BS EN 12200-1:2016

BSI Standards Publication

Plastics rainwater piping systems for above ground external use — Unplasticized poly(vinyl chloride) (PVC-U)

Part 1: Specifications for pipes, fittings and the system

bsi.

National foreword

This British Standard is the UK implementation of EN 12200-1:2016. It supersedes BS EN 12200-1:2000 which is withdrawn.

The responsible UK committee gives the following advice concerning the scope and contents of EN 12200-1.

a) EN 12200-1:2016 has been extended to cover pipes manufactured by multi-layer co-extrusion and the use of acrylic materials for both the outer layer of the pipe and the fittings. It also allows greater use of recycled PVC-U material.

b) EN 12200-1:2016 is specific to rainwater downpipe systems installed outdoors. For indoor rainwater downpipe reference should be made to standards for soil and waste discharge within the building structure, e.g. BS EN 1329-1:2014.

NOTE In the UK, plastics rainwater downpipe systems installed outdoors normally have "unsealed" joints (see Table 2 which details wall thickness requirements for both sealed and unsealed systems).

c) Since in Table 12 reference is made to "stage 3" of the grey scale according to EN 20105-A02, the reference here and to this standard in clause 2 should be considered to relate to the latest published edition (currently 1995) of that standard.

d) The unique UK diameter of 82.4 mm minimum (mean outside diameter) as detailed in BS 4514 is not listed in Table 1 but is commonly used for rainwater applications in the UK. It is advised that pipes and fittings to this size will still be able to be marked EN 12200-1 when manufactured in accordance with the diameter tolerances specified in BS 4514 and using the general rules for other dimensions such as wall thickness as detailed in Clause 6.2.2 of this standard.

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

A list of organizations represented on this subcommittee 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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English Version

Plastics rainwater piping systems for above ground external use - Unplasticized poly(vinyl chloride) (PVC-U) - Part 1: Specifications for pipes, fittings and the system

Systèmes de canalisations de descentes d'eaux pluviales en plastique à usage externe en aérien - Poly(chlorure de vinyle) non plastifié (PVC-U) - Partie 1: Spécifications pour tubes, raccords et le système

Kunststoff-Rohrleitungssysteme für außenliegende Regenfallleitungen - Weichmacherfreies Polyvinylchlorid (PVC-U) - Teil 1: Anforderungen an Rohre, Formstücke und das Rohrleitungssystem

This European Standard was approved by CEN on 9 January 2016.

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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

This document (EN 12200-1:2016) has been prepared by Technical Committee CEN/TC 155 "Plastics piping systems and ducting systems", the secretariat of which is held by NEN.

This document supersedes EN 12200-1:2000.

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 October 2016, and conflicting national standards shall be withdrawn at the latest by October 2016.

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 European Standard has been prepared in liaison with CEN/TC 128 "Roof covering products for discontinuous laying and products for wall cladding" taking into account EN 607 [1] and EN 1462 and CEN/TC 165 "Waste water engineering" taking into account the design guidance in EN 12056-3 [4].

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 12200 consists of the following Parts, under the general title "*Plastics rainwater piping systems for above ground external use — Unplasticized poly(vinyl chloride) (PVC-U)*":

— Part 1: Requirements for pipes fittings and the system (the present standard);

— Part 2: Guide for the assessment of conformity [3].

For Rainwater discharge systems used internally within buildings the following standards apply:

EN 1329, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Unplasticized poly(vinyl chloride) (PVC-U)*

EN 1451, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Polypropylene (PP)*

EN 1453, *Plastics piping systems with structured-wall pipes for soil and waste discharge (low and high temperature) inside buildings – Unplasticized poly(vinyl chloride) (PVC-U)*

EN 1455, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Acrylonitrile-butadiene-styrene (ABS)*

EN 1519, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Polyethylene (PE)*

EN 1565, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Styrene copolymer blends (SAN+PVC)*

EN 1566, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Chlorinated poly(vinyl chloride) (PVC-C)*

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, Former Yugoslav Republic of Macedonia, 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 pipes, fittings, brackets and the system of unplasticized poly(vinyl chloride) (PVC-U) intended for use as above-ground external rainwater piping systems.

It also specifies:

a) The requirements for metallic brackets.

b) Both solid wall pipes and fittings, (i.e. product manufactured from a single layer), as well as solid wall multi-layer pipes.

c) The test parameters for the test methods referred to in this standard.

Pipes can be used in conjunction with fittings and brackets of acrylic materials provided these polymers meet the performance requirements of this standard.

The products are usually used in conjunction with gutters conforming to EN 607 [1]. They are not intended for use with products conforming to EN 612 [2].

This standard is applicable to PVC-U rainwater systems of circular, square, rectangular or any other shape with sealed (rubber ring or solvent cement) or unsealed joints.

This standard covers a range of pipes and fittings sizes.

NOTE 1 It is the responsibility of the purchaser or specifier to make the appropriate selections from the size range to take into account their particular requirements and any relevant national regulations and installation practices or codes.

NOTE 2 The term “rainwater” in this standard is used also to encompass “surface water” (as defined in EN 752 [6]) run-off from buildings.

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 513:1999, *Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors - Determination of the resistance to artificial weathering*

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 1462, *Brackets for eaves gutters - Requirements and testing*

EN 12095, *Plastics piping systems - Brackets for rainwater piping systems - Test method for bracket strength*

CEN/TS 14541:2013, *Plastics pipes and fittings - Characteristics for utilisation of non-virgin PVC-U, PP and PE materials*

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

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

EN 20105-AO2, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour (ISO 105-A02)*

EN ISO 306, *Plastics - Thermoplastic materials - Determination of Vicat softening temperature (VST) (ISO 306)*

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

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

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

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

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

EN ISO 4892-2, *Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps (ISO 4892-2)*

EN ISO 4892-3, *Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps (ISO 4892-3)*

EN ISO 8256, *Plastics - Determination of tensile-impact strength (ISO 8256)*

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

ISO 6259-2, *Thermoplastics pipes — Determination of tensile properties — Part 2: Pipes made of unplasticized poly(vinyl chloride) (PVC-U), chlorinated poly (vinyl chloride) (PVC-C) and high-impact poly (vinyl chloride) (PVC-HI)*

ISO 13254, *Thermoplastics piping systems for non-pressure applications — Test method for water tightness*

3 Terms, definitions, symbols and abbreviations

For the purposes of this document, the following terms, definitions, symbols and abbreviations apply.

3.1 Terms and definitions

In addition to the terms and definitions given below, the terms and definitions given in EN ISO 472 and EN ISO 1043-1 apply.

