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EAST AFRICAN STANDARD

Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Polyethylene (PE)

Draft for comments only — Not to be cited as East African Standard

EAST AFRICAN COMMUNITY

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First Edition 2010

Foreword

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

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. 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 procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

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.

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Introduction

In the preparation of this East African Standard, the following source was consulted extensively:

ISO 8770:2003, *Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Polyethylene (PE)*

Assistance derived from this source and others inadvertently not mentioned is hereby acknowledged.

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INTERNATIONAL STANDARD

ISO 8770

Second edition
2003-11-15

Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Polyethylene (PE)

Systèmes de canalisations en plastique pour l'évacuation des eaux-vannes et des eaux usées (à basse et à haute température) à l'intérieur des bâtiments — Polyéthylène (PE)

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Reference number
ISO 8770:2003(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 8770 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 1, *Plastics pipes and fittings for soil, waste and drainage (including land drainage)*.

This second edition cancels and replaces the first edition (ISO 8770:1991), which has been technically revised.

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Introduction

Pipes and fittings conforming to this International Standard also meet the requirements of EN 1519-1 which are applicable to those pipes and fittings which, according to EN 1519-1, are intended to be used inside buildings (application area code “B”, see EN 1519-1) only.

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Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Polyethylene (PE)

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1 Scope

This International Standard specifies the requirements for solid-wall polyethylene (PE) pipes and fittings for soil and waste discharge (low and high temperature) inside buildings, as well as the system itself. It does not include buried pipework.

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

This International Standard is applicable to PE pipes and fittings, as well as assemblies of such pipes and fittings, intended to be used for the following purposes:

a) soil and waste discharge pipework for the conveyance of domestic waste waters (low and high temperature);

b) ventilation pipework associated with a);

c) rainwater pipework inside the building.

It is applicable to pipes and fittings designed for jointing by means of elastomeric sealing rings or by butt fusion or electrofusion.

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.

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)*

ISO 1133:1997, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics*

ISO 3126:—[1)], *Plastics piping systems — Plastics components — Determination of dimensions*

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

1) To be published. (Revision of ISO 3126:1974)

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EN 743:1994, *Plastics piping and ducting systems — Thermoplastics pipes — Determination of the longitudinal reversion*

EN 744, *Plastics piping and ducting systems — Thermoplastics pipes — Test method for resistance to external blows by the round-the-clock method*

EN 763:1994, *Plastics piping and ducting systems — Injection-moulded thermoplastics fittings — Test method for visually assessing effects of heating*

EN 1053, *Plastics piping systems — Thermoplastics piping systems for non-pressure applications — Test method for watertightness*

EN 1054, *Plastics piping systems — Thermoplastics piping systems for soil and waste discharge — Test method for airtightness of joints*

EN 1055:1996, *Plastics piping systems — Thermoplastics piping systems for soil and waste discharge inside buildings — Test method for resistance to elevated temperature cycling*

3 Symbols and abbreviations

3.1 Symbols

A	length of engagement
B	length of lead-in
C	depth of sealing zone
d_e	outside diameter (at any point)
d_{em}	mean outside diameter
d_n	nominal outside diameter
d_s	inside diameter of the socket
d_{sm}	mean inside diameter of the socket
DN	nominal size
DN/OD	nominal size (outside-diameter related)
e	wall thickness (at any point)
e_m	mean wall thickness
e_2	wall thickness of the socket
e_3	wall thickness at the groove
E	wall thickness of an electrofusion socket
L_1	length of spigot
L_2	depth of penetration

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L_3 length of fusion zone

L_4 unheated length of an electrofusion socket

l effective length of a pipe

N effective insertion depth

R radius of swept fittings

z design length (z-length) of a fitting

α nominal angle of a fitting

3.2 Abbreviations

PE polyethylene

MFR melt mass-flow rate

OIT oxidation induction time

4 Material

4.1 PE compound

The compound for pipes and fittings shall be PE based material to which may be added those additives that are needed to facilitate the manufacture of components conforming to the requirements of this International Standard.

In order to conform to national requirements on fire regulations, other additives may be used.

