	34,3	38,0	42,9	47,4	59,8	66,0
1 600	1 600	39,2	43,4	49,0	54,1	68,3	75,4

[1)] S 20 is applicable for application area code "U" only.

NOTE For components conforming to this standard, the standard dimension ratio, SDR, and the values of the pipe series S specified in Table 3a are related as follows:

S 20 corresponds to SDR 41,0;

S 16 corresponds to SDR 33,0;

S 11,2 corresponds to SDR 23,4.

Table 3b — Wall thicknesses/PP-HM materials

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Wall thickness SN 8 S 13,3	
		$e_{min.}$	$e_{m,max}$
110	110	4,0	4,6
125	125	4,6	5,3
160	160	5,8	6,6
200	200	7,3	8,3
250	250	9,1	10,3
315	315	11,4	12,8
355	355	12,9	14,4
400	400	14,5	16,2
450	450	16,3	18,2
500	500	18,1	20,3
630	630	22,8	25,3
800	800	29,0	32,1
1 000	1 000	36,2	40,0
1 200	1 200	43,4	47,8
1 400	1 400	50,6	55,8
1 600	1 600	57,9	62,8

NOTE 2 For components conforming to this standard, the standard dimension ratio, SDR, and the values of the pipe series S specified in Table 3b are related as follows:

S 13, 3 corresponds to SDR 27,6 〈A1〉

Table 4 — Mean outside diameters with close tolerances type CT

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Mean outside diameter	
		$d_{em,\ min.}$	$d_{em,\ max.}$
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

NOTE 1 Spigot ends of fittings with maximum mean outside diameters conforming to Table 4 can be used with pipes and fittings conforming to prEN 1401-1 provided that the socket(s) for these pipes and fittings are intended to be used for elastomeric ring seal joints.

NOTE 2 Spigot ends of fittings with mean outside diameters conforming to Table 4 are recommended to be injection moulded.

6.3.3 *Design lengths*

The design lengths shall be declared by the manufacturer.

NOTE The design lengths (see the dimensions *Z* in Figure 7, Figure 8, Figure 9, Figure 10, Figure 11 and Figure 14 to Figure 19) are intended to assist in the design of moulds and are not intended to be used for quality control purposes. ISO 265-1:1988 can be used as a guideline.

6.3.4 *Wall thicknesses*

6.3.4.1 The minimum wall thickness, $e_{min.}$, of the body or the spigot of a fitting shall conform to Table 3a, except that a reduction of 5 % resulting from core shifting is permitted. In such a case, the average of two opposite wall thicknesses shall be equal to or exceed the values given in Table 3a.

6.3.4.2 Where a fitting or adapter provides for a transition between two nominal sizes, the wall thickness of each connecting part shall conform to the requirements for the applicable nominal size. In such a case, the wall thickness of the fitting body is permitted to change gradually from the one wall thickness to the other.

6.3.4.3 The wall thickness of fabricated fittings, except for spigot and socket, may be changed locally by the fabrication process, providing that the minimum wall thickness of the body conforms to $e_{3,min.}$, as given in Table 6a, as appropriate for the pipe series concerned.

6.4 Dimensions of sockets and spigots

6.4.1 *Diameters and lengths of elastomeric ring seal sockets and spigots*

The diameters and lengths of elastomeric ring seal sockets and lengths of spigots shall conform to Table 5 (see Figure 2, Figure 3, Figure 4 or Figure 5, as applicable).

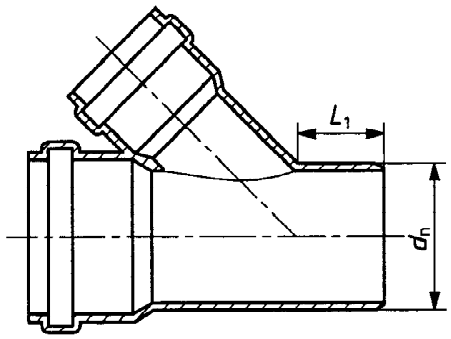

Figure 2 — Spigot length

Where sealing rings are firmly retained, the dimensions for the minimum value for *A* and the maximum value for *C* shall be measured to the effective sealing point (see Figure 5) as specified by the manufacturer.

This point shall give a full sealing action.

Different designs of elastomeric ring seal sockets and spigots are permitted, provided the joints conform to the requirements given in Table 12.