3.1.1
nominal size DN
numerical designation of the size of a component, other than a component designated by thread size, which is approximately equal to the manufacturing dimension, in millimetres (mm)

3.1.2
nominal size DN/OD
nominal size, related to the outside diameter

3.1.3
nominal outside diameter (d_n)
specified outside diameter, in millimetres, assigned to a nominal size DN/OD

3.1.4
outside diameter (d_e)
value of the measurement of the outside diameter through its cross-section at any point of a pipe or spigot of a fitting, rounded to the next greater 0,1 mm

3.1.5
mean outside diameter (d_{em})
value of the measurement of the outer circumference of a pipe or spigot of a fitting in any cross-section, divided by π (≈3,142), rounded to the next greater 0,1 mm

3.1.6
mean inside diameter of a pipe (d_{im})
arithmetical mean of a number of measurements of the inside diameter of a pipe in the same cross-section

3.1.7
mean inside diameter of a socket (d_{sm})
arithmetical mean of a number of measurements of the inside diameter of a socket in the same cross-section

3.1.8
wall thickness (e)
value of the measurement of the wall thickness at any point around the circumference of a component rounded to the next greater 0,1 mm

3.1.9
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

3.2 Definitions of multilayer pipes

NOTE: These definitions were taken from CEN ISO/TR 27165 [5].

3.2.1
solid wall multilayer pipe
pipe with smooth internal and external surface, having co-extruded layers on either or both the outside and/or inside of the pipe

3.2.2
external layer of multilayer pipe
layer subject to direct UV exposure

3.2.3
internal layer of multilayer pipe
layer not subject to direct UV exposure

3.3 Material terms and definitions

3.3.1
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 reprocessed or recycled material has been added

3.3.2
own reprocessed material
material prepared from rejected unused pipes, gutters or fittings, including trimmings from the production of pipes, gutters 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

3.3.3
external reprocessed material
material comprising either one of the following forms:

a) material from rejected unused pipes, gutters 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 PVC-U products other than pipes and fittings, regardless of where they are manufactured

3.3.4
recycled material
material comprising either of the following forms:

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

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

3.4 Definitions for brackets

3.4.1
anchor bracket
bracket designed to be fixed to a wall or other support and attached to a socket of a pipe or fitting to prevent the socket from moving under the effect of thermal expansion

Note 1 to entry: Some anchor brackets can be adapted to act as a guide bracket (see 3.4.2).

3.4.2
guide bracket
bracket designed to be fixed to a wall or other support and to fit a pipe sufficiently loosely to allow longitudinal thermal movement whilst preventing the pipe from bowing between anchor brackets

Note 1 to entry: By fixing a guide bracket tightly below a fitting on vertical pipework, it can be made to act as an anchor bracket (see 3.4.1).

3.5 Symbols

For the purposes of this document, the following symbols apply.

A	length of engagement
C	depth of sealing zone
d_e	outside diameter
d_{em}	mean outside diameter
d_{im}	mean inside diameter of pipe or spigot
d_n	nominal outside diameter
d_s	inside diameter of a socket
d_{sm}	mean inside diameter of a socket
e	wall thickness (at any point)
e_m	mean wall thickness
e_2	wall thickness of a socket
e_3	wall thickness at the groove
L_1	length of spigot
L_2	length of socket
l	effective length of a pipe
Z_d	design length (Z_d length) of a fitting
α	nominal angle of a fitting

3.6 Abbreviations

For the purposes of this document, the following abbreviations apply.

DN	nominal size
DN/OD	nominal size, outside diameter related
PVC-U	unplasticized poly(vinyl chloride)
TIR	true impact rate

4 Material

4.1 PVC-U material

The compound/ formulation shall be PVC to which are added those additives that are needed to facilitate the manufacture of components conforming to the requirements of this standard.

The PVC content shall be at least 80 % by mass for pipes and 85 % by mass for injection-moulded fittings and brackets and shall be determined by calculation. In case of dispute, the PVC content can also be determined in accordance with EN 1905.

4.2 Other materials

Fittings, brackets and the external layer of the pipe may be made from acrylic polymers provided they meet the requirements in Table 12.

4.3 Utilization of non-virgin material

Utilization of non-virgin material shall conform to Annex A (normative).

4.4 Sealing ring retaining means

Sealing rings may be retained using means made from polymers other than PVC-U, provided the joints conform to the requirements given in Table 12.

4.5 Metallic brackets

All such components shall fulfil the material and corrosion resistance requirements of EN 1462.

5 General characteristics - appearance

When viewed without magnification, the internal and external surfaces of pipes and fittings shall be smooth, clean and free from grooving, blistering, impurities, pores or other surface irregularity likely to prevent conformity of pipes and fittings to this standard. Each end of a pipe or a fitting shall be cleanly cut, if applicable, and shall be square to its axis.

6 Geometrical characteristics

6.1 General

Dimensions shall be measured in accordance with EN ISO 3126.

In case of dispute the reference temperature is (23 ± 2) °C.

NOTE Figures 1 to 12 are schematic sketches only, to indicate the relevant dimensions. They do not necessarily represent manufactured components.

6.2 Dimensions of pipes

6.2.1 Diameters of circular pipes

The mean diameters of circular pipes shall conform to Table 1.

Table 1 — Pipe diameters

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter	Mean outside diameter		Mean inside diameter	Internal cross-sectional area [a] (mm^2)
	d_n	$d_{em,min}$	$d_{em,max}$	$d_{im,min}$	
50	50	50,0	50,3	46,3	1684
53 [b]	53	53,0	53,3	49,3	1909
60	60	60,0	60,**3**	56,3	2490
63	63	63,0	63,3	59,3	2762
68 [b]	68	68,3	68,7	64,6	3278
70	70	70,0	70,4	66,3	3452
75	75	75,0	75,4	71,3	3993
80	80	80,0	80,4	76,0	4536
82	82	82,0	82,4	78,0	4788
90	90	90,0	90,4	85,6	5755
100	100	100,0	100,4	95,4	7148
105 [b]	105	105,5	105,9	100,7	7964
110	110	110,0	110,4	104,7	8610
125	125	125,0	125,4	119,1	11141
140	140	140,0	140,5	133,6	14019
160	160	160,0	160,5	152,5	18265

[a] For the determination of the wall thickness of non-circular pipes and their sockets, see 6.2.4.2.

[b] These sizes are based on the inside diameter series in EN 476 and are not interchangeable with other pipes conforming to the standards listed in the foreword.

6.2.2 Outside dimensions and tolerances of non-circular pipes

The pipe cross-section may be square, rectangular or any other shape. The external sizes shall be given by the manufacturer. The tolerances on the external sizes shall conform to Table 1 using the largest dimension as the nominal size and rounding down to the nearest outside diameter as given in the table. See Figure 1.

EXAMPLE For a rectangular pipe of 80 × 65 the applicable tolerances would be as DN 80.