Fabricated fittings or parts of fabricated fittings shall be made from pipes and/or mouldings conforming to this International Standard, except for the requirements for the wall thickness of fabricated fittings and/or mouldings from PE which conform to material and physical characteristics as required in this International Standard.

4.2 Reprocessable and recyclable material

In addition to virgin material, the use of reprocessable material obtained during the production and testing of products conforming to this International Standard is permitted. External reprocessable or recyclable material shall not be used.

NOTE Definitions concerning materials are given in EN 1519-1.

4.3 Melt mass-flow rate

The MFR of the PE base material shall be determined in accordance with ISO 1133:1997, using set of conditions T (temperature: 190 °C, load: 5 kg).

Pipes and fittings shall be made from materials with an MFR lying in the following range:

0,2 g/10 min $\leqslant$ MFR (190/5) $\leqslant$ 1,1 g/10 min

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4.4 Fusion-jointing compatibility

Compounds designated PE 63, PE 80 and PE 100 having an MFR (190/5) lying in the range given in 4.3 shall be considered to be compatible for fusion-jointing to each other.

4.5 Thermal stability

When determined in accordance with EN 728, using a test temperature of 200 °C, the oxidation induction time (OIT) of the material shall be not less than 20 min.

NOTE This requirement for thermal stability is only applicable to materials for pipes and fittings intended for butt fusion.

4.6 Sealing ring retaining means

Sealing rings may be retained, using means made from plastics other than PE, provided the joints conform to the requirements given in Clause 8.

4.7 Fire behaviour

No specific requirements are set by this International Standard on fire behaviour. Attention is drawn to the need to comply with any relevant national regulations in this respect.

5 General characteristics

5.1 Appearance

When viewed without magnification, the following requirements shall be met:

— the internal and external surfaces of pipes and fittings shall be smooth, clean and free from grooving, blistering, impurities, pores or any other surface irregularity likely to prevent conformity of pipes and fittings to this International Standard;

— each end of a pipe or fitting shall be cleanly cut, if applicable, and shall be square to its axis.

5.2 Colour

Pipes and fittings shall be uniformly coloured through the whole wall.

The recommended colour for pipes and fittings is black.

6 Geometrical characteristics

6.1 General

All dimensions shall be measured in accordance with ISO 3126.

The figures given in this International Standard are schematic sketches only, to indicate the relevant dimensions. They do not necessarily represent manufactured components. The dimensions given shall be conformed to however.

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6.2 Dimensions of pipes

6.2.1 Outside diameter

The mean outside diameter, d_{em}, shall conform to Table 1 or Table 2, as applicable.

Table 1 — Mean outside diameters
(metric series)

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Mean outside diameter d_{em}	
		min.	max.
32	32	32,0	32,3
40	40	40,0	40,4
50	50	50,0	50,5
56	56	56,0	56,5
63	63	63,0	63,6
75	75	75,0	75,7
80	80	80,0	80,8
90	90	90,0	90,9
100	100	100,0	100,9
110	110	110	111
125	125	125,0	126,2
160	160	160,0	161,5
200	200	200,0	201,8
250	250	250,0	252,3
315	315	315,0	317,9

Table 2 — Mean outside diameters
(series based on inch dimensions)

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Mean outside diameter d_{em}	
		min.	max.
38	38	37,9	38,4
44	44	44,3	44,8
57	57	57,0	57,5

