WORKING DRAFT EAST AFRICAN STANDARD

Plastics rainwater piping systems for above ground external use - Unplasticized Polyvinyl chloride (PVC-U) - Specification for Pipes, fittings and the system

EAST AFRICAN COMMUNITY

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the principles and procedures for development of East African Standards.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 047, *Plastic pipes, fittings, valves, piping systems and ducting systems.*

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

Plastics rainwater piping systems for above ground external use - Unplasticized Polyvinyl Chloride (PVC-U) - Specification for Pipes, fittings, and the system

1 Scope

This draft East African standard specifies the requirements for pipes, fittings and the system of un-plasticized poly(vinyl chloride) (PVC-U) intended for use as above-ground external rainwater down pipes.

It also specifies the test parameters for the test methods referred to in this standard.

It 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.

It also specifies requirements for brackets for anchoring the pipes.

NOTE It is the responsibility of the purchaser to specify or 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.

2 Normative references

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

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

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

ISO 23711 *Elastomeric seals — Requirements for materials for pipe joint seals used in water and drainage applications — Thermoplastic elastomers*

ISO 2507-1, *Thermoplastics pipes and fittings — Vicat softening temperature—Part 1: General test method*
ISO 2507-2, *Thermoplastics pipes and fittings — Vicat softening temperature—Part 2: Test conditions for unplasticized poly vinyl chloride (PVC-U) or chlorinated poly(vinyl chloride) (PVC-C) pipes and fittings and for high impact resistance poly(vinyl chloride) (PVC-HI) pipes*
ISO 2505, *Thermoplastics pipes — Longitudinal reversion — Test method and parameters*
ISO 3127, *Thermoplastics pipes — Determination of resistance to external blows — Round-the-clock method*

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

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 13254 *Thermoplastics piping systems for non-pressure applications — Test method for watertightness*

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

EN 10204:1991, *Metallic products — Types of inspection documents*

EN 12095, *Plastics piping systems — Test method for bracket strength*

ISO 105-A02 Textiles — Tests for colour fastness Part A02: Grey scale for assessing change in colour

ISO 527-3, *Plastics — Determination of tensile properties Part 3: Test conditions for film and sheets*

ISO 3126, Plastics piping systems — Plastics components — Determination of dimensions

ISO 8256, *Plastics — Determination of tensile impact strength*

ISO 472, *Plastics vocabulary*

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

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

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

ISO 4892-3, Plastics — Methods of exposure to laboratory light sources Part 3: Fluorescent UV lamps

3 Definitions, symbols and abbreviations

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

3.1 Definitions

In addition to the definitions given below, the definitions given in ISO 472 and 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 (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 pipe thickness at any point around the circumference 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 for brackets

3.2.1
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 Some anchor brackets can be adapted to act as a guide bracket. (see 3.2.2)

3.2.2
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 By fixing an guide bracket tightly below a fitting on vertical pipe work, it can be made to act as an anchor bracket. (See 3.2.1)

3.3 Symbols

A : length of engagement

C : depth of sealing zone

d_s : inside diameter of a socket

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 of a fitting

α : nominal angle of a fitting

3.4 Abbreviations

TIR :true impact rate
BS: British Standard
EN: European Standard

4 Material

4.1 Raw material

The raw material shall be PVC-U to which are added those additives that are needed to facilitate the manufacture of components conforming to the requirements of this standard.

4.2 Utilization of non-virgin material

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

4.3 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.

4.4 Brackets not of PVC-U

All such components shall fulfill the material and corrosion resistance requirements of WD TC 047-03: 2024

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 ISO 3126.

In case of dispute the reference temperature is (23 ± 2) ^{o}C.

NOTE Figures 1 to 11 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 the requirements given in Table 1.

