BS EN 14758-1:2012

BSI Standards Publication

Plastics piping systems for non-pressure underground drainage and sewerage — Polypropylene with mineral modifiers (PP-MD)

Part 1: Specifications for pipes, fittings and the system

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National foreword

This British Standard is the UK implementation of EN 14758-1:2012. It supersedes BS EN 14758-1:2005+A1:2009 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/88/1, Plastics piping for non-pressure applications.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Plastics piping systems for non-pressure underground drainage and sewerage - Polypropylene with mineral modifiers (PP-MD) - 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 - Polypropylène avec modificateurs minéraux (PP-MD) - Partie 1: Spécifications pour les tubes, les raccords et le système

Kunststoff-Rohrleitungssysteme für erdverlegte drucklose Abwasserkanäle und -leitungen - Polypropylen mit mineralischen Additiven (PP-MD) - Teil 1: Anforderungen an Rohre, Formstücke und das Rohrleitungssystem

This European Standard was approved by CEN on 22 January 2012.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Foreword

This document (EN 14758-1:2012) has been prepared by Technical Committee CEN/TC 155 “Plastics piping systems and ducting systems”, the secretariat of which is held by NEN.

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of an identical text or by endorsement, at the latest by September 2012, and conflicting national standards shall be withdrawn at the latest by September 2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 14758-1:2005+A1:2009.

In this revised document the following changes are made:

— relevant test methods are changed from EN to ISO versions;

— the long term durability test are removed.

The 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).

The System Standards 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 14758 consists of the following parts under the general title *Plastics piping systems for non-pressure underground drainage and sewerage — Polypropylene with mineral modifiers (PP-MD)*

Part 1: Specifications for pipes, fittings and the system

Part 2: Guidance for the assessment of conformity (published as CEN/Technical Specification)

Part 3: Guidance for installation (published as CEN/Technical Specification).

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the requirements for solid-wall pipes, fittings and the system of piping systems made from mineral modified polypropylene materials (PP-MD) 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 European Standard.

This European Standard covers a range of nominal sizes, a range of pipe series/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 14758 (see Foreword) it is applicable to PP-MD pipes and fittings, their elastomeric sealing ring 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 European Standard is applicable to PP-MD 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 4, Table 7 and Table 13.

NOTE 4 Pipes, fittings and other components conforming to any of the plastics product standards listed in Annex B can be used with pipes and fittings conforming to this European Standard, when they conform to the requirements for joint dimensions given in Clause 6 and to the requirements of Table 13.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 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 ISO 472:2001, *Plastics — Vocabulary (ISO 472:1999)*

EN ISO 580:2005*, Plastics piping and ducting systems - Injection-moulded thermoplastics fittings - Methods for visually assessing the effects of heating (ISO 580:2005)*

EN ISO 1043-1:2001, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics (ISO 1043-1:2001)*

EN ISO 1133:2005, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics (ISO 1133:2005)*

EN ISO 1167 (all parts), *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure*

EN ISO 2505:2005*, Thermoplastics pipes — Longitudinal reversion — Test method and parameters (ISO 2505:2005)*

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

EN ISO 13967, *Thermoplastics fittings — Determination of ring stiffness (ISO 13967)*

EN ISO 13968, *Plastics piping and ducting systems — Thermoplastics pipes — Determination of ring flexibility (ISO 13968)*

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

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

ISO 11173, *Thermoplastics pipes — Determination of resistance to external blows — Staircase method*

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

ISO 13259, *Thermoplastics piping systems for underground non-pressure applications — Test method for leaktightness of elastomeric sealing ring type joints*

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

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

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this European Standard, the terms, definitions and symbols given in EN ISO 472:2001 and EN ISO 1043-1:2001 and the following apply.

3.1.1
application area code
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 1 to entry: 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
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
d_n
specified outside diameter, in millimetres, assigned to a nominal size (DN/OD)

3.1.2.4
outside diameter
d_e
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
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

3.1.2.6
mean inside diameter of a socket
$d_{s,m}$
arithmetical 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
value of the measurement of the wall thickness at any point around the circumference of a component

3.1.2.8
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

3.1.2.9
pipes series
S
number for pipe designation [SOURCE: ISO 4065 (1)]

3.1.2.10
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, and the minimum wall thickness, e_{min}

3.1.2.11
nominal ring stiffness
SN
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
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. Figures 7 and 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
mineral modified material (PP-MD)
material to which has been added minerals during specific processing operation(s) which during such processing is well distributed in the material

3.1.3.3
mean particle size
D50
diameter which 50 % by mass of the particles of a mineral modifier is smaller than

3.1.3.4
particle top cut
D98
diameter which 98 % by mass of the particles of a mineral modifier is smaller than

3.1.3.5
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

3.1.3.6
external reprocessable material
material comprising either one of the following forms:
a) material from rejected unused pipes or fittings or trimmings there from, that will be reprocessed and that were originally processed by another manufacturer;
b) material from the production of unused products other than pipes and fittings, regardless of where they are manufactured

3.1.3.7
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 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

D50 mean particle size

D98 particle top cut

d_e outside diameter

d_{em} mean outside diameter

d_{im} mean inside 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

$CaCO_3$	calcium carbonate
DN	nominal size
DN/OD	nominal size, outside diameter related
MFR	melt mass-flow rate
$MgCO_3$	magnesium carbonate
$Mg_3Si_4O_{10}(OH)_2$	magnesium silicate
PP	polypropylene
PP-MD	mineral modified polypropylene

SDR standard dimension ratio

SN nominal ring stiffness

TIR true impact rate

4 Material

4.1 PP-MD material

The base material for PP-MD pipes and fittings shall be a polypropylene base material to which are added mineral modifier(s) of known specification and containing those other additives that are needed to facilitate the manufacture of components conforming to the requirements of this European Standard.