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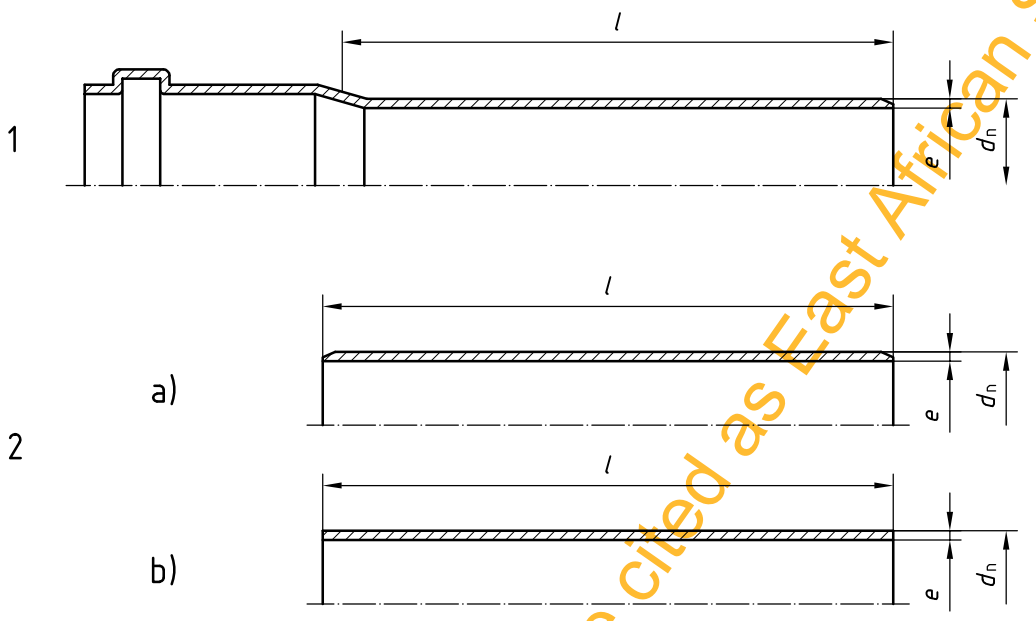
6.2.2 Effective length of pipes

The effective length, l, of a pipe shall not be less than that declared by the manufacturer and shall be measured as shown in Figure 1. For pipes with sockets, the effective length is considered to be the distance between the pipe ends minus the socket length. For practical reasons, this length is measured to the outside of the socket.



Key

1 single socket pipe

2 plain-ended pipes

a) with chamfer

b) without chamfer

Figure 1 — Effective length of pipes

6.2.3 Chamfering

If a chamfer is applied, the angle of chamfering shall be between 15° and 45° to the axis of the pipe (see Figure 3). When pipes without a chamfer are used, the pipe ends shall be deburred.

The remaining wall thickness of the end of the pipe shall be at least 1/3 of e_{min}.

6.2.4 Wall thicknesses

The wall thickness, e, shall conform to Table 3 or Table 4, as applicable, but for the metric series a maximum wall thickness at any point of up to 1,25e_{min} is permitted, provided that the mean wall thickness, e_m, is less than or equal to the specified $e_{m,max}$.

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Table 3 — Wall thicknesses
(metric series)

Dimensions in millimetres

Nominal size	Nominal outside diameter	Wall thickness			
		Pipe series			
		S 16		S 12,5	
DN/OD	d_n	e min.	e_m max.	e min.	e_m max.
32	32	3,0	3,5	3,0	3,5
40	40	3,0	3,5	3,0	3,5
50	50	3,0	3,5	3,0	3,5
56	56	3,0	3,5	3,0	3,5
63	63	3,0	3,5	3,0	3,5
75	75	3,0	3,5	3,0	3,5
80	80	3,0	3,5	3,1	3,6
90	90	3,0	3,5	3,5	4,1
100	100	3,2	3,8	3,8	4,4
110	110	3,4	4,0	4,2	4,9
125	125	3,9	4,5	4,8	5,5
160	160	4,9	5,6	6,2	7,1
200	200	6,2	7,1	7,7	8,7
250	250	7,7	8,7	9,6	10,8
315	315	9,7	10,9	12,1	13,6

Table 4 — Wall thicknesses
(series based on inch dimensions)

Dimensions in millimetres

Nominal size	Nominal outside diameter	Wall thickness	
DN/OD	d_n	e min.	e_m max.
38	38	2,9	3,5
44	44	2,9	3,5
57	57	2,9	3,5

6.3 Dimensions of fittings

6.3.1 Outside diameters

The mean outside diameter, d_{em}, of the spigot end shall conform to Table 1 or Table 2, as applicable.

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6.3.2 z-lengths

The design length(s) [z-length(s)] of fittings (see Figure 7 to Figure 21) shall be as given by the manufacturer.

NOTE The z-length(s) of a fitting are intended to assist in the design of moulds and are not intended to be used for quality control purposes. ISO 265-1 may be used as a guideline.