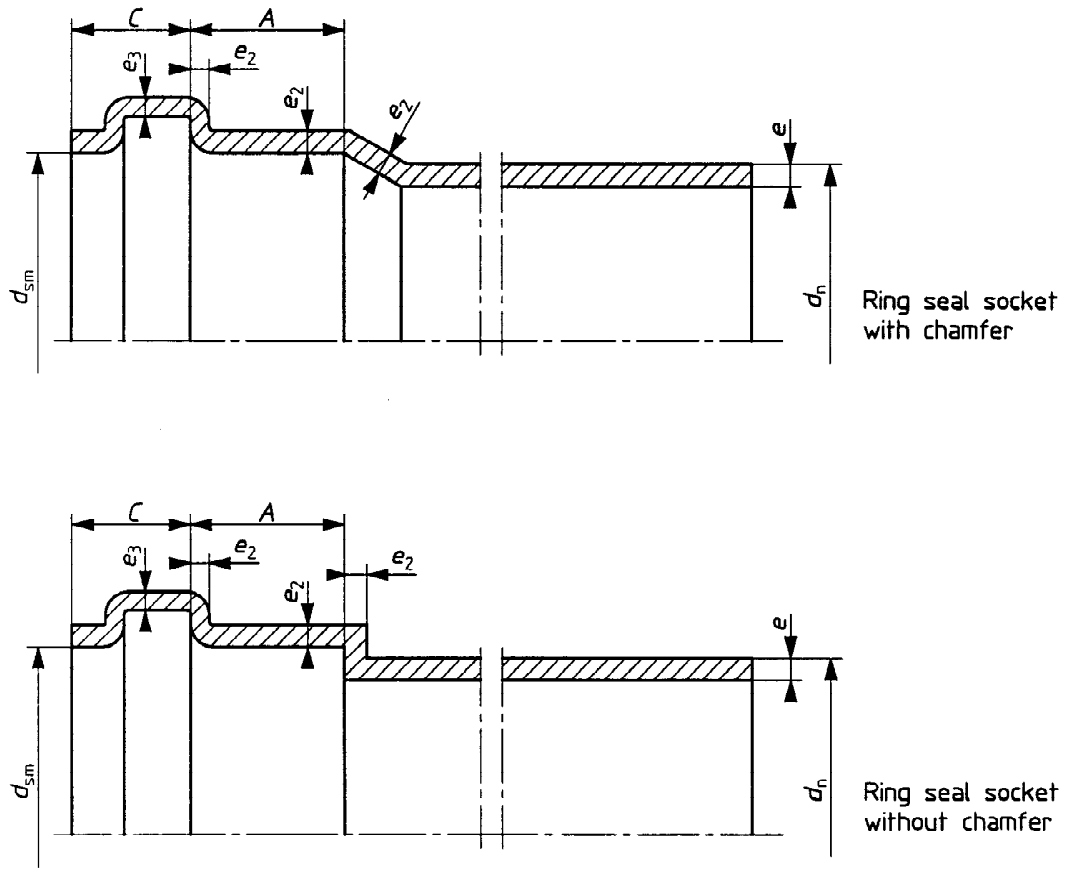

Figure 3 — Basic dimensions of sockets for elastomeric ring seal joints

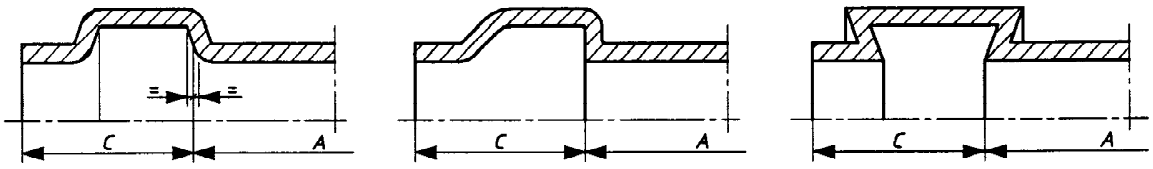

Figure 4 — Typical groove designs for elastomeric ring seal sockets

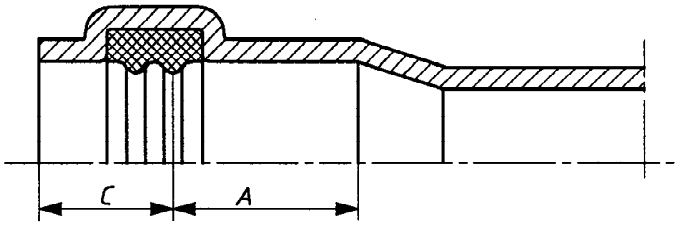

Figure 5 — Example for measuring the effective sealing point

Table 5 — Socket diameters and lengths of sockets and spigot

Dimensions in millimetres

Nominal size	Nominal outside diameter	Minimum mean inside diameter of the socket	Socket[1]		Spigot
DN/OD	d_n	$d_{sm,\ min.}$ [2]	$A_{min.}$ [3]	$C_{max.}$ [4]	$L_{1,\ min.}$
110	110	110,4	40	22	62
125	125	125,4	43	26	68
160	160	160,5	50	32	82
200	200	200,6	58	40	98
250	250	252,4	68	50	118
315	315	318,0	81	63	144
355	355	358,3	85	71	160
400	400	403,7	98	80	178
450	450	454,2	108	90	198
500	500	504,6	118	100	218
630	630	635,8	144	126	270

[1] The socket is designed for an effective length of pipe of 6 m.