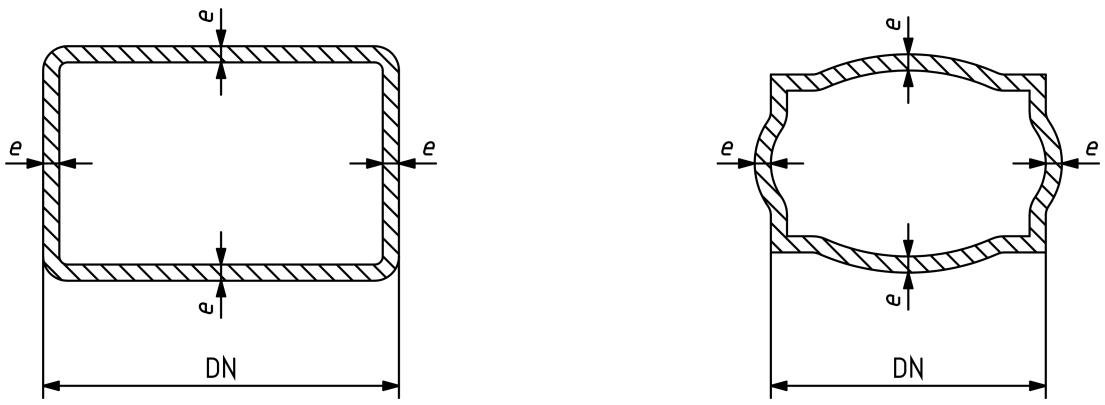

Figure 1 — Dimensions of non-circular pipes

6.2.3 Effective length of pipes

The effective length (useful length) of a pipe, *l*, shall be not less than that specified by the manufacturer when measured as shown in Figure 2.

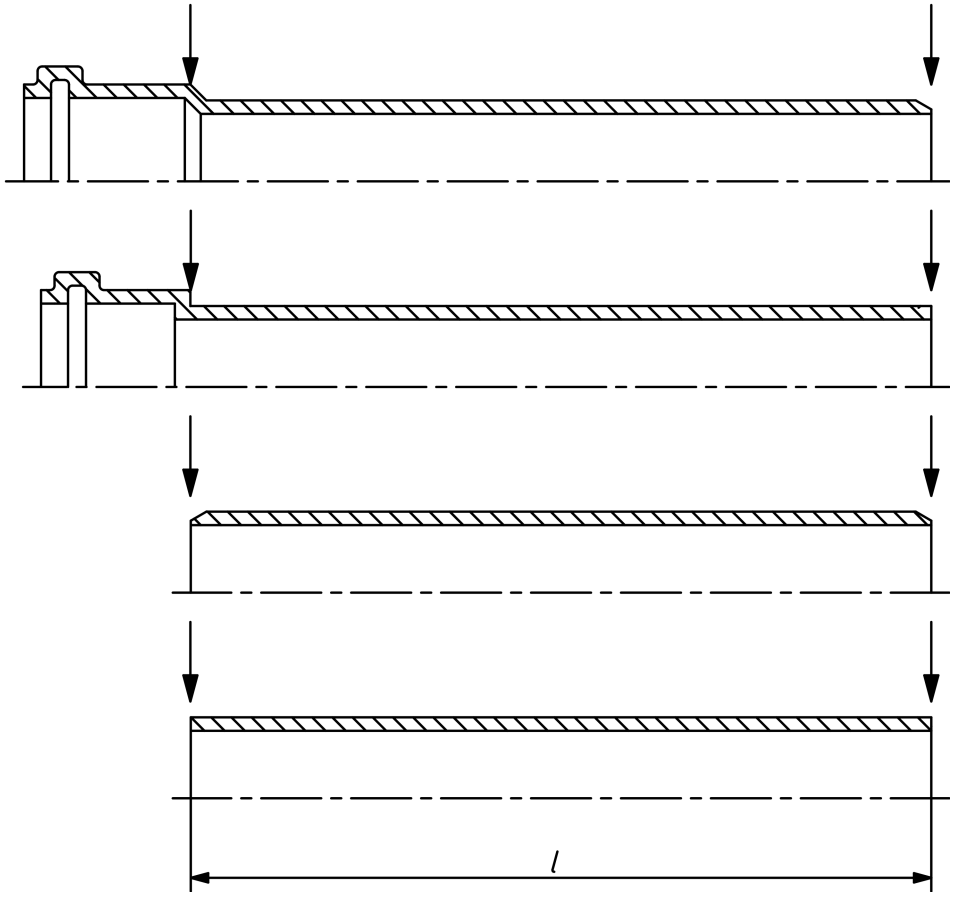

Figure 2 — Effective length of pipe

6.2.4 Wall thicknesses of pipes and their sockets

6.2.4.1 Wall thicknesses of pipes and their sockets - circular

The wall thickness of circular pipes and their sockets, including any layers, shall conform to Table 2 when measured at the location points as shown in Figure 3.

Table 2 — Wall thicknesses of pipes, sockets and spigots

Dimensions in millimetres

Nominal size **DN/OD**	**Nominal outside diameter** d_n	**Wall thickness of pipes and fittings**				
		sealed system			unsealed system	
		e_{min}	$e_{2,min}$	$e_{3,min}$ [a]	e_{min}	$e_{2,min}$
50	50	1,5	1,4	1,0	1,2	1,0
53 [b]	53	1,5	1,4	1,0	1,3	1,2
60	60	1,5	1,4	1,0	1,3	1,2
63	63	1,5	1,4	1,0	1,3	1,2
68 [b]	68	1,5	1,4	1,0	1,5	1,4
70	70	1,5	1,4	1,0	1,5	1,4
75	75	1,5	1,4	1,0	1,5	1,4
80	80	1,6	1,4	1,0	1,5	1,4
82	82	1,6	1,4	1,0	1,5	1,4
90	90	1,8	1,6	1,0	1,8	1,6
100	100	1,9	1,7	1,0	1,8	1,7
105 [b]	105	2,0	1,7	1,1	1,8	1,7
110	110	2,2	2,0	1,2	2,0	1,8
125	125	2,5	2,2	1,4	-	-
140	140	2,7	2,4	1,5	-	-
160	160	3,2	2,9	1,8	-	-

[a] Only applicable to ring seal systems see Figure 3.

[b] These sizes are based on the inside diameter series in EN 476 and are not interchangeable with other pipes conforming to the standards listed in the foreword.