6.3.3 Wall thickness

The minimum wall thickness, e_{min}, of the body or the spigot end of a fitting shall conform to Table 3 or Table 4, as applicable, except that a reduction of 5 % resulting from core shifting is permitted. In such cases, the average of two opposite wall thicknesses shall be equal to or greater than the values given in Table 3 or Table 4, as applicable.

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

Where a sealing ring is located by means of a retaining cap or ring (see Figure 2), the wall thickness in this area shall be calculated by addition of the wall thickness of the socket and the wall thickness of the retaining cap or ring at the corresponding places in the same cross-sectional plane.

The wall thicknesses of fabricated fittings, except for spigot ends and sockets, may be changed locally to suit the fabrication process, provided that the minimum wall thickness of the body conforms to the minimum value of e_3 as given in Table 7 or Table 8, as applicable.

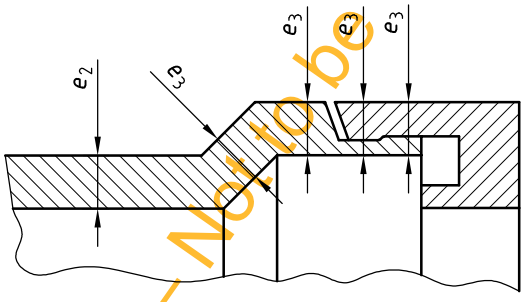

Figure 2 — Example of calculation of wall thickness of socket with retaining cap

6.4 Dimensions of sockets and pipe ends

6.4.1 Dimensions of ring seal sockets and spigot ends

6.4.1.1 Diameters and lengths

The diameters and lengths of ring seal sockets and spigot ends (see Figure 3, Figure 4 and Figure 5) shall conform to Table 5 or Table 6, as applicable, and shall be in accordance with the following conditions:

a) where sealing rings are firmly retained, the minimum value of A and the maximum value of C shall be as measured to the effective sealing point (see Figure 5 for an example) and this point shall give a full sealing action;

b) where sealing rings are firmly retained, the required values given for dimension B (see Figure 4) do not apply.

Different designs of ring seal socket (see Figure 4) may be used, provided the joints conform to the requirements given in Clause 8.

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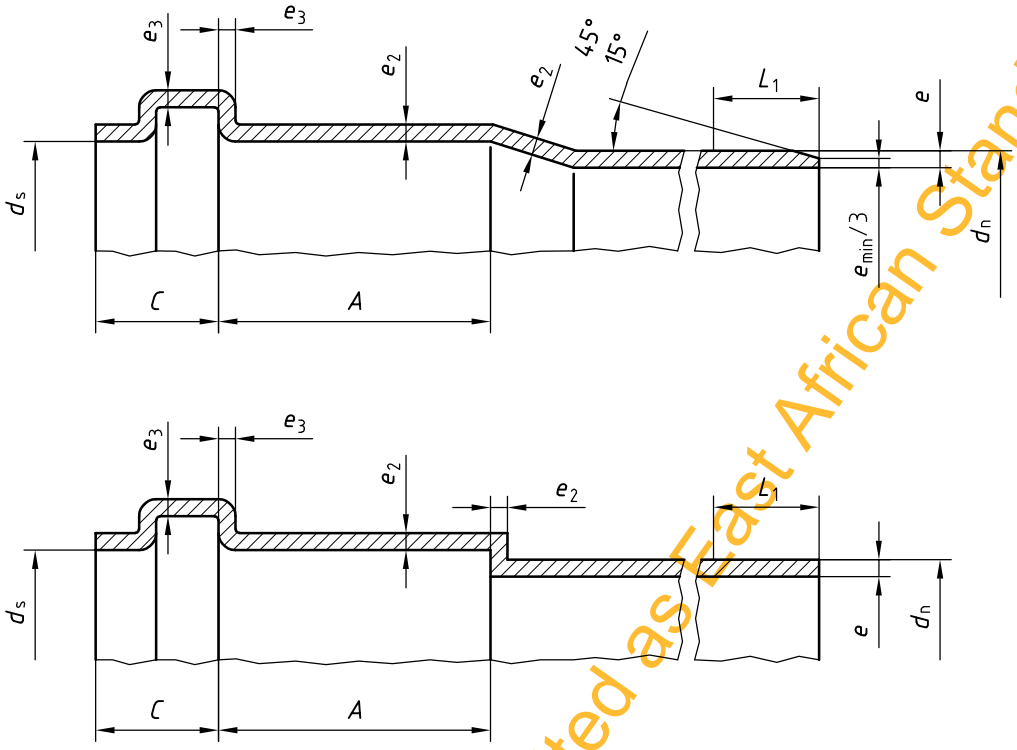