[2] For nominal sizes DN/OD ≤ 200, $d_{sm,\ min.}$ conforms to prEN 1401-1. For nominal sizes DN/OD ≥ 250, $d_{sm,\ min.}$ conforms to ISO 8773:1991.

[3] $A_{min.}$ values conform to ISO 8773:1991.

[4] Higher values for C are allowed. In that case the manufacturer shall state in his documentation the actual required $L_{1,\ min.}$ according to the equation $L_{1,\ min.} = A_{min.} + C$.

For sockets which have a nominal outside diameter greater than 630 mm, the values of $d_{sm,min.}$, $A_{min.}$ and $C_{max.}$ shall be calculated using the following equations:

$d_{sm,\ min.} = 1{,}0092 d_n$;

$A_{min.} = (0{,}2 d_n + 18)$ mm;

$C_{max.} = 0{,}2 d_n$.

For pipe lengths longer than 6 m the length of engagement A in the socket shall be calculated from the equation:

$A = (0{,}2 d_n + 3l)$ mm,

where l is the pipe length in metres.

6.4.2 *Wall thicknesses of sockets*

The wall thicknesses of sockets, e_2 and e_3 (see Figure 3), excluding the socket mouth, shall conform to [A1] Table 6a or 6b, as applicable [A1], except that a reduction of 5 % of e_2 and e_3 resulting from core shifting is permitted. In such a case the average of two opposite wall thicknesses shall be equal to or exceed the values given in Table 6a.

Where a sealing ring is located by means of a retaining cap or ring (see Figure 6) the wall thickness in this area shall be calculated by addition of the wall thickness of the socket and the wall thickness of the retaining cap or ring at the corresponding places in the same cross-section.

[A1] **Table 6a — Wall thicknesses of sockets for normal PP materials** [A1]

Dimensions in millimetres

Nominal size	Nominal outside diameter	Wall thickness					
		SN 2 S 20[1)]		SN 4 S 16		SN 8 S 11,2	
DN/OD	d_n	$e_{2,\ min.}$	$e_{3,\ min.}$	$e_{2,\ min.}$	$e_{3,\ min.}$	$e_{2,\ min.}$	$e_{3,\ min.}$
110	110	—	—	3,1	2,6	4,3	3,6
125	125	—	—	3,6	3,0	4,9	4,1
160	160	—	—	4,5	3,7	6,3	5,2
200	200	—	—	5,6	4,7	7,8	6,5
250	250	5,6	4,7	7,0	5,8	9,7	8,1
315	315	6,9	5,8	8,8	7,3	12,2	10,2
355	355	7,8	6,5	9,9	8,2	13,7	11,4
≥ 400	≥ 400	8,8	7,4	11,1	9,3	15,4	12,9

[1)] S 20 is applicable for application area code "U" only.

[A1] **Table 6b — Wall thicknesses/of sockets for PP-HM materials**

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Wall thicknesses SN 8 S 13,3	
		$e_{2,min}$	$e_{3,max}$
110	110	3,6	3,0
125	125	4,1	3,5
160	160	5,2	4,4
200	200	6,6	5,5
250	250	8,2	6,8
315	315	10,3	8,6
355	355	11,6	9,7
≥ 400	≥ 400	13,1	10,9

[A1]

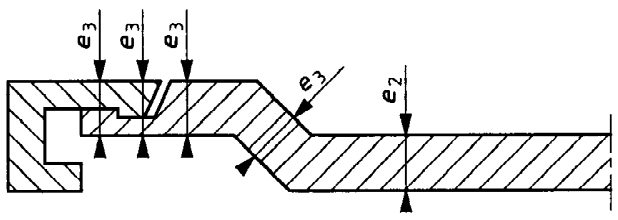

Figure 6 — Example for calculation of the wall thickness of sockets with retaining cap

6.5 Types of fittings

This standard is applicable for the following types of fittings. Other designs of fittings are permitted.

a) Bends (see Figure 7, Figure 8, Figure 9, Figure 10 or Figure 11):

— unswept and swept angle (see ISO 265-1:1988);

— spigot/socket and socket/socket;

— butt fused from segments.

NOTE 1 Preferred nominal angles α: 15°, 30°, 45°, 87,5° to 90°.

b) Couplers and slip couplers (see Figure 12 or Figure 13).

c) Reducers (see Figure 14).

d) Branches and reducing branches (see Figure 15, Figure 16, Figure 17 or Figure 18):

— unswept and swept angle;

— spigot/socket and socket/socket.

NOTE 2 Preferred nominal angles α: 45°, 87,5° to 90°.

e) Branches with flange and collar (see Figure 19).

f) Plugs (see Figure 20); minimum length of spigot, $M_{min.} = (C_{max.} + 10)$ mm, (see Table 5).

g) Push fit sockets for butt fusion for pipe end (see Figure 21).