Table 1 — Preferred pipe diameters

Dimensions in millimetres

Nominal size DN/OD [a]	Nominal outside diameter d_n	Mean outside diameter		Mean inside diameter d_{im}, min	Internal cross-sectional area [b] (mm^2)
		d_{em}, min	d_{em}, max		
50	50	50.0	50.3	46.3	1 684
63	63	63.0	63.3	59.3	2 762
75	75	75.0	75.4	71.3	3 993
82	82	82.0	82.4	78.0	4 788
90	90	90.0	90.4	85.6	5 760
110	110	110.0	110.4	104.7	8 619
125	125	125.0	125.4	119.1	11 141
140	140	140.0	140.5	133.6	14 031
160	160	160.0	160.5	152.5	18 280

[a] Nominal sizes 50 <DN/OD<160 mm other than those in the table are permitted. They should be selected from the Renard R40 series or traditional nominal sizes. In such cases the pipe outside diameter tolerance, mean inside diameter and internal cross-sectional area shall be interpolated from the nearest adjacent values above and below in the table.

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

These sizes are based on the inside diameter series in EN 476

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 x 65 the applicable tolerances would be as DN 80.

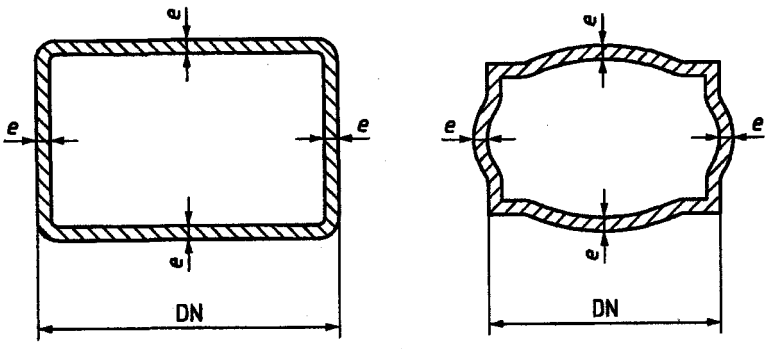

Figure 1 — Dimensions of non-circular pipes

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.