Figure 3 — Dimensions of sockets and spigot ends for ring seal joints

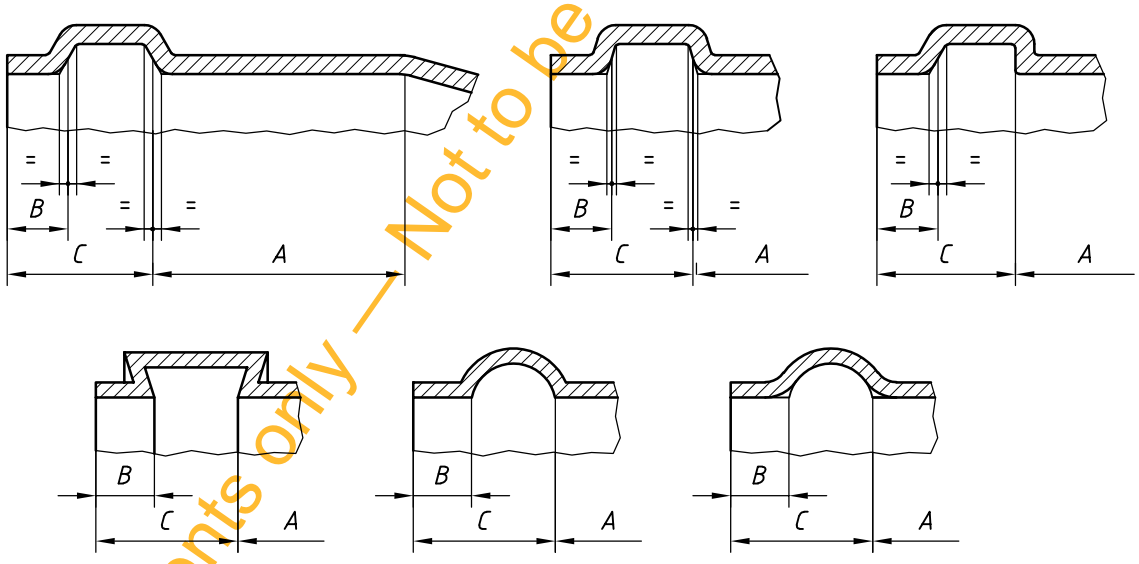

Figure 4 — Typical groove designs for ring seal sockets

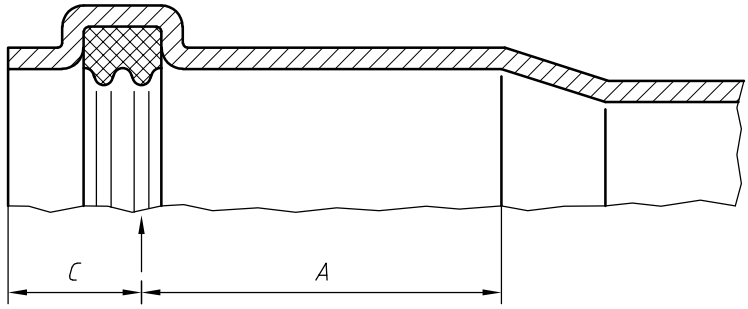

Figure 5 — Example of measurement of effective sealing point

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Table 5 — Diameters and lengths of ring seal sockets and spigot ends
(metric series)