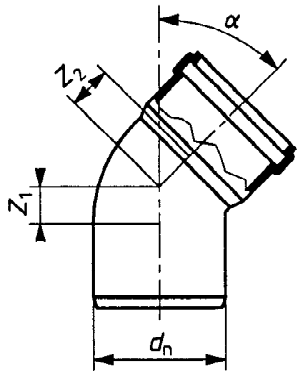

Figure 7 — Bend with single socket (unswept)

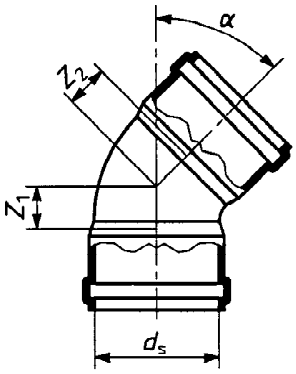

Figure 8 — Bend with all sockets (unswept)

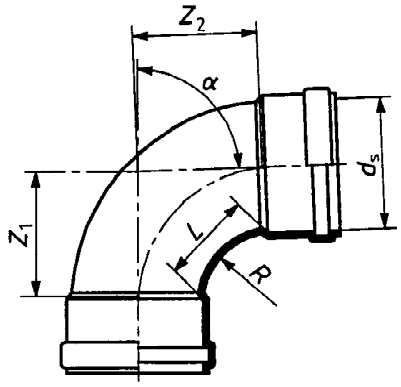

Figure 9 — Bend with all sockets (swept)

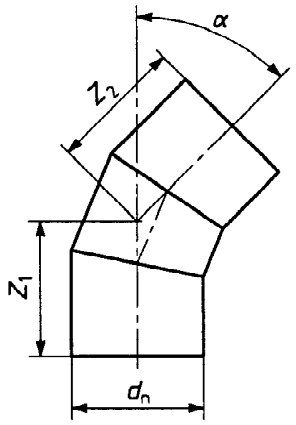

Figure 10 — Bend, butt-fused from segments

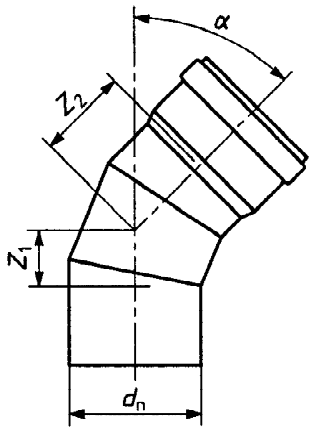

Figure 11 — Bend with socket and spigot end, butt-fused from segments

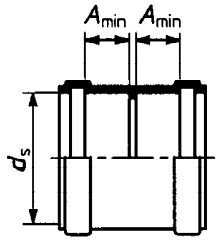

Figure 12 — Coupler

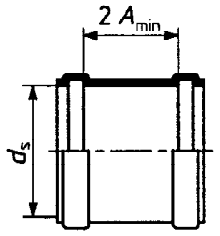

Figure 13 — Slip coupler

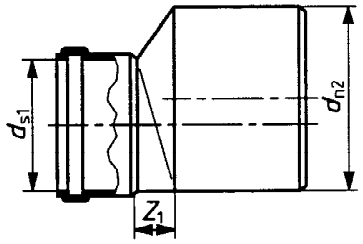

Figure 14 — Reducer

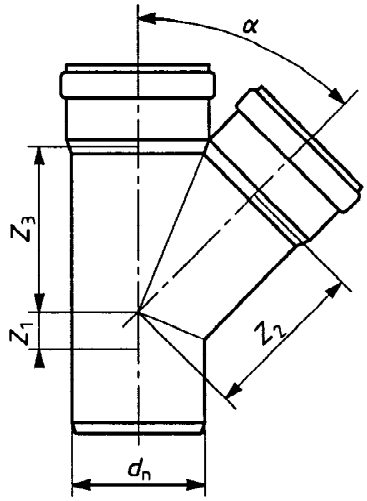

Figure 15 — Branch (unswept)

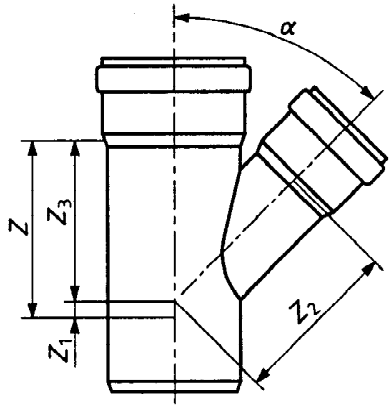

Figure 16 — Reducing branch

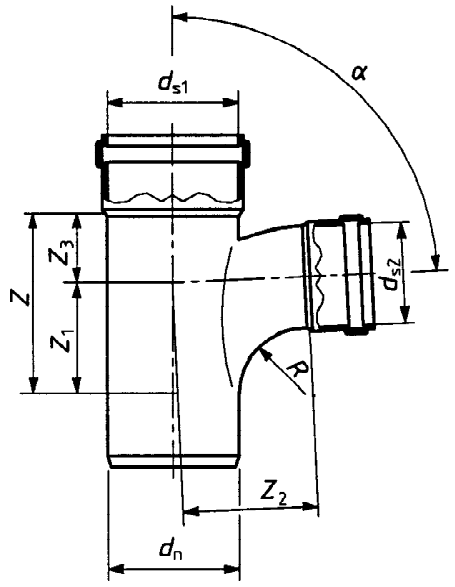

Figure 17 — Reducing branch (swept)