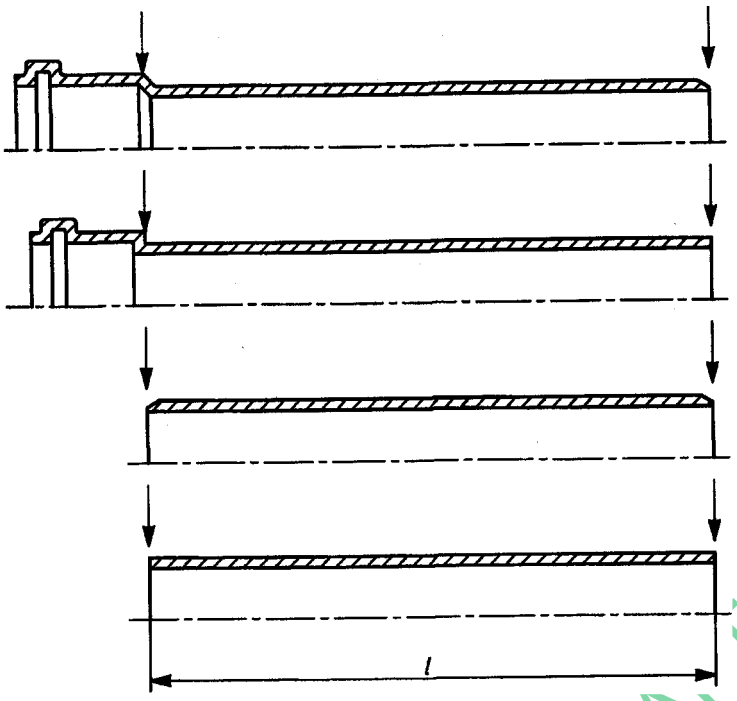

Figure 2 — Effective length of pipe

6.2.4 Wall thicknesses of pipes and sockets

6.2.4.1 Wall thickness of circular pipes and their sockets

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

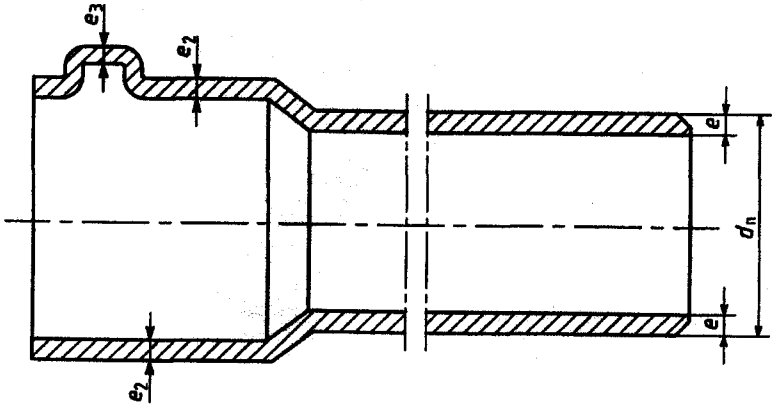

Figure 3 — Wall thickness location points

Table 2 — Wall thicknesses of pipes and pipe sockets

Dimensions in millimetres

Nominal size DN/OD [a)]	Nominal outside diameter d_n	Wall thickness of pipes and fittings				
		Sealed system			Unsealed system	
		e_{min}	$e_{2,min}$	$e_{3,min}$	e_{min}	$e_{2,min}$
50	50	1.5	1.4	1.0	1.2	1.0
63	63	1.5	1.4	1.0	1.3	1.2
75	75	1.5	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
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)] Where non-preferred sizes not listed in the table are manufactured (see footnote a in Table 1) the values of e_{min}, $e_{2,min}$, and $e_{3,min}$ shall be interpolated from the nearest adjacent values both above and below in this table.

These sizes are based on the inside diameter series in EN 476:

6.2.4.2 Wall thickness of non-circular pipes and their sockets

The wall thickness of non-circular pipes and their sockets 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.

Figure 4 provides guidance on how the nominal angle of a bend is measured

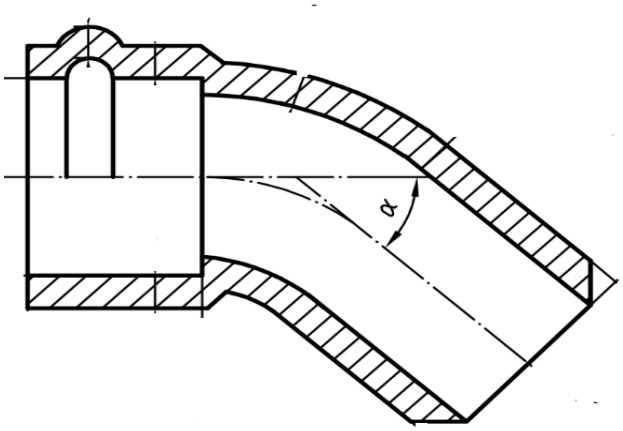

Figure 4 — Guidance on how the nominal angle, α, of a bend is measured

6.3.4 Design lengths (Z_d)

The Z_d-length(s) of fittings shall 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 Figure 5) shall conform to Table 3.

Where sealing rings are firmly fixed and have multiple sealing zones, the dimensions $\boldsymbol{A}_{min}$ and $\boldsymbol{C}_{max.}$ shall be measured to the effective sealing point as specified by the manufacturer.