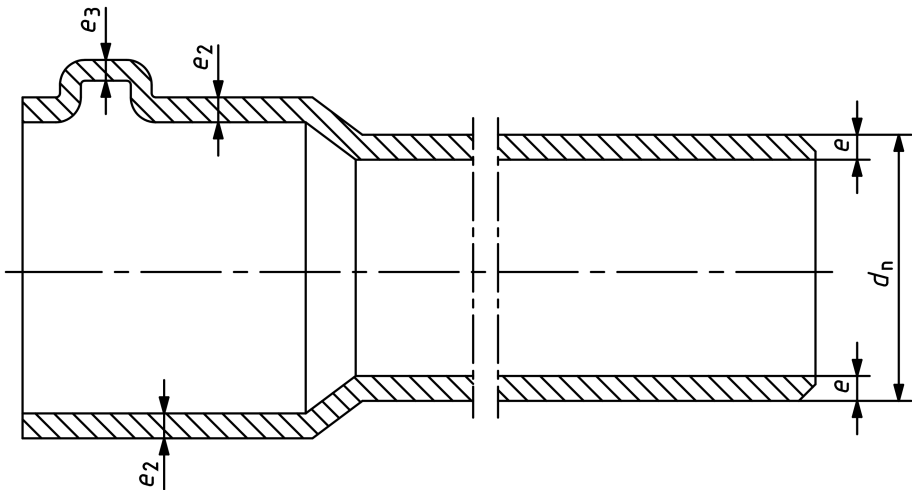

Figure 3 — Wall thickness location points

6.2.4.2 Wall thicknesses of pipes and sockets - non-circular

The wall thickness of non-circular pipes and their sockets, including any outer layer, when measured at the location points as shown in Figure 3 shall be determined as follows:

a) determine the internal cross-sectional area;

b) round down to the next lower value in Table 1 and identify the corresponding circular nominal size;

c) use the wall thickness values for pipes and sockets as defined in Table 2 for that nominal size, which apply only to the middle of the faces of the non-circular pipe and socket (see Figure 1).

6.2.5 Dimensions of sockets

The dimensions of pipe sockets (see Figures 4 and 5) shall be the same as for fittings (see 6.4).

6.3 Dimensions of fittings

6.3.1 Nominal size(s)

The nominal size of a fitting shall correspond to and be designated by the nominal size of the pipe which it is intended to fit. Non-circular fittings are sized in the same manner in accordance with 6.2.2

6.3.2 Wall thicknesses of fittings

The wall thickness of the body of fittings, $e_{\min}$, sockets, $e_{2,\min}$, and ring seal grooves of sealed systems, $e_{3,\min}$, shall conform to Table 2 and Figure 3.

6.3.3 Angles

For bends the nominal angles, α, shall be 87,5/90°, 75°, 67,5°, 60° and 45°.

For branches and double branches, the nominal angles, α, shall be 87,5/90°, 67,5°, 60° and 45°.

If other angles are required, they shall be agreed between manufacturer and purchaser and be identified accordingly.

6.3.4 Design lengths (Z_d)

The Z_d length(s) of fittings should be given by the manufacturer.

NOTE The Z_d lengths are intended to assist in the design of moulds and are not intended to be used for quality control purposes. ISO 265-1 can be used as a guideline.

6.4 Diameters and lengths of sockets and spigots

6.4.1 Ring seal sockets and spigots

The diameters and lengths of ring seal sockets and spigots (see Figures 4, 5 and 6) shall conform to Table 3.

Where sealing rings are firmly retained and have multiple sealing zones, the dimensions $A_{\min}$ and $C_{\max}$ shall be measured to the effective sealing point as specified by the manufacturer.

Table 3 — Diameters and lengths of ring seal sockets and related spigots

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter	Mean inside diameter [a]	Lengths of sockets and spigots		
	d_n	$d_{sm,min}$	A_{min}	C_{max}	$L_{1,min}$
50	50	50,4	20	18	37
53 [b]	53	53,4	21	18	37
60	60	60,4	22	18	37
63	63	63,4	22	18	37
68 [b]	68	68,8	24	19	43
70	70	70,4	24	19	43
75	75	75,5	25	20	43
80	80	80,5	26	21	44
82	82	82,5	26	21	44
90	90	90,5	28	23	46
100	100	100,5	30	24	46
105 [b]	105	106,0	31	25	52
110	110	110,5	32	26	54
125	125	125,5	35	28	60
140	140	140,6	39	30	60
160	160	160,6	42	32	60

[a] Calculated as follows: $d_{sm,min} = (d_{em,max} + 0,1)$ mm.

[b] These sizes are based on the inside diameter series in EN 476 and are not interchangeable with other pipes conforming to the standards listed in the foreword.

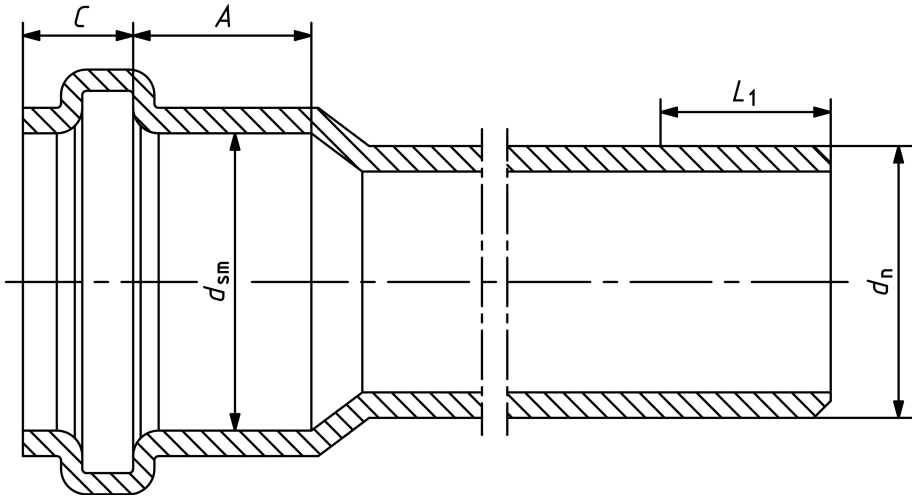

Figure 4 — Location of points of measurement for ring seal sockets and spigots

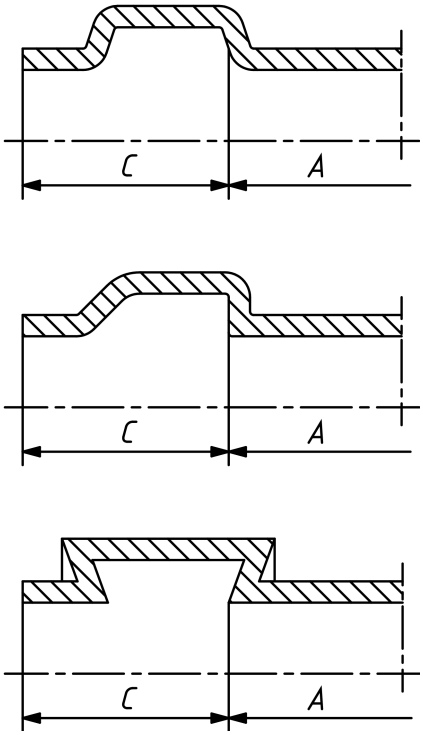

Figure 5 — Typical groove designs for elastomeric seal ring sockets

Where sealing rings are firmly retained, the minimum value for A and the maximum value for C (see Figure 5) shall be measured to the effective sealing point (see Figure 6) as specified by the manufacturer and, if applicable, in agreement with a certification body.