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 European Standard and by using material from piping components of own production is permitted. External reprocessable or recyclable material shall not be used.

4.3 Melt mass-flow rate

Pipes and fittings shall be made from PP-MD materials where the PP base material has an MFR as follows:

MFR (230/2,16) ≤ 1,5 g/10 min.

The MFR of the base material shall be tested in accordance with EN ISO 1133:2005, using the test parameters:

temperature 230 °C and loading mass 2,16 kg

4.4 Mineral modifiers

4.4.1 Types of mineral modifiers

The mineral modifiers shall be of following types:

— coated calcium carbonate, $CaCO_3$

or

— talc.

When it is calcium carbonate following apply:

— content of $CaCO_3$ ≥ 96 % by mass;

— content of $MgCO_3$ ≤ 4 % by mass;

— content of $CaCO_3$ and $MgCO_3$ in total ≥ 98 % by mass.

When it is talc following apply:

— content of magnesium silicate ($Mg_3Si_4O_{10}(OH)_2$) ≥ 97 % by mass.

NOTE The addition of mineral modifiers is an effective way of increasing the E-modulus of the base polypropylene material.

4.4.2 Characteristics of mineral modifiers

The physical properties of modifiers shall conform to the following:

For $CaCO_3$:

— mean particle size, D50 ≤ 2,5 μm;

— particle top cut, D98 ≤ 20 μm.

For talc:

— mean particle size; D50 ≤ 7 μm;

— particle top cut, D98 ≤ 30 μm.

4.4.3 Content of mineral modifier

The content of mineral modifier in pipes and fittings shall be less than 50 % by mass.

The actual quantity and specification of mineral modifier shall be specified in the manufacturers quality plan.

4.4.4 Dispersion of mineral modifiers

To ensure a good dispersion of the mineral modifier, the pipe shall be pressure tested in accordance with EN ISO 1167 at 80 °C with circumferential (hoop) stress of 5,5 MPa. No failure within the test period of one hour.

4.5 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.

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 Test temperature Orientation Number of test pieces Circumferential (hoop) stress Conditioning period Type of test Test period	Types a) or b) 80 °C Not specified 3 4,2 MPa 1 h water-in-water 140 h	EN ISO 1167
Resistance to internal pressure	No failure during the test period	End caps Test temperature Orientation Number of test pieces Circumferential (hoop) stress Conditioning period Type of test Test period	Types a) or b) 95 °C Not specified 3 2,5 MPa 1 h Water-in-water 1 000 h	EN ISO 1167

4.6 Sealing ring retaining means

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

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 European 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 except that in thin external and/or internal layers the use of colours are accepted for the purpose of colour coding, video inspection and/or UV-protection.

The colour should preferably be black, orange-brown (approximately RAL 8023)[1)] or dusty grey (approximately RAL 7037) [1)]. Other colours may be used.

6 Geometrical characteristics

6.1 General

Dimensions shall be measured in accordance with EN ISO 3126.

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

6.2 Dimensions of pipes

6.2.1 Outside diameters

The mean outside diameter, d_{em}, shall conform to Table 2 or Table 3, as applicable.

1) See colour register RAL 840-HR [2].

Table 2 — Mean diameters

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter	Mean outside diameter [a]		Minimum mean inside diameter	
	d_n	$d_{em,min}$	$d_{em,max}$	$d_{im,min}$	
				SN 4	SN 8
110	110	110,0	110,4	102,0	99,2
125	125	125,0	125,4	116,0	112,6
160	160	160,0	160,5	148,8	144,4
200	200	200,0	200,6	185,8	180,6
250	250	250,0	250,8	232,6	226,0
315	315	315,0	316,0	293,2	284,8
355	355	355,0	356,1	330,4	321,0
400	400	400,0	401,2	372,4	361,8
450	450	450,0	451,4	419,2	407,2
500	500	500,0	501,5	465,8	452,4
630	630	630,0	631,8	587,0	570,4
800	800	800,0	802,0	745,6	724,2
1 000	1 000	1 000,0	1 002,0	932,2	905,4

a The tolerances for mean outside diameters conform to ISO 11922-1 [3], grade C.

6.2.2 Outside diameters with close tolerances (type CT)

For the purposes of this European Standard in addition to the dimensions and tolerances given in Table 2 for spigot ends of pipes and fittings, tolerances which are in accordance with EN 1401-1 [5], 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 3.

Table 3 — Mean outside diameters with close tolerances type CT

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter	Mean outside diameter	
	d_n	$d_{em,min}$	$d_{em,max}$
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 pipes and fittings with maximum mean outside diameters conforming to Table 5 can be used with pipes and fittings conforming to EN 1401-1 [5] provided that the socket(s) for these pipes and fittings are intended to be used for elastomeric ring seal joints.