Dimensions in millimetres

Nominal size	Nominal outside diameter	Other socket dimensions					Length of spigot end
DN/OD	d_n	d_{sm} min.	Type [a] A min.	Type L [a] A min.	B min.	C max.	L_1 min.
32	32	32,4	28	—	5	25	46
40	40	40,5	28	—	5	26	46
50	50	50,6	28	85	5	28	46
56	56	56,6	30	86	5	30	48
63	63	63,7	31	87	5	31	49
75	75	75,8	33	88	5	33	51
80	80	80,9	34	88	5	34	54
90	90	91	36	89	5	36	54
100	100	101	38	89	5	38	54
110	110	111,1	40	91	6	40	62
125	125	126,3	43	93	7	43	69
160	160	161,5	50	96	9	50	82
200	200	201,9	58	100	12	58	98
250	250	252,4	68	105	18	68	118
315	315	318	81	111	20	81	144

[a] Sockets of type N (normal type) and type L (long type) are designated for different lengths of pipe. Type L sockets may be used as an expansion joint in fixed joint systems which do not in themselves allow for expansion and contraction.

Table 6 — Diameters and lengths of ring seal sockets and spigot ends
(series based on inch dimensions)

Dimensions in millimetres

Nominal size	Nominal outside diameter	Other socket dimensions				Length of spigot end
DN/OD	d_n	d_{sm} min.	A min.	B min.	C max.	L_1 min.
38	38	38,2	25	3,8	12	37
44	44	44,7	25	3,8	15	40
57	57	57,5	25	3,8	18	43

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6.4.1.2 Wall thicknesses

The wall thickness of the socket, e_2, and the wall thickness in the groove area, e_3, shall conform to Table 7 or Table 8, as applicable.

Table 7 — Wall thicknesses of sockets
(metric series)

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Wall thicknesses	
		e_2 min.	e_3 min.
32	32	2,7	2,3
40	40	2,7	2,3
50	50	2,7	2,3
56	56	2,7	2,3
63	63	2,7	2,3
75	75	2,7	2,3
80	80	2,7	2,3
90	90	2,7	2,3
100	100	2,8	2,4
110	110	3,1	2,6
125	125	3,6	3
160	160	4,5	3,7
200	200	5,6	4,7
250	250	7	5,8
315	315	8,8	7,3

Table 8 — Wall thicknesses of sockets
(series based on inch dimensions)

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Wall thicknesses	
		e_2 min.	e_3 min.
38	38	2,7	2,3
44	44	2,7	2,3
57	57	2,7	2,3

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6.4.2 Dimensions of electrofusion sockets

The dimensions of electrofusion sockets (see Figure 6) shall conform to Table 9.

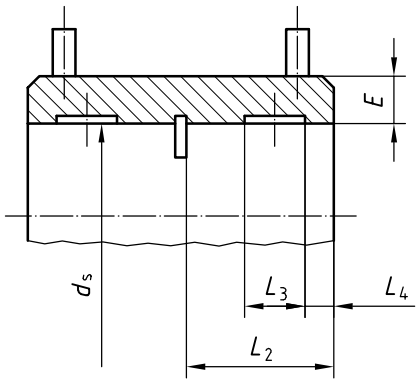

Figure 6 — Example of an electrofusion socket

6.4.3 Dimensions of pipe ends for butt fusion joints

The mean outside diameter, d_{em}, of pipes with plain ends intended to be used for butt fusion joints shall conform to Table 1 or Table 2, as applicable. The wall thickness, e, shall conform to Table 3 or Table 4, as applicable.

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Table 9 — Dimensions of electrofusion sockets

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Other socket dimensions				
		d_{sm} min.	L_2 min.	L_3 min.	L_4 min.	E
32	32		20	10		
40	40		20	10		
50	50		20	10		
56	56		20	10		
63	63		23	10		
75	75	a	25	10	5	b
80	80		25	10		
90	90		25	10		
100	100		28	15		
110	110		28	15		
125	125		28	15		
160	160		28	15		
200	200		50	25		
250	250		60	25		
315	315		70	25		

[a] The mean inside diameter, d_{sm}, of the socket shall be measured in a plane which is parallel to and at a distance of $L_4 + 0{,}5L_3$ from the socket mouth. The mean inside diameter of a socket shall be specified by the manufacturer in such a way that, after assembly and fusion-jointing of pipes and fittings, the joints will conform to the requirements given in Clause 8.

[b] The wall thickness, E, of the electrofusion socket shall be at least equal to the minimum wall thickness, e_{min}, of the corresponding pipe conforming to Table 3.