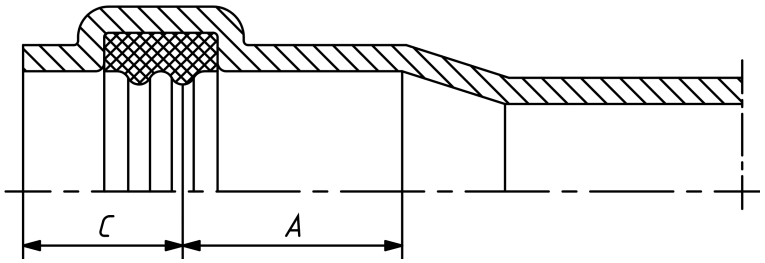

Figure 6 — Example for measuring the effective sealing point

6.4.2 Solvent cement and unsealed sockets and spigots

The diameters and lengths of solvent cement and unsealed sockets and spigots (see Figure 7) shall conform to Table 4.

The manufacturer shall declare whether the sockets are tapered or parallel. If parallel the d_{sm} dimensions shall apply over the entire socket. If tapered the d_{sm} dimension shall apply at the mid mean point with a maximum taper angle of 20' per side.

Table 4 — Diameters and lengths of solvent cement sockets and sockets for unsealed systems and their related spigots

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter	Mean inside diameter		Lengths of sockets and spigots
	d_n	$d_{sm,min}$	$d_{sm,max}$ [a]	$L_{1,min}$ and $L_{2,min}$ [b]
50	50	50,1	50,4	30
53 [c]	53	53,1	53,5	31
60	60	60,1	60,5	35
63	63	63,1	63,5	36
68 [c]	68	68,5	68,9	37
70	70	70,1	70,5	37
75	75	75,2	75,6	40
80	80	80,2	80,6	42
82	82	82,2	82,6	42
90	90	90,2	90,6	46
100	100	100,2	100,6	46
105 [c]	105	105,7	106,1	47
110	110	110,2	110,6	48
125	125	125,2	125,7	51
140	140	140,3	140,8	55
160	160	160,3	160,8	58

[a] $d_{sm,max}$-values do not apply to unsealed systems.

[b] For unsealed systems the $L_{1,min}$ and $L_{2,min}$ values may be reduced to $0{,}75L_{1,min}$.

[c] These sizes are based on the inside diameter series in EN 476 and are not interchangeable with other pipes conforming to the standards listed in the foreword.

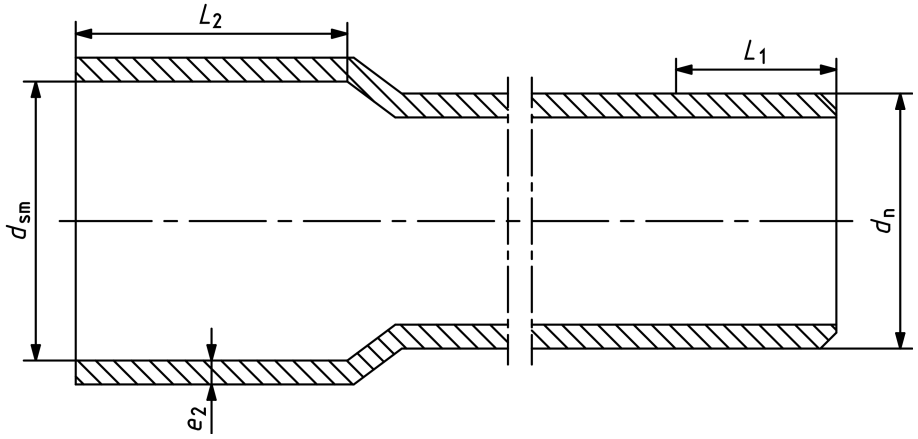

Figure 7 — Location of points of measurement of solvent cement sockets, unsealed sockets and spigots

6.4.3 Non-circular sockets and spigots

Non-circular sockets shall be sized as detailed in 6.2.2 using the maximum dimension of the pipe. The tolerances and dimensions given in Tables 3 or 4 shall then be applied accordingly.

6.4.4 Spigot sleeves

Spigot sleeves intended for jointing unsealed systems to the inside diameter of pipes shall not be subject to Table 1 requirements but shall conform to Table 5 and Figure 10.

Table 5 — Minimum inside diameter of spigot sleeves

Dimensions in millimetres

Nominal size **DN/OD**	**Nominal outside diameter** d_n	**Minimum mean inside diameter** $d_{im,min}$
50	50	40
53 [a]	53	43
60	60	50
63	63	53
68 [a]	68	58
70	70	60
75	75	65
80	80	70
82	82	72
90	90	80
100	100	90
105 [a]	105	95
110	110	95

[a] These sizes are based on the inside diameter series in EN 476 and are not interchangeable with other pipes conforming to the standards listed in the foreword.

6.5 Types of fittings

This standard includes all fittings likely to be connected to the rainwater pipe system.

Typical examples of branches, bends, pipe couplers, pipe couplers with fixing lugs, outlet shoes and transition fittings are shown in Figures 8 to 12.

Transition fittings include round to square adaptors, reducers, rainwater heads, adaptors to other materials and adaptors to drainage systems including gullies.