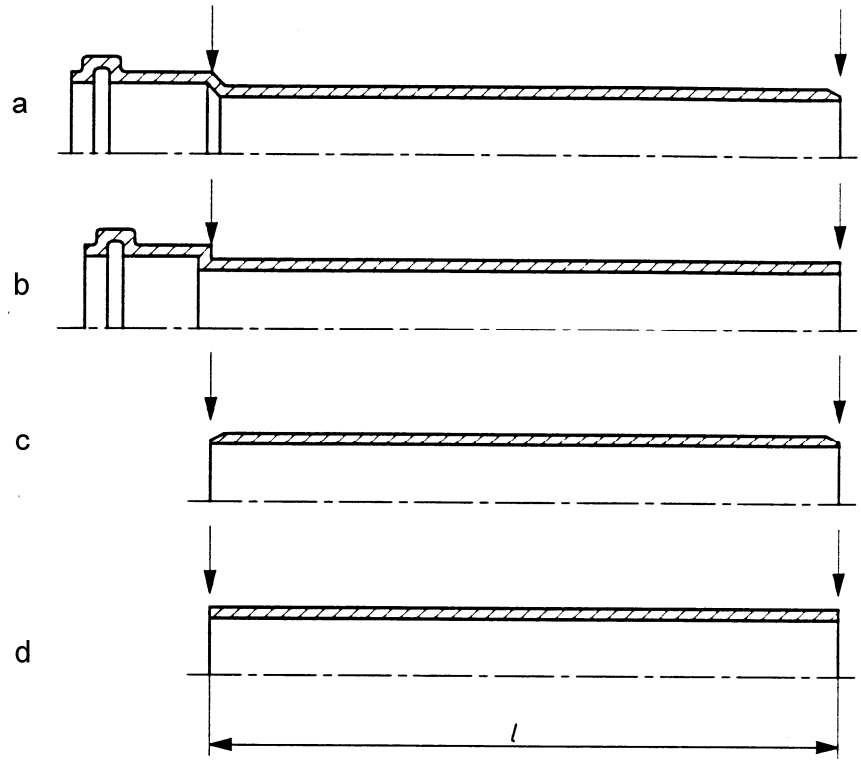
NOTE 2 Spigot ends of pipes and fittings with mean outside diameters conforming to Table 4 are recommended to be injection-moulded.

6.2.3 Minimum mean inside diameter

The mean inside diameter, $d_{im,min}$ shall conform to Table 2.

6.2.4 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.



Key
a single-socketed pipe with ring seal, with chamfer
b single-socketed pipe with ring seal, without chamfer
c plainended pipe, with chamfer
d plainended pipe, without chamfer

Figure 1 — Effective length of pipes

6.2.5 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 $\frac{1}{3}$ of e_{min}.

6.2.6 Wall thicknesses

The actual wall thickness of the pipe will depend upon the E-modulus of the mineral modified material, and shall be sufficient to give the pipe the ring stiffness which the pipe is classified for, but shall not be less than specified in Table 4.

The wall thickness, e_{min}, measured as minimum value on the test samples used for classification of ring stiffness class according to 6.3, shall be recorded and further used as minimum wall thickness, e_{min}, that the manufacturer is allowed to use in the current production of pipe.

Table 4 — Wall thickness

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Minimum wall thickness [a] e_{min}
110	110	3,4
125	125	3,9
160	160	4,9
200	200	6,2
250	250	7,7
315	315	9,7
355	355	10,9
400	400	12,3
450	450	13,8
500	500	15,3
630	630	19,3
800	800	24,5
1 000	1 000	30,6

[a] The minimum required wall thickness is according to the pipe series S 16 of ISO 4065 [1]) which corresponds to SDR 33.

6.3 Ring stiffness classes

The pipe shall be classified by ring stiffness either as SN 4 or SN 8. The classification shall be based upon ring stiffness testing in accordance with EN ISO 9969.

6.4 Dimensions of fittings

6.4.1 Outside diameters

The mean outside diameter, d_{em}, of the spigot shall conform to Table 2 or Table 3, as applicable.

6.4.2 Design lengths

The design lengths shall be declared by the manufacturer.

NOTE The design lengths (see the dimensions Z in Figures 7 to 9 and Figures 12 to 16 are intended to assist in the design of moulds and are not intended to be used for quality control purposes. ISO 265-1 [4] can be used as a guideline.

6.4.3 Wall thicknesses and stiffness

The actual wall thickness of the fitting will depend upon the E-modulus of the mineral modified material, and shall be sufficient to give the fitting the stiffness which the fitting is classified for, but shall not be less than specified in Table 4.

The wall thickness that is measured as minimum value on the body of the fitting sample used for classification of the stiffness of the fitting shall be recorded and further used as the minimum wall thickness, e_{min}, that the manufacturer is allowed to use in the current production of fittings.

The minimum wall thickness, e_{min}, of the body or the spigot of a fitting shall conform to Table 4, 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 4.

Stiffness of fittings shall be classified by stiffness either as SN 4 or SN 8. The classification shall be based upon stiffness testing in accordance with EN ISO 13967.

When a fitting conforming to this European Standard has the same wall thickness and material composition as the corresponding pipe, the stiffness of this fitting because of its geometry, is equal to or greater than the stiffness of that pipe. Consequently fittings are classified with the corresponding pipe stiffness.

For DN/OD ≥ 500 the manufacturers guaranteed minimum stiffness of a fitting, between the SN values, may be used for calculation purposes.