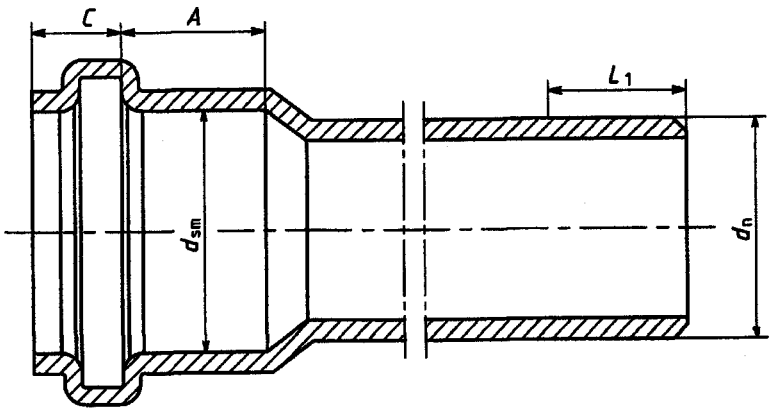

Figure 5 — Location of points of measurement for ring seal sockets and spigots

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

Dimensions in millimetres

Nominal size DN/ON [a]	Nominal outside diameter d_n	Mean inside diameter [b] $d_{sm,\ min.}$	Lengths of sockets and spigots		
			$A_{min.}$	$C_{max.}$	$L_{l,\ min.}$
50	50	50.4	20	18	37
63	63	63.4	22	18	37
75	75	75.5	25	20	43
82	82	82.5	26	21	44
90	90	90.5	28	23	46
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] Where non-preferred sizes not listed in the table are manufactured (see footnote 1 in Table 1) the values of $d_{sm,min.}$, $A_{min.}$, $C_{max.\ and}$ $L_{l,\ min.}$ shall be interpolated from the nearest adjacent values both above and below in this table.

[b] Calculated as follows $d_{sm,min} = (d_{sm,min} + 0.1)$ mm.

These sizes are based on the inside diameter series in EN 476:1997.

6.4.2 Solvent cement and unsealed sockets and spigots

The diameters and lengths of solvent cement and unsealed sockets and spigots (see Figure 6) shall conform to Table 4.

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

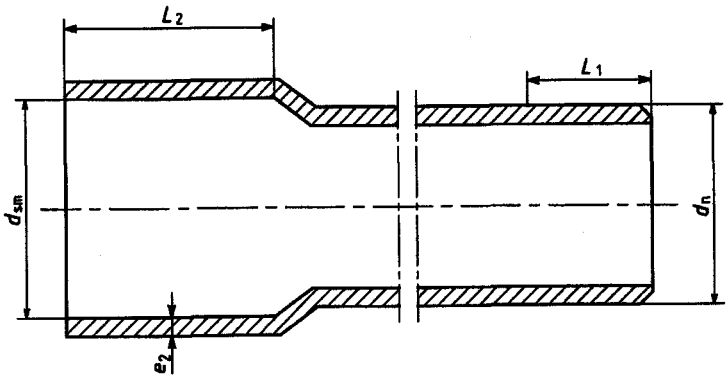

Figure 6 — Location of points of measurement of solvent cement sockets, unsealed sockets and spigots

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

Dimensions in millimetrees

Nominal size DN/OD [a)]	Nominal outside diameter d_n	Mean inside diameter $d_{sm,min}$	Mean inside diameter $d_{sm,max}$ [b]	Lengths of sockets and spigots $L_{1,min}$ and $L_{2,min}$ [c]
50	50	50.1	50.4	30
63	63	63.3	63.5	36
75	75	75.2	75.6	40
82	82	82.2	82.6	42
90	90	90.2	90.6	46
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) Where non-preferred sizes not listed in the table are manufactured (see footnote a in Table 1) the values of ,, $d_{sm,min}$, $d_{sm,max}$, $L_{1,min}$ and $L_{2,min}$ shall be interpolated from the nearest adjacent values both above and below in this table.

b) $d_{sm,min}$ values do not apply to unsealed systems.

c) For unsealed systems the $L_{1,min}$ and $L_{2,min}$ values may be reduced to $0.75L_{1min}$.

These sizes are based on the inside diameter series in EN 476:1997.

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 the requirements given in Table 1 but shall conform to the requirements given in Table 5 and as shown in Figure 7.

Table 5 — Minimum inside diameter of spigot sleeves

Dimensions in millimetres

Nominal size DN/OD [a)]	Nominal outside diameter d_n	Minimum inside diameter $d_{im,min}$
50	50	40
63	63	53
75	75	65
82	82	72
90	90	80
110	110	95

a) Where non-preferred sizes not listed in the table are manufactured (see footnote 1 in Table 1) the value of $d_{im,min}$ shall be interpolated from the nearest adjacent values both above and below in this table.