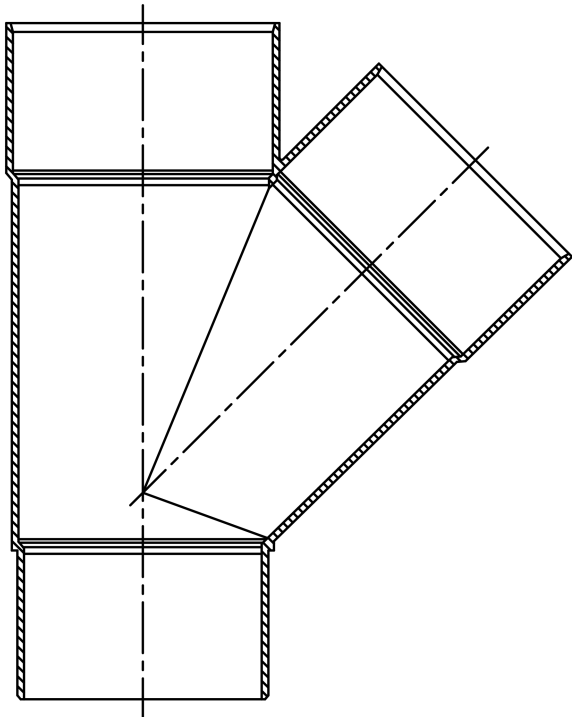

Figure 8 — Typical Branch with outlet spigot sleeve to fit to internal pipe bore

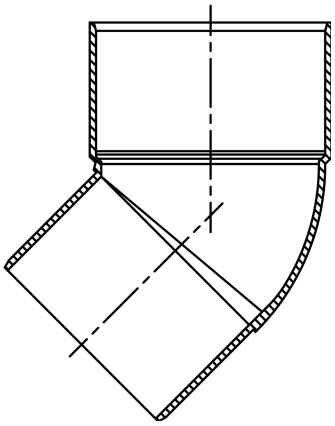

Figure 9 — Typical Bend with outlet spigot sleeve to fit to internal pipe bore

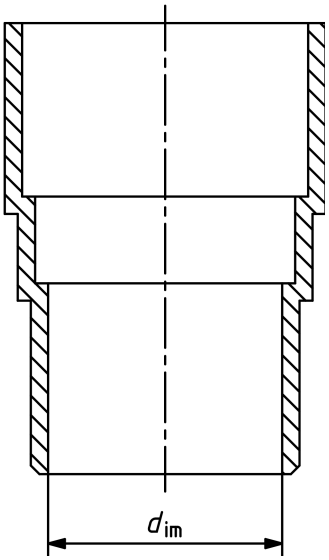

Figure 10 — Typical pipe coupler with spigot sleeve

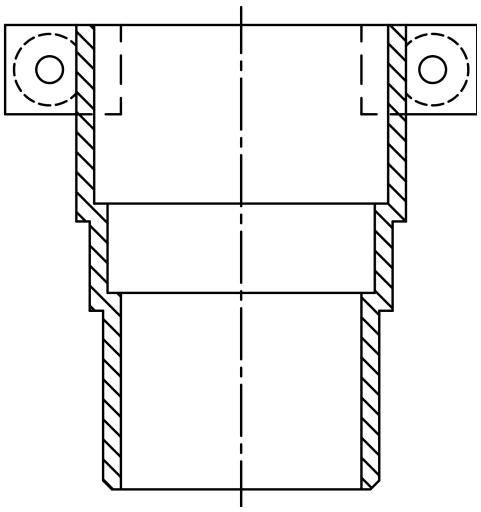

Figure 11 — Typical pipe coupler with fixing lugs and outlet spigot sleeve

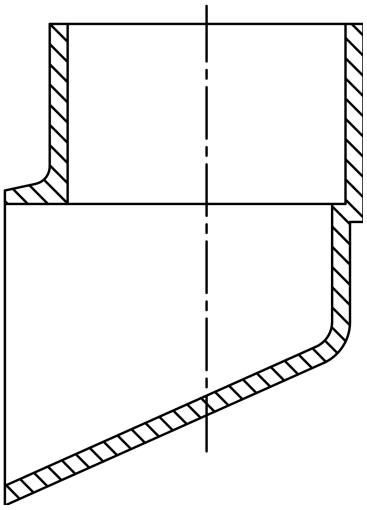

Figure 12 — Typical outlet shoe

6.6 Brackets

The nominal size of the bracket shall correspond to and be designated by the nominal size of pipe or socket which it is intended to fit. Non-circular brackets shall be sized in accordance with 6.2.2

7 Mechanical characteristics

7.1 Pipes

When tested in accordance with the test methods as specified in Table 6 using the indicated parameters, the pipe shall have mechanical characteristics conforming to the requirements given in Table 6.

Non-circular sections sized as described in 6.2.2 shall be tested in accordance with the corresponding size values for circular pipe. When impact testing non-circular pipes they shall be struck centrally on the widest flat face or flattest side. The V-block described in ISO 3127 shall also be modified to fit the non-circular pipe profile. Non-circular pipes shall be struck only once per specimen.

Table 6 — Mechanical characteristics of pipes

Characteristics	Requirements	Test parameters		Test method
Impact resistance (round- the - clock method)	TIR ≤ 10 %	Type of striker for d_n < 110 mm: d_n ≥ 110 mm: Mass of striker Fall of striker Conditioning medium Condition and test temperature	 d 25 d 90 Shall conform to Table 7 Shall conform to Table 7 Water or air 0 °C	ISO 3127
Tensile impact strength [a]	≥ 500 kJ/m^2	Machined specimen Test temperature	Type 2, 3 or 5 [b] in accordance with EN ISO 8256 (23 ± 2) °C	Method A of EN ISO 8256
Tensile strength	≥ 42 N/mm^2	Strain speed Test piece	5 mm/min Type 1 conforming to ISO 6259-2	ISO 6259-2
Elongation at break	≥ 100 %	Strain speed Test piece	5 mm/min Type 1 conforming to ISO 6259-2	ISO 6259-2

[a] This type test also relates to the ageing of pipes (see Table 12).

[b] In case of dispute test piece of type 5 shall be used.

Table 7 — Falling weight impact energy

Nominal size DN/OD	Nominal outside diameter d_n mm	Mass of striker kg	Fall height m
50	50	0,5	1,0
53 [a]	53	0,5	1,0
60	60	0,8	1,0
63	63	0,8	1,0
68 [a]	68	0,8	1,0
70	70	0,8	1,0
75	75	0,8	1,0
80	80	1,25 [b]	1,0 [b]
82	82	1,25 [b]	1,0 [b]
90	90	0,8	2,0
100	100	1,25	2,0
105 [a]	105	1,6	2,0
110	110	1,6	2,0
125	125	2,0	2,0
140	140	2,5	2,0
160	160	3,2	2,0

[a] These sizes are based on the inside diameter series in EN 476 and are not interchangeable with other pipes conforming to the standard

[b] Alternatively a weight of 0,8 kg can be used from a height of 1,5m.

7.2 Mechanical characteristics of anchor brackets

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

Table 8 — Mechanical characteristics of brackets

Characteristic	Requirement	Test parameters	Test method
Bracket strength	Permanent distortion ≤ 3 mm	Shall conform to Table 9	EN 12095

Table 9 — Vertical test loads on brackets

Nominal size DN/OD	Nominal outside diameter d_n mm	Vertical test load on bracket [a] kg
50	50	9,1
53 [b]	53	12,0
60	60	14,0
63	63	15,1
68 [b]	68	17,9
70	70	19,4
75	75	21,8
80	80	25,0
82	82	25,9
90	90	31,8
100	100	39,7
105 [b]	105	44,1
110	110	47,8
125	125	61,7
140	140	77,2
160	160	101,3

[a] Calculation based on weight of 5,5 m column of water.