Where a fitting or adaptor 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.

The wall thickness of fabricated fittings, except for spigot and socket, may be changed locally due to the fabrication process, providing that the minimum wall thickness of the body conforms to, $e_{3,min}$, as specified in 6.5.2, as appropriate for the pipe series concerned.

6.5 Dimensions of sockets and spigots

6.5.1 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 Figures 2, 3, 4 or 5, as applicable).

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 11.

Table 5 — Socket diameters and lengths of sockets and spigots

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter	Minimum mean inside diameter of the socket	Socket		Spigot
	d_n	$d_{sm,min}$ [b]	A_{min} [a, c]	C_{max} [d]	$L_{1,min}$
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	89	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

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

[b] For nominal sizes DN/OD ≤ 200, $d_{sm,min}$ conforms to EN 1401-1 [5]. For nominal sizes DN/OD ≥ 250, $d_{sm,min}$ conforms to ISO 8773 [6].

[c] A_{min} values conform to ISO 8773 [6].

[d] 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: $A = (0{,}2 d_n + 3 \times l)$ mm, where l is the pipe length in metres.

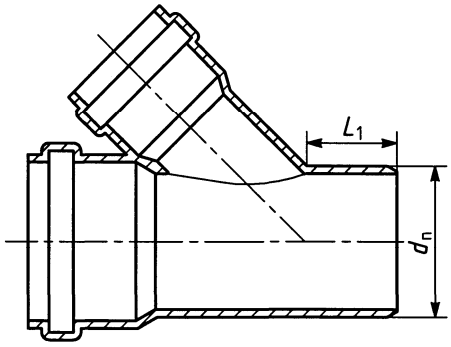
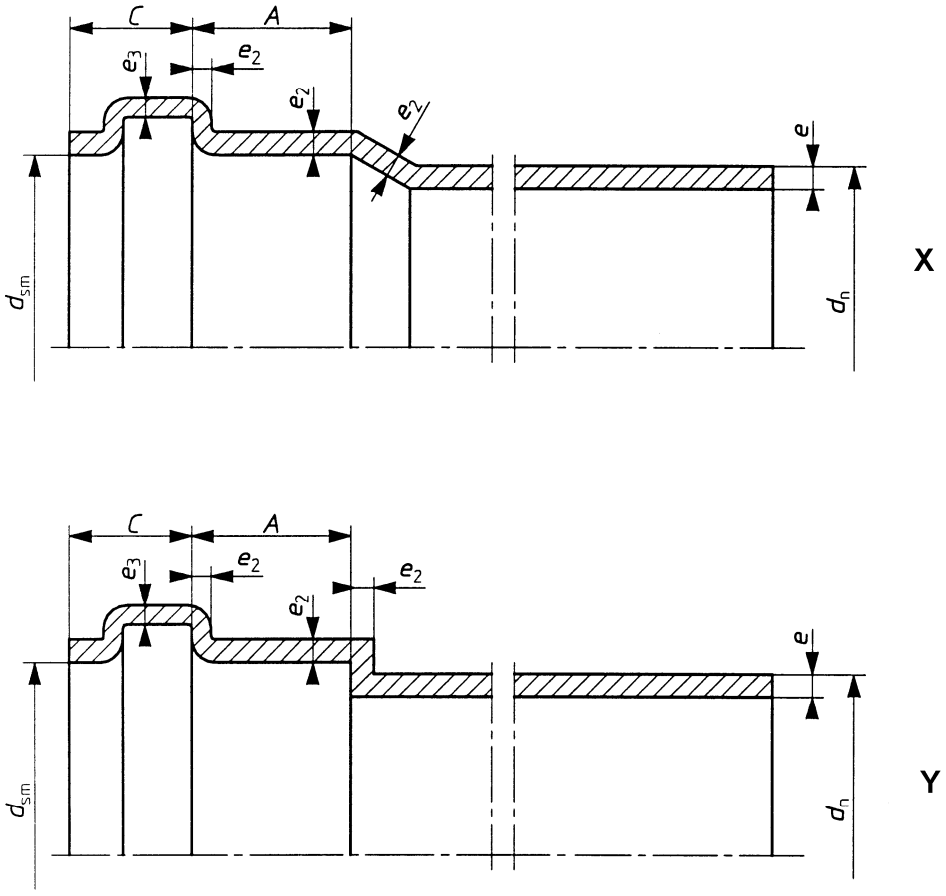