These sizes are based on the inside diameter series in EN 476:1997

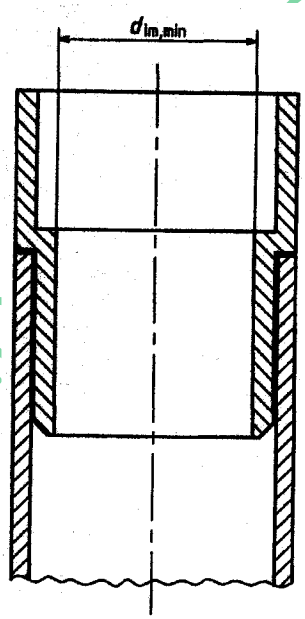

Figure 7 — Fitting spigot sleeve fitted to internal pipe bore

6.5 Types of fittings

This standard includes branches, bends, pipe couplers, pipe couplers with fixing lugs, outlet shoes and transition fittings. (See Figures 8 to 12).

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

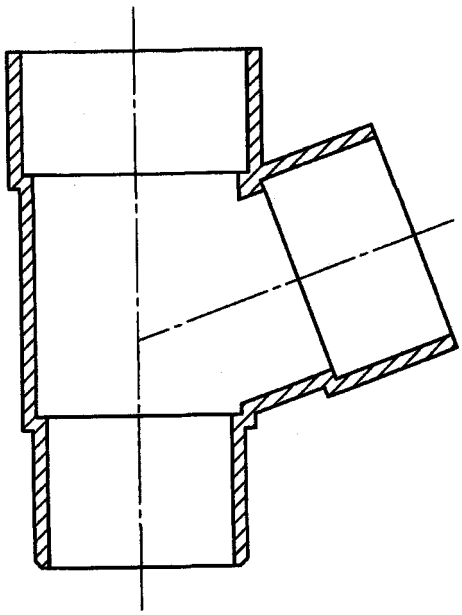

Figure 8 — Typical branch with outlet spigot sleeve

Figure 9 — Typical bend double socket

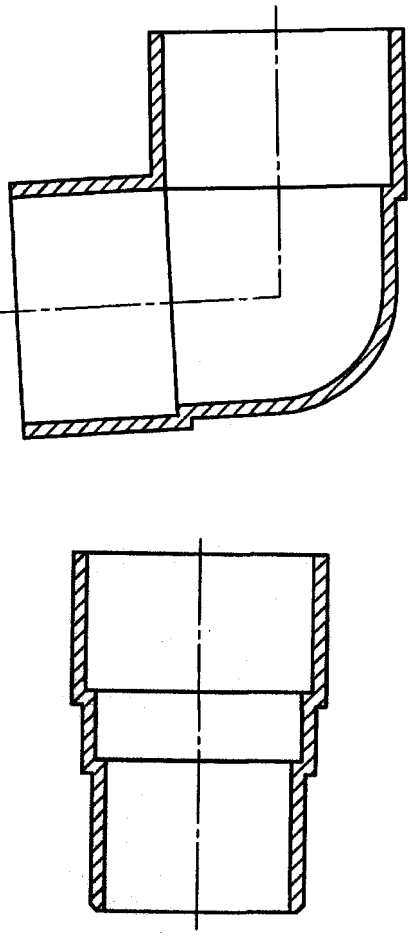

Figure 10 — Typical pipe coupler with spigot sleeve

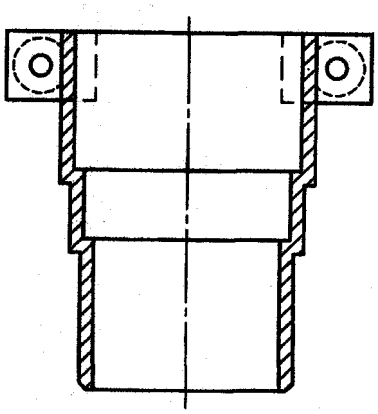

Figure 11 — Typical pipe coupler with fixing lugs and outlet spigot sleeve

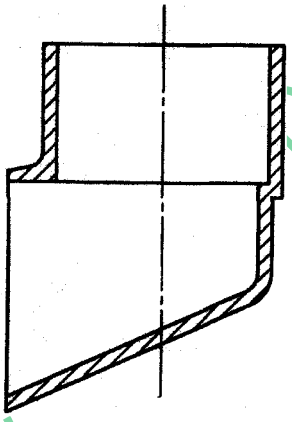

Figure 12 — Typical outlet shoe

6.6 Brackets

Brackets made from PVC-U shall conform to the requirements of 4.1, 4.2 and 7.2.

If brackets made from other materials are used with pipes and fittings conforming to this standard, they shall conform to the requirements of 4.4 and 7.2.

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 6.22.

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 of 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 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 ISO 8256 (23 ± 2) °C	Method A of ISO 8256
Tensile strength	≥ 42 N/mm	Strain speed Test piece	5 mm/min Type 5 conforming to ISO 527-3	ISO 6259-2
Elongation at break	≥ 100 %	Strain speed Test piece	5 mm/min Type 5 conforming to ISO 527-3	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 [a]	Nominal outside diameter d_n mm	Mass of striker kg	Fall height m
50	50	0.5	1.0
63	63	0.8	1.0
75	75	0.8	1.0
82	82	1.25	1.0
90	90	0.8	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] Where non-preferred sizes not listed in the table are manufactured (see footnote a in Table 1) the values of the mass and fall height of the striker shall be interpolated from the nearest adjacent values both above and below in this table.