[b] These sizes are based on the inside diameter series in EN 476 and are not interchangeable with other pipes conforming to the standards listed in the foreword.

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.

Table 10 — Physical characteristics of pipes

Characteristic	Requirement	Test parameters		Test method
Vicat softening temperature [a]	≥ 75 °C	Shall conform to EN ISO 306		EN ISO 306
Longitudinal reversion	≤ 3 % The pipe shall exhibit no bubbles or cracks	Test temperature Immersion time	(100 ± 2) °C (15 ± 2) min	Method A of EN ISO 2505 Liquid
		or [b]		
		Test-temperature Immersion time	(100 ± 2) °C (30 ± 2) min	Method B of EN ISO 2505 Air

[a] Multi-layer pipes shall only be tested on the internal PVC-U surface.

[b] Method B shall be used in cases of dispute.

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, except for any seal retaining means, shall have physical characteristics conforming to the requirements given in Table 11.

Table 11 — Physical characteristics of fittings

Characteristic	Requirement	Test parameters		Test method
Effects of heating for PVC-U fittings	[a] and [b]	Test temperature Heating time	(150 ± 2) °C (15 ± 2) min	Method A of EN ISO 580: Air oven
Effects of heating for Acrylic fittings	[a] and [b]	Test temperature Heating time	(120 ± 2) °C (15 ± 2) min	Method A of EN ISO 580: Air oven
Vicat softening temperature	≥ 75 °C	Shall conform to EN ISO 306		EN ISO 306

[a] 1) Within a radius of 15 times the wall thickness around the injection point, the depth of cracks, delamination or blisters shall not exceed 50 % of the wall thickness at that point.

2) Within a distance of 10 times the wall thickness from the diaphragm zone, the depth of cracks, delamination or blisters shall not exceed 50 % of the wall thickness at that point.

3) Within a distance of 10 times the wall thickness from the ring gate, the length of cracks, shall not exceed 50 % of the wall thickness at that point.

4) The weld line shall not have opened more than 50 % of the wall thickness at the line.

5) In all other parts of the surface the depths of cracks and delaminations shall not exceed 30 % of the wall thickness at that point. Blisters shall not exceed a length of 10 times the wall thickness.

[b] After cutting through the fitting, the cut surfaces shall show no foreign particles, when viewed without magnification.

9 Fitness for purpose of joint and system

When tested in accordance with the test methods specified in Table 12 pipes, fittings and their assemblies shall conform to the requirements given in Table 12.

Table 12 — Fitness for purpose characteristics of joint or system

Characteristic	Requirement	Test parameters		Test method
Water tightness [a]	No leakage	Shall conform to ISO 13254		ISO 13254
Artificial ageing [b] (colour fastness)	The change of colour shall not exceed stage 3 of the grey scale according to EN 20105-A02	Radiation energy Cycling and temperature regime	2,6 GJ/m^2 Method 1 of EN 513:1999	Method A of EN ISO 4892-2 (Xenon test): artificial weathering
		or [c]		
		Exposure time irradiance value Cycle: - irradiation - condensation	1600 h (UVA 351 lamp [d]) 0,76 $Wm^{-2} \times nm^{-1}$ at 340 nm 6h at (50 ± 5) °C 2h at (50 ± 5) °C	EN ISO 4892-3 (QUV test)
Tensile impact strength after ageing (pipe only)	≥ 50 % of the value before ageing	Test temperature Test piece	(23 ± 2) °C Shall conform to Table 6	Method A of EN ISO 8256

[a] Water tightness requirements do not apply to unsealed systems.

[b] This is intended as a type test for each formulation and colour on samples taken from extruded or moulded product as appropriate. Exposure shall be applied to the external surface only.

[c] Where in case of dispute, the method of EN ISO 4892-2 (Xenon test) shall be used.

[d] Experience has shown that these test parameters provide reliable weathering data.

10 Sealing rings

Sealing rings shall conform to all requirements of EN 681-1 or EN 681-2, as applicable they shall have no detrimental effect on the properties of the pipe and of the fittings

11 Adhesives

The adhesive shall comply with all requirements of EN 14680.

As an alternative, adhesive complying with all requirements EN 14814 is deemed to be suitable.

The adhesive shall have no detrimental effects on the properties of the pipe and of the fittings

12 Marking

12.1 General

Marking elements shall be labelled or printed or formed directly on the pipe or the fitting, in such a way that after storage, weathering and handling, and installation, legibility is maintained in accordance with one of the following levels.

One of the following three levels of legibility of the marking is specified for the individual marking aspect in the column “Minimum durability of legibility of marking” in Tables 13 and 14.

The symbols for the legibility mean the following:

a durable in use;

b legible until the system is installed;

c marking on the packaging, legible until the component 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 use of e.g. detergents 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.

If printing is used, the colouring of the printed information shall differ from the basic colouring of the pipe or the fitting.

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

12.2 Minimum required marking of pipes

Pipes shall be marked at least once per pipe.

The marking shall conform to Table 13.

Table 13 — Minimum required marking of pipe

Aspects	Marking or symbol	Durability of legibility of marking
Material	PVC or PVC-U	a
Manufacturer	Name or trade mark	a
Number of this standard	EN 12200	a
Pipe size [a]	e.g. 80 or 65 × 65	a
Wall thickness (*e*)	e.g. 1,6	a
Manufacturing information	[b]	c

[a] Non-circular pipes shall be designated as 6.2.2.

[b] For providing traceability the following details shall be given:

1) the production date (at a minimum the, year and month) in figures or in code;

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

NOTE The R symbol may be used as a code for identification of Rainwater application.

12.3 Minimum required marking of fittings

The marking of fittings shall be in accordance with Table 14.

Table 14 — Minimum required marking of fittings

Aspects	Marking or symbol	Durability of legibility of marking
Material	PVC or PVC-U or other relevant symbol	a
Manufacturer	Name or trade mark	a
Number of this standard	EN 12200	a
Nominal size [a]	e.g. 80 or 65 × 65	a
Nominal angle α	e.g. 45°	a
Manufacturing information	[b]	c

[a] Fittings for non-circular pipes shall be designated as 6.2.2.

[b] For providing traceability the following details shall be given:

1) the production date (at a minimum the year), in figures or in code;

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

NOTE The R symbol may be used as a code for identification of Rainwater application.

12.4 Minimum required marking of brackets

The marking shall contain all information as specified in Table 14 and may be placed on the product or on the packaging or on a label.

In addition metal brackets shall be marked with the corrosion class as specified in EN 1462.

If marking details are formed directly on the brackets it shall be done in such a way that the marking does not initiate cracks or other types of failure.