Figure 2 — Spigot length



Key
X ring seal socket with chamfer
Y ring seal socket without chamfer

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

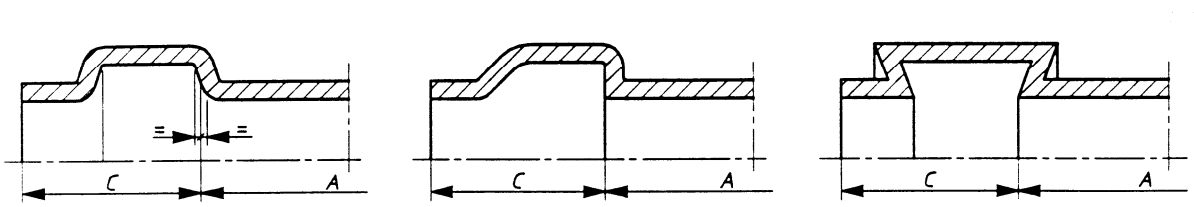


Figure 4 — Typical groove designs for elastomeric ring seal sockets

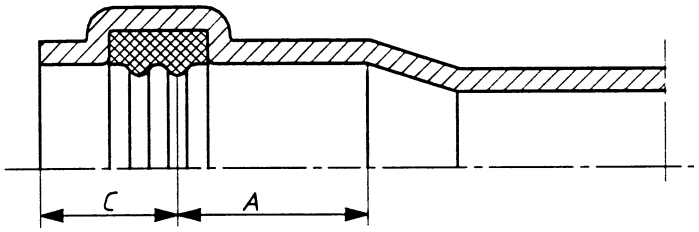


Figure 5 — Example for measuring the effective sealing point

6.5.2 Wall thicknesses of sockets

The minimum wall thicknesses of sockets, e_2 and e_3 (see Figure 3), excluding the socket mouth, shall conform to the following equations:

— $e_{2,min}$ shall be at least 0,9 × actual e_{min} (1)

— $e_{3,min}$ shall be at least 0,75 × actual e_{min} (2)

Both values shall be rounded up to nearest 0,1 mm.

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 calculated from the equations.

It shall be noted that the actual wall thickness of a component (pipe or fitting) depends on the E-modulus of the material and shall be so that the required stiffness of the component is satisfied. If the actual minimum wall thickness e_{min} of a component is larger than e_{min} according to Table 4, then the dimensions $e_{2,min}$ and $e_{3,min}$ shall be increased in same ratio as the actual e_{min} of the body.

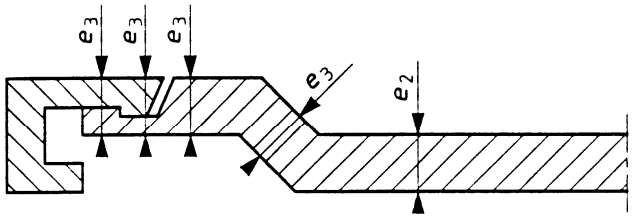


Figure 6 — Example for calculation of the wall thickness of sockets with retaining cap

6.6 Types of fittings

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

— Bends (see Figures 7, 8 or 9):

  – unswept and swept angle (see ISO 265-1[4]);

  – spigot/socket and socket/socket;

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

— Couplers and slip couplers (see Figures 10 or 11);

— Reducers (see Figure 12);

— Branches and reducing branches (see Figures 13, 14, 15 or 16):

  – unswept and swept angle;

  – spigot/socket and socket/socket.

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

— Plugs (see Figure 17): minimum length of spigot, M_{min} = (C_{max} + 10) mm, (see Table 5).

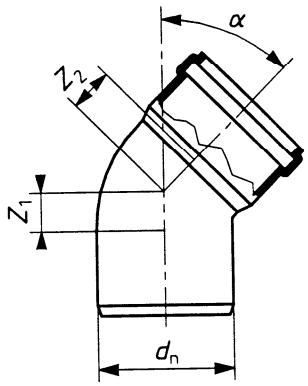


Figure 7 — Bend with single socket (unswept)

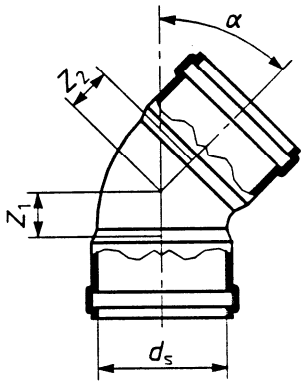


Figure 8 — Bend with all sockets (unswept)

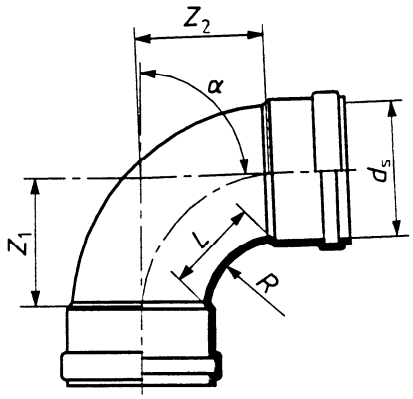


Figure 9 — Bend with all sockets (swept)

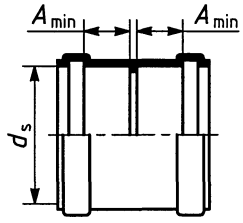


Figure 10 — Coupler

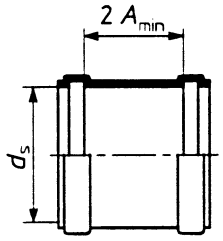


Figure 11 — Slip coupler

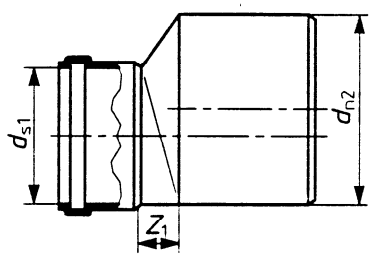


Figure 12 — Reducer

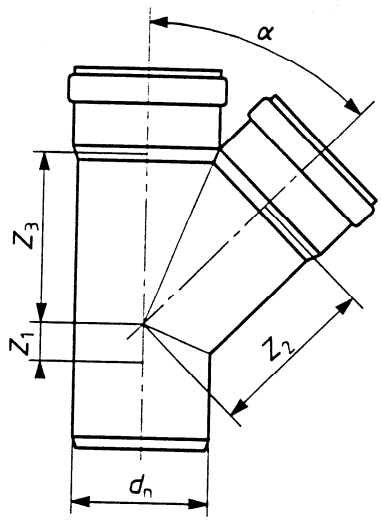


Figure 13 — Branch (unswept)