These sizes are based on the inside diameter series in EN 476

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 [a]	Nominal outside diameter d_n mm	Vertical test load on bracket [b] kg
50	50	9.1
63	63	15.1
75	75	21.8
82	82	25.9
90	90	31.8
110	110	47.8
125	125	61.7
140	140	77.2
160	160	101.3

[a] Where non-preferred sizes not listed in the table are manufactured (see footnote a in Table 1) the value of the test load shall be interpolated from the nearest adjacent values both above and below in this table.

[b] Calculation based on weight of 5.5 m column of water.

These sizes are based on the inside diameter series in EN 476

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	≥ 75°C	Shall conform to ISO 2507-2		ISO 2507-1
	≤ 3 % the pipe shall exhibit no bubbles or cracks	Test temperature Immersion time	(100 ± 2) °C (15 ± 2) min	Method A of KS ISO 2505 :Liquid
Longitudinal reversion		or [a]		
		Test-temperature Immersion time	(100 ± 2) °C (30 ± 2) min	Method B of KS ISO 2505 Air
[a] 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	[a] and [b]	Test temperature Heating time	(150 ± 2) °C (15 ± 2) min	Method A of ISO 580 Air oven
Vicat softening temperature	≥ 75°C	Shall conform to ISO 2507-2		ISO 2507-1

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
Watertightness [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 ISO 105-A02	Radiation energy Cycling and temperature regime	2.6 GJ/m^2 Method 1 of EN 513	Method A of ISO 4892-2 (Xenon test):artificial weathering [3]
		or [c]		
		Exposure time Cycle: – irradiation – condensation	1 600 h (UVA 351 lamp) 6h at (50 ± 5) °C 2h at (50 ± 5) °C	ISO 4892-3 (QUV test)
Tensile impact strength after ageing (pipe only)	≥ 50 % of the value before ageing	Test temperature Test piece	(23 ± 5) °C shall conform to Table 6	Method A of ISO 8256

[a] Watertightness requirements do not apply to unsealed system.

[b] This is intended as a type test for each formulation and colour and may be carried out on other profiles, e.g. those manufactured to WD TC 047-02-2024.