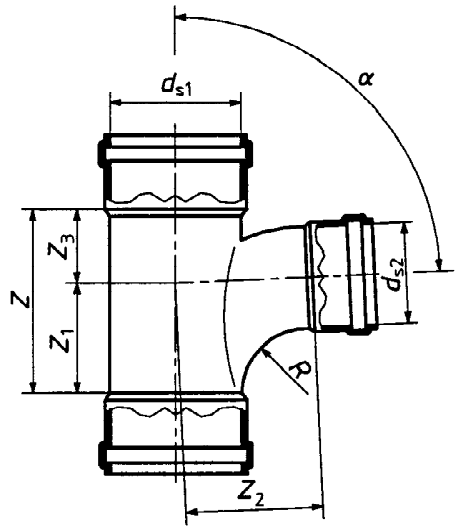

Figure 18 — All socket reducing branch (swept)

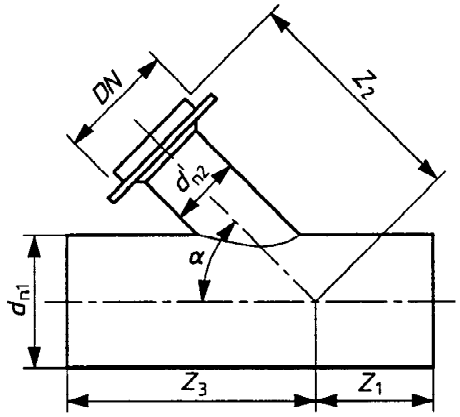

Figure 19 — Branch with flange and collar

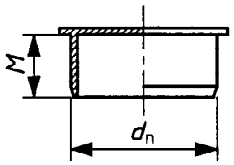

Figure 20 — Plug

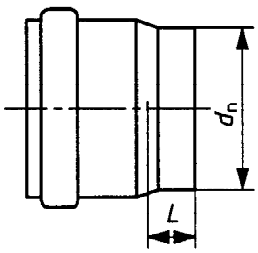

Figure 21 — Push fit socket for butt fusion for pipe end

7 Mechanical characteristics

7.1 Mechanical characteristics of pipes

7.1.1 *General requirements*

When tested in accordance with the test method as specified in Table 7 using the indicated parameters, the pipe shall have general mechanical characteristics conforming to the requirements given in Table 7.

7.1.2 *Additional mechanical requirements*

Pipes intended to be used in areas where installation is usually carried out at temperatures below −10 °C shall conform to the requirements of an impact test (staircase method) as specified in Table 8.

The pipes shall be marked with a ice-crystal symbol in accordance with Table 13.

7.2 Mechanical characteristics of fittings

When tested in accordance with the test methods as specified in Table 9 using the indicated parameters, the fitting shall have mechanical characteristics conforming to the requirements given in Table 9.

8 Physical characteristics

8.1 Physical characteristics of pipes

When tested in accordance with the test methods as specified in Table 10 using the indicated parameters, the pipe shall have physical characteristics conforming to the requirements given in Table 10.

8.2 Physical characteristics of fittings

When tested in accordance with the test method as specified in Table 11 using the indicated parameters, the fitting shall have physical characteristics conforming to the requirements given in Table 11.

9 Performance requirements

When tested in accordance with the test methods as specified in Table 12 using the indicated parameters, the joints and the system shall have fitness for purpose characteristics conforming to the requirements given in Table 12.

10 Sealing rings

10.1 The sealing ring shall have no detrimental effects on the properties of the pipe and the fitting and shall not cause the test assembly to fail to conform to Table 12.

10.2 Materials for sealing rings shall conform to EN 681-1 or prEN 681-2, as applicable.

10.3 Thermoplastic elastomer (TPE) seals shall additionally conform to the long-term performance requirements as specified in Table 12.