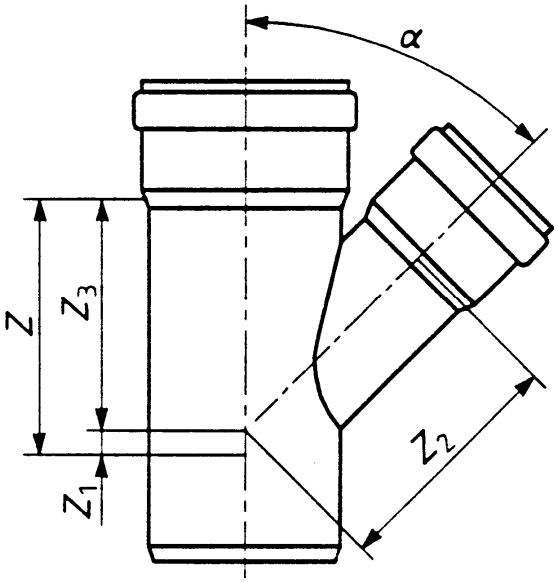


Figure 14 — Reducing branch

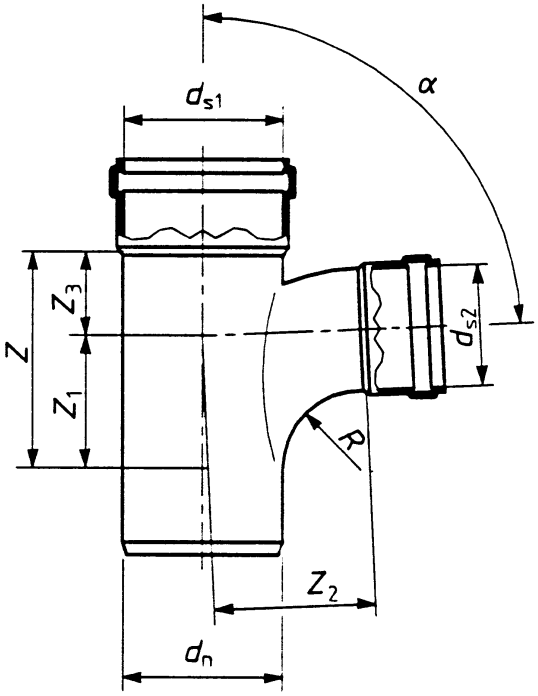


Figure 15 — Reducing branch (swept)

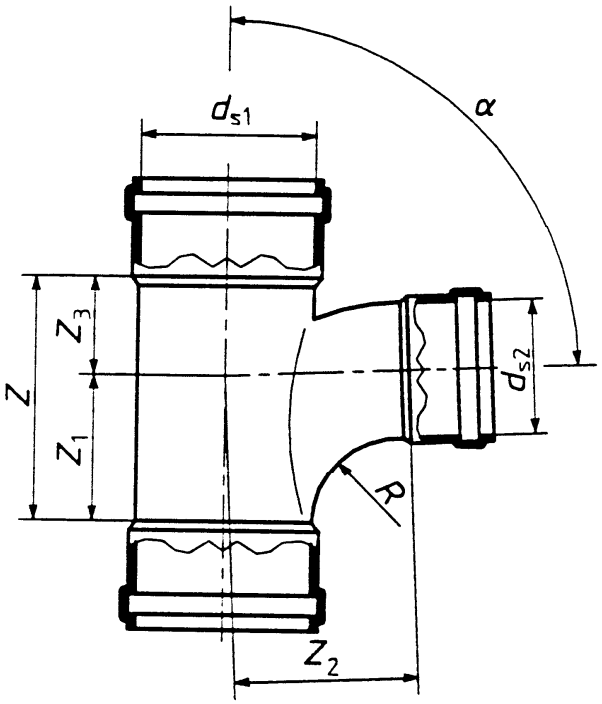


Figure 16 — All socket reducing branch (swept)

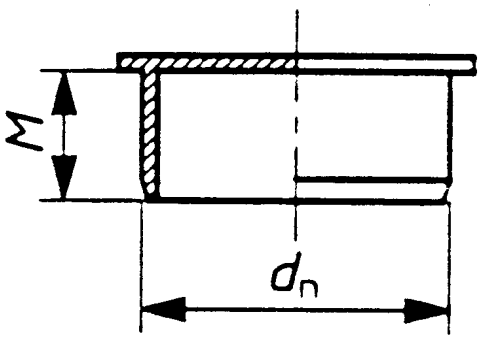


Figure 17 — Plug

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 6 using the indicated parameters, the pipe shall have general mechanical characteristics conforming to the requirements given in Table 6.