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

10 Sealing rings

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

10.2 Materials for sealing rings shall conform to ISO 23711.

11 Adhesives

The adhesive shall be solvent cement and shall be as specified by the manufacturer of pipes and/or fittings.

The adhesive shall have no detrimental effects on the properties of the pipe and of the fittings and shall not cause the test assembly to fail to conform to the requirements given in Table 12.

12. Marking

12.1 General

12.1.1 Marking elements shall be labeled 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” given 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.

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

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

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

12.1.4 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 the requirements given in 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	WD TC 047 -01-2024	a
Pipe size [a]	e.g. 80 or 65 x 65	a
Wall thickness (e)	e.g 1,6	a
Rainwater	R	c
Manufacturing inform	[2)]	c
Quality Mark(if a certification scheme is set up)		b

a Non-circular pipes shall be designated as 6.2.2

b For providing traceability the following details shall be given:

1 the production period, 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.

12.3 Fittings

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

Table 14 — Minimum required marking of fittings

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	WD TC 047 -01-202	a
Nominal size [a)]	4e.g. 80 or 65 x 65	a
Nominal angle	e.g 45º	a
Rainwater	R	c
Manufacturing inform	[b)]	c
Quality Mark (if a certification scheme is set up)		b

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 period, 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.

12.4 Brackets

Brackets of PVC-U shall be marked in accordance with Table 14.

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.

Brackets made of material other than PVC-U shall not be marked directly but shall carry the following information on the packaging or on a label.

— designed for use with systems conforming to WD TC 047 -01-2024;
— nominal size;
— manufacturer's name or trade mark;
— corrosion class as specified in WD TC 047-03-2024.

12.5 Certified components

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

Annex A
(normative)

Utilization of non-virgin material

A.1 Material terms and definitions

A.1.1
virgin material
materials 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 reprocess able or recyclable material has been added

A.1.2
own reprocess able 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

A.1.3
external reprocess able material
material comprising either one of the following forms:

a) material from rejected unused pipes of 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

A.1.4
recyclable 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.

A.2 Reprocess able and recyclable material

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

A.2.1 Own reprocess able material

The use of clean own reprocess able material with agreed specification for the production of pipes and fittings is permitted without limitations.

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

A.2.2 External reprocess able and recyclable materials with agreed specification

A.2.2.1 Material from PVC-U pipes, gutters and fittings

External reprocess able and recyclable 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 added to virgin or own reprocess able material or a mixture of those two materials for the production of pipes and fittings provided that all of the following conditions are met:

a) a specification for each material shall be agreed between the supplier of external reprocess able or recyclable material and the pipe manufacturer. It shall at least cover the characteristics given in Table

A.1. When determined in accordance with the test method given in Table A.1, the actual values for these characteristics shall conform to the agreed value, and the permitted deviations shall conform to those given in Table A.1.

NOTE The quality plan of the supplier of external reprocess able or recyclable material should conform to ISO 9002For the purposes of this sub clause, the manufacturer is responsible for claiming and ensuring that the quality plan conforms to or is no less stringent than the relevant requirements of ISO 9002.It is not essential for the manufacturer to be approved and registered for operation in accordance with ISO 9002.

Table A.1 — Specification of characteristics to be covered by an agreement and the maximum permitted deviation for these characteristics

Characteristic	Permitted deviations	Test method
PVC-content [a]	± 4 % absolute by mass	EN 1905
K-value [a]	± 3 units	ISO 13229
Density [a]	± 20 kg/m3	ISO 1183-1
Vicat softening temperature (VST) [a]	± 2°C	ISO 2507-1
Particle size [b]	Requirements and test method shall be agreed and stated in the specification	
Type of stabilizer [b]	Requirements and test method shall be agreed and stated in the specification	
Impurities [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] If the source of the material is pipes and fittings produced under a recognized quality mark from partner state, it is not required to test this material characteristics if the requirement covered by the quality mark conforms to the requirement given in this table.