Table 7 — General mechanical characteristics of pipes

Characteristic	Requirements	Test parameters		Test method
Impact resistance[1] (round-the-clock method)	TIR ≤ 10 %	Test/conditioning temperature	0 °C	EN 744
		Conditioning medium	Water or air	
		Type of striker	d 90	
		Mass of striker for:		
		d_n = 110 mm	1,0 kg	
		d_n = 125 mm	1,25 kg	
		d_n = 160 mm	1,6 kg	
		d_n = 200 mm	2,0 kg	
		d_n = 250 mm	2,5 kg	
		d_n ≥ 315 mm	3,2 kg	
		Fall height of striker for:		
		d_n = 110 mm	1 600 mm	
		d_n ≥ 125 mm	2 000 mm	
A1 Ring stiffness, normal PP materials A1	S 20 ≥ 2 kN/m²	Test temperature	(23 ± 2) °C	EN ISO
	S 16 ≥ 4 kN/m²	Deflection	3 %	9969
	S 11,2 ≥ 8 kN/m²	Deflection speed for:		
		110 mm < d_n ≤ 200 mm	(5 ± 1) mm/min	
		200 mm < d_n ≤ 400 mm	(10 ± 2) mm/min	
		400 mm < d_n ≤ 1 000 mm	(20 ± 2) mm/min	
		d_n > 1 000 mm	(50 ± 5) mm/min	
A1 Ring stiffness, PP-HM materials	S 13,3: ≥ 8 kN/m²	Test temperature	(23 ± 2) °C	EN ISO
		Deflection	3 %	9969 A1
		Deflection speed for:		
		110 mm ≤ d_n ≤ 200 mm	(5 ± 1) mm/min	
		200 mm ≤ d_n ≤ 400 mm	(10 ± 2) mm/min	
		400 mm < d_n ≤ 1 000 mm	(20 ± 2) mm/min	
		d_n > 1 000 mm	(50 ± 5) mm/min	

[1] If the manufacturer chooses to use indirect testing (see prEN 1852-2), the preferred temperature is (23 ± 2) °C.

Table 8 — Additional mechanical characteristics of pipes

Characteristic	Requirements	Test parameters		Test method
Impact resistance (staircase method)	H50 ≥ 1 m max. one break below 0,5 m	Test/conditioning temperature	0 °C	EN 1411
		Type of striker	d 90	
		Mass of striker for:		
		d_n = 110 mm	4 kg	
		d_n = 125 mm	5 kg	
		d_n = 160 mm	8 kg	
		d_n = 200 mm	10 kg	
		d_n ≥ 250 mm	12,5 kg	

Table 9 — Mechanical characteristics of fittings

Characteristic	Requirements	Test parameters		Test method
Flexibility or mechanical strength[1)]	No sign of splitting, cracking, separation and/or leakage	Test period Minimum displacement or Minimum moment for: [DN] ≤ 250 [DN] > 250	15 min 170 mm $0{,}15 \times [DN]^3 \times 10^{-6}$ kN·m 0,01 × [DN] kN·m	prEN 12256
Impact strength (Drop test)	No damage	Test/conditioning temperature Fall height for: d_n = 110 mm d_n = 125 mm d_n = 160 mm d_n = 200 mm Point of impact	0 °C 1 000 mm 1 000 mm 500 mm 500 mm Mouth of the socket	prEN 12061

[1)] Only for fabricated fittings made from more than one piece. A sealing ring retaining means is not considered as a piece.

Table 10 — Physical characteristics of pipes

Characteristic	Requirements	Test parameters		Test method
Longitudinal reversion	≤ 2 % The pipe shall exhibit no bubbles or cracks	Test temperature Immersion time	150 °C 30 min	Method A: Liquid, in accordance with EN 743
		or		
		Test temperature Immersion time for: $e \leq 8$ mm 8 mm < $e \leq 16$ mm $e > 16$ mm	150 °C 60 min 120 min 240 min	Method B: Air, in accordance with EN 743
Melt mass-flow rate (MFR-value)	Permitted max. deviation when processing the compound into pipe: 0,2 g/10 min	Test temperature Reference time Nominal load	230 °C 600 s 2,16 kg	ISO 4440-1:1994 together with ISO 4440-2:1994 Condition 12

Table 11 — Physical characteristics of fittings

Characteristic	Requirements	Test parameters		Test method
Effects of heating	1) 2) 3)	Temperature Heating time for: $e \leq 10$ mm $e > 10$ mm	150 °C 30 min 60 min	Method A: Air oven, in accordance with EN 763

[1)] The depth of cracks, delamination or blisters shall not be more than 20 % of the wall thickness around the injection point(s). No part of the weld line shall open to a depth of more than 20 % of the wall thickness.

[2)] Mouldings that shall be used for fabricated fittings may be tested separately.

[3)] For fittings manufactured from pipes, the pipes used for such fabricating shall conform to the requirements given in Table 7 and Table 10.