Annex A
(normative)

Utilization of non-virgin material

A.1 Own reprocessed material

A.1.1 The use of clean own reprocessed material from solid wall (single layer) pipes and fittings complying with this standard and gutters complying with EN 607 [1] is permitted without limitations.

A.1.2 The use of clean own reprocessed material from the production of pipes and fittings from standards other than those listed in A.1.1 is permitted without limitations in any internal layer of multilayer pipe and up to the approved type test level in solid wall single layer.

If fitting material is used for the production of pipes it shall be considered as recycled material.

NOTE For the purposes of this clause the term extruded products means extruded pipes, gutters and any parts of a fabricated fitting which is made from an extrusion. The term injection moulded products means injection-moulded fittings and injection-moulded parts of a fabricated fitting.

A.2 External reprocessed and recycled material with agreed specification

A.2.1 Material from PVC-U pipes, gutters and fittings

External reprocessed and recycled material with an agreed specification from PVC-U pipes, gutters and fittings that are available in relevant quantities and intervals of time is permitted to be used alone or added to virgin or own reprocessed material or a mixture of those two materials for the production of pipes, provided that all the following conditions a) to f) are met.

a) the compound/formulation shall comply with the requirements given in 4.1;

b) a specification for the external reprocessed or recycled material shall be agreed between the supplier and the pipe manufacturer, covering at least the characteristics given in CEN/TS 14541:2013, Table 1;

c) all other applicable conditions given CEN/TS 14541:2013, 4.2 shall be met;

d) the maximum quantity of external reprocessed and recycled material that is intended to be added shall be specified by the pipe manufacturer;

e) the quantity of external reprocessed and recycled material that is actually added in each production series shall be recorded by the pipe manufacturer;

f) type testing shall be carried out on the end product with the maximum specified amount of and with each form of external reprocessed or recycled material with an agreed specification. Approved results shall be taken as proving conformity also of pipes containing lower levels of additions of external reprocessed or recycled material.

The use of reprocessed and recycled materials is not permitted in the outer layer of multilayer pipe and solid wall pipe where exposed to UV.

A.2.2 Material not from PVC-U pipes, gutters and fittings

External reprocessed and recycled material with an agreed specification from PVC-U products that are

available in relevant quantities and intervals of time shall be permitted to be used up to 100 % by mass or added to virgin or own reprocessed material or a mixture of those two materials for the inner layer of pipes not subject to UV under the following conditions:

a) all of the conditions specified in a) to f) of A.2.1 are met;

b) the external reprocessed and recycled material shall be clean and comply with the provisions given in Table A.1.

Table A.1 — Requirements for external reprocessed and recycled material from PVC-U products other than pipes gutters and fittings

Characteristic	Requirements	Test method
PVC-content	4.1	EN 1905
K-value	56 ≤ *K*-value ≤ 70	EN ISO 13229
Vicat softening temperature (VST)	≥ 62 °C	EN ISO 306
Type of stabilizer [a]	To comply with national regulations	
Impurities [b] for particle size ≤ 1000 μm for 1000 μm < particle size < 1400 μm	 ≤ 1500 ppm ≤ 1500 ppm	EN 15346:2014, Annex C or evaluation of sheets or evaluation of micronized material
Particle size > 1000 μm < 1400 μm	 max 15 % by mass 100 % by mass	Sieve analysis

[a] Attention is drawn to possible national regulations regarding heavy metals, e.g. cadmium.

[b] Based on the source of material and the recycling process a relevant test method and requirements shall be agreed and stated in the specification. Both the test method and the requirements shall be published.

A.3 External reprocessed and recycled material not covered by an agreed specification

A.3.1 Material from PVC-U pipes and fittings

External reprocessed and recycled material not covered by an agreed specification from PVC-U pipes and fittings that are available in random quantities and intervals of time may be added to virgin or own reprocessed material or a mixture of those two materials for the production of the inner layer of multilayer pipes provided that all of the following conditions a) to d) are met:

a) when this material is used, the production shall be considered as at least one batch and shall be tested accordingly;

NOTE Fulfilment of condition a) means that every discrete batch is to be fully tested in accordance with the requirements of this European Standard.

b) the material shall be clean and dry;

c) for internal layers of pipe not subject to U/V up to 100 % of external reprocessed or recycled material is permitted to be added;

d) the quantity of external reprocessed and recycled materials that is actually added in each production series shall be recorded by the pipe manufacturer.

The use of reprocessed and recycled materials is not permitted in the outer layer of multilayer pipe or solid wall pipes where exposed to UV

A.3.2 Material not from PVC-U pipes and fittings

External reprocessed and recycled material not covered by an agreed specification and not from pipes, gutters or fittings are not permitted.

Annex B
(informative)

Survey of possible use of reprocessed and recycled material

Table B.1 — Survey of possible use of reprocessed and recycled material

Material	Application area	Own reprocessed material meeting the requirements of this standard and EN 607 [1]	Own reprocessed material from other standards	External reprocessed and recycled material from pipes and fittings with agreed specification	Reprocessed and recycled material from non-pipes and fittings with agreed specification	Reprocessed and recycled material from pipes and fittings without agreed specification	Reprocessed and recycled material from non-pipes and fittings without agreed specification
Specified in		A.1.1	A.1.2	A.2.1	A.2.2	A.3.1	A.3.2
PVC-U	Solid wall single layer	Up to 100 %	Up to type test approved level	Not permitted	Not permitted	Not permitted	Not permitted
PVC-U	Inner layer of multilayer pipe	Up to 100 %	Up to 100 %	Up to 100 %	Up to 100 %	Up to 100 %	Not permitted
PVC-U	Outer layer of multilayer pipe	Not permitted	Not permitted	Not permitted	Not permitted	Not permitted	Not permitted
PVC-U	Fittings	Up to 100 %	Not permitted	Not permitted	Not permitted	Not permitted	Not permitted

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[2] EN 612: 2005, *Eaves gutters with bead stiffened fronts and rainwater pipes with seamed joints made of metal sheet*

[3] CEN/TS 12200-2:2003, *Plastics rainwater piping systems for above ground external use - Unplasticized poly(vinyl chloride) (PVC-U) - Part 2: Guidance for the assessment of conformity*

[4] EN 12056-3:2000, *Gravity drainage systems inside buildings - Part 3: Roof drainage, layout and calculation*

[5] CEN ISO/TR 27165, *Thermoplastics piping systems - Guidance for definitions of wall constructions for pipes (ISO/TR 27165)*

[6] EN 752:2008, *Drain and sewer systems outside buildings*

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

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

[9] EN ISO 13229, *Thermoplastics piping systems for non-pressure applications - Unplasticized poly(vinyl chloride) (PVC-U) pipes and fittings - Determination of the viscosity number and K-value (ISO 13229)*

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

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