[b] The relevant requirements and test method are depending on the recycling process and on the end product.

b) each delivery shall be covered by a certificate according to 3.1.B of EN 10204:1991, showing conformity to the agreed specification;

c) the maximum quantity of external reprocess able and recyclable material that is intended to be added shall be specified by the pipe or fitting manufacturer;

d) the quantity of external reprocess able and recyclable material that is actually added in each production series shall be recorded by the pipe or fitting manufacturer;

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

A2.2.2 Material from other PVC-U products than pipes gutters and fittings

External reprocess able and recyclable material with an agreed specification from PVC-U bottles or window frames that are available in relevant quantities and intervals of time is permitted to be added to virgin or own reprocess able material or a mixture of those two materials for the production of pipes and fittings provided that all of the following conditions are met:

a) the material shall conform to all of the conditions given in a) to e) of A.2.2.1, inclusive, and to all of the additional characteristics and requirements given in Table A.2.

Table A.2 — Requirements for external reprocess able and recyclable material from PVC-U products other than pipes gutters and fittings

Characteristic	Requirements	Test method
PVC-content	≥ 80 % by mass	EN 1905
K-value	56 ≤ K-value ≤ 70	EN 922
Density	1 390 kg/m^3 ≤ density ≤ 1 500 kg/m^3	ISO 1183-1
Vicat softening temperature (VST)	≥ 62°C	ISO2507-1
Impurities	≤ 1 500 ppm for particle size ≤ 1 000 µm ≤ 1 500 ppm for 1 000 µm< particle size < 1400 µm	[a]
Particle size	> 1 000 µm: max 15 % < 1 400 µm: 100%	Sieve analysis
Application source of the material	One source: bottles or window frames	
If the source of the material is unused products for which the complete formulation is known and is such that all the requirements given in this table are fulfilled the material does not have to be tested and does not have to meet the requirements for particle size.		
[a] 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.		

b) the material shall be clean and dry;

c) the maximum allowed amount of reprocess able and recyclable materials shall depend on the difference in K-value of the virgin material and the reprocess able and recyclable material as follows:

1) if the difference in K-value, when determined in accordance with ISO 13229, is ≤ 4 units, then up to 20 % by mass may be added:

2) if the difference K-value is > 4 units, or not determined, then up to 5 % by mass may be added:

d) the quantity of external reprocess able and recyclable materials that is actually added in each production series shall be recorded by the pipe and fitting manufacturer.

NOTE The attention is drawn to possible national regulations regarding heavy metals, e.g. cadmium.

A.2.3 External reprocess able and recyclable material not covered by an agreed specification

A.2.3.1 Material from PVC-U pipes and fittings

External reprocess able and recyclable material not covered by an agreed specification from PVC-U pipes and fittings that are available in random quantities and intervals of time is permitted to be added to virgin or own reprocess able material or a mixture of those two materials for the production of pipes provided that all of the following conditions are met:

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

b) the material shall be clean and dry;

c) the maximum allowed amount of external reprocess able and recyclable materials that may be added shall depend on the difference in K-value of the virgin material and the external reprocess able and recyclable material as follows:

1) if the difference in K-value, when determined in accordance with ISO 13229, is ≤ 4 units, then up to 10 % by mass may be added;

2) if the difference in K-value is > 4 units, or not determined, then up to 5 % by mass may be added.

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

A.2.3.2 Material from other PVC-U products than pipes and fittings

External reprocess able and recyclable material not covered by an agreed specification from other PVC-U products than pipes and fittings shall not be used for the production of pipes and fittings conforming to this standard.

Bibliography

1.BS EN 12200-1 Plastics rainwater piping systems for above ground external use — Unplasticized poly (vinyl chloride) (PVC-U) Part 1: Specifications for pipes, fittings and the system.
2 KS 2199:2009 Brackets for eaves gutters — Requirements and testing
3. ISO 265-1 Pipes and fittings of plastics materials — Fittings for domestic and industrial waste pipes — Basic dimensions: Metric series Part 1: Unplasticized poly(vinyl chloride) (PVC-U)