Table 12 — Fitness for purpose characteristics

Characteristic	Requirements	Test parameters		Test method
Tightness of elastomeric sealing ring joint		Temperature Spigot deflection Socket deflection Difference	(23 ± 5) °C ≥ 10 % ≥ 5 % ≥ 5 %	Method 4 and condition B, in accordance with EN 1277
	No leakage	Water pressure	0,05 bar	
	No leakage	Water pressure	0,5 bar	
	≤ − 0,27 bar	Air pressure	−0,3 bar	
		Temperature Angular deflection for: $d_n \leq 315$ mm 315 mm < $d_n \leq 630$ mm $d_n > 630$ mm	(23 ± 5) °C 2° 1,5° 1°	Method 4 and condition C, in accordance with EN 1277
	No leakage	Water pressure	0,05 bar	
	No leakage	Water pressure	0,5 bar	
	≤ − 0,27 bar	Air pressure	−0,3 bar	
Elevated temperature cycling[1)]	No leakage	Shall conform to EN 1055		Test assembly b) (Figure 2 of EN 1055) in accordance with EN 1055
Long-term performance of TPE-seals	Sealing pressure: 1) at 90 days ≥ 1,3 bar 2) by extrapolation to 100 years: ≥ 0,6 bar	Test temperature	(23 ± 5) °C	prEN 1989

[1)] Test required only for components intended to be used for application area code "D" and for d_n less than or equal to 200 mm.

11 Marking

11.1 General

11.1.1 Marking elements shall be printed or formed directly on the component or be on a label, in such a way that after storage, weathering, handling and installation, the required legibility is maintained.

Two levels of legibility of the marking on components are specified for the individual marking aspects given in Table 13 and Table 14. The required durability of marking is coded with decreasing stringency as follows:

a) durable in use;

b) legible until the system is installed.

NOTE The manufacturer is not responsible for marking being illegible due to actions caused during installation and use such as painting, scratching, covering of the components, or by use of detergents etc. on the components, unless agreed or specified by the manufacturer.

11.1.2 Marking shall not initiate cracks or other types of defects which adversely influence the performance of the pipe or the fitting.

Marking by indentation reducing the wall thickness not more than 0,25 mm shall be deemed to conform to this clause without infringing the requirements for the wall thickness given in **6.2.4**.

11.1.3 The size of the marking shall be such that the marking is legible without magnification.

11.2 Minimum required marking of pipes

Pipes shall be marked at intervals of maximum 2 m, at least once per pipe.

The minimum required marking of pipes shall conform to Table 13.

11.3 Minimum required marking of fittings

The minimum required marking of fittings shall conform to Table 14.

11.4 Additional marking

11.4.1 Pipes and fittings conforming to this standard which also conform to other standards may be additionally marked with the required marking of those standards.

11.4.2 Pipes and fittings conforming to this standard which are third party certified may be marked accordingly.

NOTE Attention is drawn to the possible need to include CE marking when required for legislative purposes.

Table 13 — Minimum required marking of pipes

Aspects	Marking or symbols	Legibility code
Number of the standard	EN 1852	a
Application area code	U or UD, as applicable	a
Manufacturer's name and/or trade mark	XXX	a
Nominal size	e.g. 200	a
Minimum wall thickness or S-series	e.g. either 6,2 or S 16	a
Material	A1 PP or PP-HM, as applicable A1	a
Nominal ring stiffness	e.g. SN 4	a
Manufacturer's information	1)	a
Cold climate performance2)	❄ (Ice-crystal)	a
MFR-class3)	e.g. MFR-B	a

1) For providing traceability the following details shall be given:

a) the production period, year and month, in figures or in code;

b) a name or code for the production site if the manufacturer is producing in different sites, nationally and/or internationally.

2) This marking is only applicable to pipes which by testing have proved to conform to **7.1.2**.

3) Only required marking for pipes intended for butt fusion joints.

Table 14 — Minimum required marking of fittings

Aspects	Marking or symbols	Legibility code
Number of the standard	EN 1852	b
Application area code	U or UD, as applicable	a
Manufacturer's name and/or trade mark	XXX	a
Nominal size	e.g. 200	a
Nominal angle	e.g. 45°	b
Minimum wall thickness or S-series	e.g. either 6,2 or S 16	a
Material	A1 PP or PP-HM, as applicable A1	a
Symbol for close tolerance, when applicable	CT	b
Manufacturer's information	1)	b
MFR class2)	e.g. MFR-B	a

1) For providing traceability the following details shall be given:

a) the production period, year, in figures or in code;

b) a name or code for the production site if the manufacturer is producing in different sites, nationally and/or internationally.

2) Only required marking for fittings intended for butt fusion joints.

Annex A (informative)
General characteristics of PP pipes and fittings

A.1 General

EN 476 specifies the general requirements for components used in discharge pipes, drains and sewers for gravity systems. Pipes and fittings conforming to this standard fully meet these requirements.

Further, the following information is given.

A.2 Material characteristics

The material of pipes and fittings conforming to this standard have generally these characteristics:

Modulus of elasticity of normal PP materials	1 250 MPa $\leq E_{(1min)} <$ 1 700 MPa;
Modulus of elasticity of PP-HM materials	$E_{(1min)} \geq$ 1 700 MPa;
Average density	$\approx$ 0,9 g/cm^3;
Average coefficient of linear thermal expansion	$\approx$ 0,14 mm/m·K;
Thermal conductivity	$\approx$ 0,2 WK^{-1}m^{-1};
Specific heat capacity	$\approx$ 2000 J/kg·K;
Surface resistance	$> 10^{12}\Omega$.