Table 6 — General mechanical characteristics of pipes

Characteristic	Requirements	Test parameters		Test method
Impact resistance [a] (round-the-clock method)	TIR ≤ 10 %	Test/conditioning temperature Conditioning medium Type of striker Mass of striker for: d_n = 110 mm d_n = 125 mm d_n = 160 mm d_n = 200 mm d_n = 250 mm $d_n \geq$ 315 mm Fall height of striker for: d_n = 110 mm $d_n \geq$ 125 mm	0 °C water or air d 90 1,0 kg 1,25kg 1,6 kg 2,0 kg 2,5 kg 3,2 kg 1 600 mm 2 000 mm	ISO 3127
Ring stiffness	SN 4: ≥ 4 kN/m^2 SN 8: ≥ 8 kN/m^2	Test temperature Deflection Deflection speed for: 110 mm < $d_n \leq$ 200 mm 200 mm < $d_n \leq$ 400 mm 400 mm < $d_n \leq$ 1 000 mm	(23 ± 2) °C 3 % (5 ± 1) mm/min (10 ± 2) mm/min (20 ± 2) mm/min	EN ISO 9969
Ring flexibility	Shall conform to 7.1.2	Deflection	30 % of d_{em}	EN ISO 13968
[a] If the manufacturer chooses to use indirect testing, the preferred temperature is (23 ± 2) °C.				

7.1.2 Ring flexibility

When tested in accordance with the test method described in Table 6 using the indicated parameter and visually inspected without magnification a) and b) shall be conformed to during the test.

a) there shall be no decrease of the measured force;

b) there shall be no cracking in any part of the wall structure

and c) and d) shall be conformed to after the test;

c) there shall be no other types of rupture in the test piece;

d) permanent buckling in the pipe wall shall not occur.

7.1.3 Additional mechanical requirements

Pipes intended to be used in areas where installation also is carried out at temperatures below –10 °C, may be required in the national foreword to conform to the requirements of an impact test (staircase method) as specified in Table 7.

The pipes shall be marked with an ice crystal in accordance with Table 12.

Table 7 — 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	−10 °C	ISO 11173
		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	

7.2 Mechanical characteristics of fittings

When tested in accordance with the test methods as specified in Table 8 using the indicated parameters, the fitting shall have mechanical characteristics conforming to the requirements given in Table 8.

Table 8 — Mechanical characteristics of fittings

Characteristic	Requirements	Test parameters		Test method
Stiffness [a]	SN 4: ≥ 4 kN/m^2 SN 8: ≥ 8 kN/m^2	Shall conform to EN ISO 13967		EN ISO 13967
Flexibility or mechanical strength [b]	No sign of splitting, cracking, separation and/or leakage	Test period	15 min	ISO 13264
		Minimum displacement or	170 mm	
		Minimum moment for:		
		[DN] ≤ 250	0,15 × [DN]^3 × 10^{-6} kNm	
		[DN] > 250	0,01 × [DN] kNm	
Impact strength (Drop test)	No damage	Test/conditioning temperature	0 °C	ISO 13263
		Fall height for:		
		d_n = 110 mm	1 000 mm	
		d_n = 125 mm	1 000 mm	
		d_n = 160 mm	500 mm	
		d_n = 200 mm	500 mm	
		Point of impact	mouth of the socket	

[a] When a fitting according to this European Standard has the same material and wall thickness as a corresponding pipe, the stiffness of the fitting, because of its geometry, is equal to or greater than that of the pipe. Such fitting can be classified with same stiffness class as that pipe without testing of the stiffness.

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

8 Physical characteristics

8.1 Physical characteristics of pipes

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

Table 9 — 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 ISO 2505:2005
		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 ISO 2505:2005

8.2 Physical characteristics of fittings

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

Table 10 — Physical characteristics of fittings

Characteristic	Requirements	Test parameters		Test method
Effects of heating	[a], [b] and [c]	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 ISO 580:2005

[a] The depth of cracks, de-lamination 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.

[b] Mouldings that shall be used for fabricated fittings, may be tested separately.

[c] For fittings manufactured from pipes, the pipes used for such fabricating shall conform to the requirements given in Tables 6 and 9.

9 Performance requirements

When tested in accordance with the test methods as specified in Table 11 using the indicated parameters, the joints and the system shall have fitness for purpose characteristics conforming to the requirements given in Table 11.

Table 11 — 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 %	ISO 13259, condition B
	No leakage	Water pressure	0,05 bar	
	No leakage	Water pressure	0,5 bar	
	≤ –0,27 bar	Air pressure	–0,3 bar	
Tightness of elastomeric sealing ring joint		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°	ISO 13259, condition C
	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 [a]	No leakage	Shall conform to ISO 13257		Test assembly b) (Figure 2 of ISO 13257) in accordance with ISO 13257
[a] Test required only for components intended to be used for application area code "D" and for DN/OD ≤ 200.				

10 Sealing rings

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 11.

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

11 Marking

11.1 General

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 Tables 12 and 13. The required durability of marking is coded with decreasing stringency as follows:

— durable in use;

— 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.

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.

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 12.

Table 12 — Minimum required marking of pipes

Aspects	Marking or symbols	Legibility code
- Number of the standard	EN 14758-1	a
- Application area code	U or UD, as applicable	a
- Manufacturer's name and/or trade mark	XXX	a
- Nominal size (DN/OD)	e.g. 200	a
- Minimum wall thickness	(Value in mm as determined in accordance with 6.2.5)	a
- If applicable, the symbol for close tolerance,	CT	b
- Ring stiffness class	e.g. SN 8	a
- Material	PP-MD	a
- Manufacturer's information	[a]	a
- Cold climate performance [b]	❄ (One ice-crystal, when tested at −10 °C)	a

[a] For providing traceability the following details shall be given:
— the production period, year and month, in figures or in code;
— a name or code for the production site if the manufacturer is producing in different sites, nationally and/or internationally.