A.3 Ring stiffness

The ring stiffness of pipes conforming to this standard is determined in accordance with EN ISO 9969 and is as given in Table A.1:

Table A.1 — Relations between S-series and ring stiffnesses

Normal PP 1 250 MPa $\leq E_{(1min)} <$ 1 700 MPa	PP-HM $E_{(1min)} \geq$ 1 700 MPa	Ring Stiffness
S 20	—	$\geq$ 2 kN/m^2
S 16	—	$\geq$ 4 kN/m^2
S 11,2	S 13,3	$\geq$ 8 kN/m^2

When a fitting conforming to this standard has the same wall thickness as the corresponding pipe the stiffness of this fitting because of its geometry is equal to or greater than the stiffness of that pipe.

The actual value of stiffness of the fittings can be determined in accordance with EN ISO 13967:1997.

A.4 Creep ratio

The creep ratio for pipes and fittings conforming to this standard, when determined in accordance with EN ISO 9967, is less than 4. For fittings, the full cylindrical length of the socket or spigot is used as a test piece and the pre-load force, F_0, is decreased relative to the actual length of the test piece.

A.5 Chemical resistance

PP piping systems conforming to this standard are resistant to corrosion by water with a wide range of pH-values, such as domestic waste water, rainwater, surface water and ground water. If piping systems conforming to EN 1852 are to be used for chemically contaminated waste waters, such as industrial discharges, chemical and temperature resistance have to be taken into account. For information about the chemical resistance of PP materials guidance is given in ISO/TR 10358:1993, and for rubber materials in ISO 7620:1986.

A.6 Abrasion resistance

Pipes and fittings conforming to this standard are resistant to abrasion. For special circumstances, the abrasion can be determined from the test method given in EN 295-3.

A.7 Hydraulic roughness

The internal surfaces of pipes and fittings conforming to this standard are hydraulically smooth. The design of joints and fittings ensure good hydraulic performance. For further information about hydraulic capacity of pipes and fittings conforming to this standard refer to the manufacturer's information.

A.8 Diametric deflection

In normal installation conditions, the expected average deflection of the outside diameter of the pipes will be less than 8 %. However deflections up to 15 %, e.g. caused by soil movement, will not affect the proper functioning of the piping system.

Annex B (informative)
Bibliography

EN 295-3, *Vitrified clay pipes and fittings and pipe joints for drains and sewers — Part 3: Test methods.*

EN 476, *General requirements for components used in discharge pipes, drains and sewers for gravity systems.*

〈A1〉 EN 1329-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Unplasticized poly(vinyl chloride) (PVC-U) — Part 1: Specifications for pipes, fittings and the system.*

EN 1401-1, *Plastics for piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U) — Part 1: Specifications for pipes, fittings and the system.*

EN 1451-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Polypropylene (PP) — Part 1: Specifications for pipes, fittings and the system.*

EN 1455-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Acrlylinitrile-butadiene-styrene (ABS) — Part 1: Specifications for pipes, fittings and the system.*

EN 1519-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Polyethylene (PE) — Part 1: Specifications for pipes, fittings and the system.*

EN 1565-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Styrene copolymer blends (SAN+PVC) — Part 1: Specifications for pipes, fittings and the system.*

EN 1566-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Chlorinated poly(vinyl chloride) (PVC-C) — Part 1: Specifications for pipes, fittings and the system.*

prEN 12666-1, *Plastics piping systems for non-pressure underground drainage and sewerage — Polyethylene (PE) — Part 1: Specifications for pipes, fittings and the system.*

prEN 13476-1, *Plastics piping systems for non-pressure underground drainage and sewerage — Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and Polyethylene (PE) — Part 1: Specifications for pipes, fittings and the system.* 〈A1〉

EN ISO 9967:1995, *Plastics pipes — Determination of creep ratio.*

ISO 265-1:1988, *Pipes and fittings of plastics materials — Fittings for domestic and industrial waste pipes — Basic dimensions: Metric series — Part 1: Unplasticized poly(vinyl chloride) (PVC-U).*

ISO 4065:1996, *Thermoplastics pipes — Universal wall thickness table.*

ISO 7620:1986, *Rubber materials — Chemical resistance.*

ISO 8773:1991, *Polypropylene (PP) pipes and fittings for buried drainage and sewerage systems — Specifications.*

ISO/TR 10358:1993, *Plastics pipes and fittings — Combined chemical-resistance classification table.*

ISO 11922-1:1997, *Thermoplastics pipes for the transport of fluids — Dimensions and tolerances — Part 1: Metric series.*

ISO/DIS 13967:1995, *Plastics piping systems — Thermoplastics fittings — Determination of the short term stiffness.*

RAL 840-HR[3)], *Colour register.*

[3)] Obtainable at the national standards institute.

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