[b] This marking is only applicable to pipes which by testing have proved to conform to 7.1.3.

11.3 Minimum required marking of fittings

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

Table 13 — Minimum required marking of fittings

Aspects	Marking or symbols	Legibility code
- Number of the standard	EN 14758-1	a
- Application area code	U or UD, as applicable	a
- Manufacturer's name and/or trade mark	XXX	a
- Nominal size /DN/OD)	e.g. 200	a
- If applicable, the symbol for close tolerance,	CT	b
- Nominal angle, when applicable	e.g. 45º	a
- Ring stiffness class	e.g. SN 8	a
- Minimum wall thickness of body	(Value in mm as determined in accordance with 6.4.3)	a
- Material	PP-MD	a
- Manufacturer's information	[a]	b

[a] For providing traceability the following details shall be given:
- production period, year and month, in figures or in code;
-name or code for the production site if the manufacturer is producing in different sites, nationally and/or internationally.

11.4 Additional marking

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

Pipes and fittings conforming to this European 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.

Annex A
(informative)

General characteristics of PP-MD pipes and fittings

A.1 General

EN 476 [7] specifies the general requirements for components used in discharge pipes, drains and sewers for gravity systems. Pipes and fittings conforming to this European Standard fully meet these requirements.

Further the following information is given.

A.2 Material characteristics

Several of the material characteristics of pipes and fittings made from PP-MD are dependant on the amount of mineral modifiers. Therefore specific information given by the pipe and fitting manufacturer should be observed.

Material of pipes and fittings conforming to this European Standard have generally these characteristics:

Modulus of elasticity: (Increasing value with increasing amount of minerals)	$E_{(1\ min)}$: 1 600 MPa to 3 600 MPa
Average density: (Increasing value with increasing amount of minerals)	1,0 g/cm^3 to 1,4 g/cm^3
Average coefficient of linear thermal expansion: (Decreasing value with increasing amount of minerals)	0,07 mm/mK to 0,12 mm/mK
Thermal conductivity: (Increasing value with increasing amount of minerals)	0,2 WK^{-1} m^{-1} to 0,6 WK^{-1} m^{-1}
Specific heat capacity: (Decreasing value with increasing amount of minerals)	1 300 J/kgK to 1 800 J/kgK
Surface resistance:	$> 10^{11}\ \Omega$

Creep ratio: ≤ 4 at 2 years extrapolation when tested according to EN ISO 9967 [8]

A.3 Ring stiffness

The ring stiffness of pipes conforming to this European Standard is determined in accordance with EN ISO 9969 and is either SN 4 or SN 8.

When a fitting conforming to this European 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. Consequently fittings are classified with the corresponding pipe stiffness.

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

A.4 Chemical resistance

PP-MD piping systems conforming to this European Standard are resistant to corrosion by water with a wide range of pH-values such as domestic wastewater, rainwater, surface water and ground water.

If piping systems conforming to EN 14758-1 are intended to be used for chemically contaminated waste waters, such as industrial discharges, chemical and temperature resistance should be taken into account. For information about the chemical resistance of PP-MD materials guidance is given in ISO/TR 10358 [9] and for rubber materials in ISO/TR 7620 [10].

A.5 Abrasion resistance

Pipes and fittings conforming to this European Standard are resistant to abrasion. For special circumstances, the abrasion can be determined from the test method given in EN 295-3 [11].

A.6 Hydraulic roughness

The design of joints and fittings ensure good hydraulic performances. For further information about hydraulic capacity of pipes and fittings conforming to this European Standard refer to the manufacturer's information.

A.7 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)

Standards for pipes and fittings of a material other than PP-MD

At the date of publication of this European Standard, the following (draft) standards were available:

EN 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 1852-1, *Plastics piping systems for non-pressure underground drainage and sewerage — Polypropylene (PP) — Part 1: Specifications for pipes, fittings and the system*

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

Bibliography

[1] ISO 4065, *Thermoplastics pipes — Universal wall thickness table*

[2] RAL 840-HR [1)], *Colour register*

[3] ISO 11922-1, *Thermoplastics pipes for the conveyance of fluids — Dimensions and tolerances — Part 1: Metric series*

[4] ISO 265-1, *Pipes and fittings of plastics materials — Fittings for domestic and industrial waste pipes — Basic dimensions: Metric series — Part 1: Unplasticized poly(vinylchloride) (PVC-U)*

[5] EN 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*

[6] ISO 8773, *Plastics piping systems for non-pressure underground drainage and sewerage – Polypropylene (PP)*

[7] EN 476, *General requirements for components used in drains and sewers*

[8] EN ISO 9967, *Thermoplastics pipes – Determination of creep ratio (ISO 9967)*

[9] ISO/TR 10358, *Plastics pipes and fittings — Combined chemical-resistance classification table*

[10] ISO/TR 7620, *Rubber materials — Chemical resistance*

[11] EN 295-3, *Vitrified clay pipe systems for drains and sewers — Part 3: Test methods*

1) Obtainable at the national standards institute.

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