6.5 Types of fitting

This International Standard is applicable to the following types of fitting. Other designs of fittings are permitted.

a) Bends (see Figure 7, 8, 9, 10, 11 or 12):

- unswept or swept angle (see ISO 265-1);
- spigot/socket or socket/socket;
- butt-fused from segments.

The nominal angle, α, may be selected from the following: 15°, 22°30′, 30°, 45°, 67°30′, 80°, 87°30′ to 90°.

b) Branches and reducing branches (branching single or multiple) (see Figure 13, 14, 15, 16, 17, 18 or 19):

- unswept or swept angle (see ISO 265-1);
- spigot/socket or socket/socket.

The nominal angle, α, may be selected from the following: 45°, 67°30′, 87°30′ to 90°.

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

c) Reducers (see Figure 20).

d) Access fittings (see Figure 21).

— The inside diameter of the cleaning hole shall be as specified by the manufacturer.

e) Couplers:

— double-socket (see Figure 22);

— repair collar (see Figure 23).

f) Push-fit sockets for butt fusion of pipe ends (see Figure 24).

g) Plugs (see Figure 25).

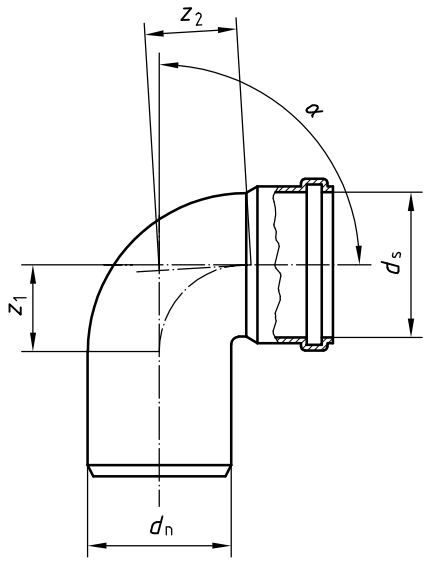

Figure 7 — Bend with single socket (unswept)

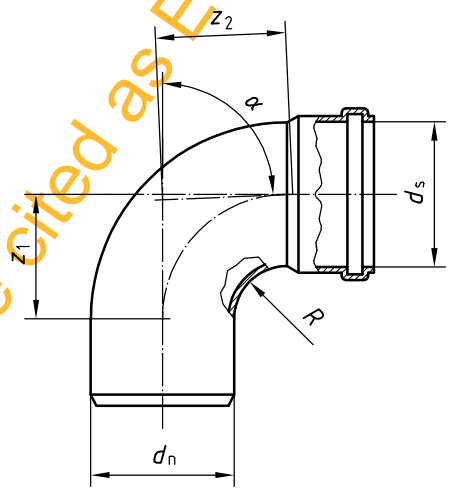

Figure 8 — Bend with single socket (swept)

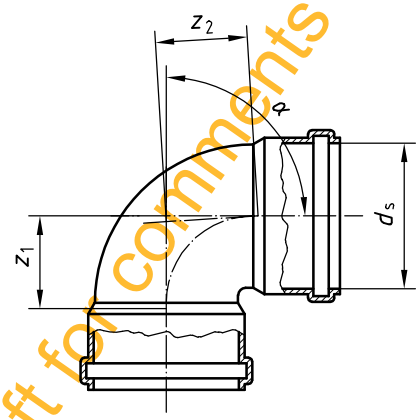

Figure 9 — Bend with only sockets (unswept)

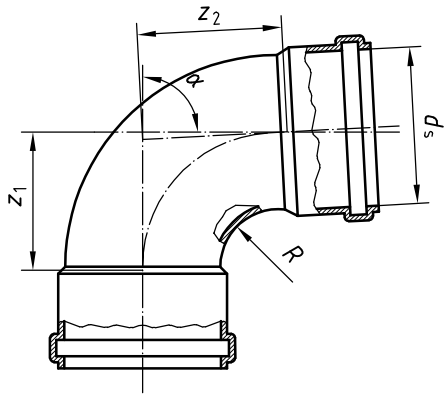

Figure 10 — Bend with only sockets (swept)

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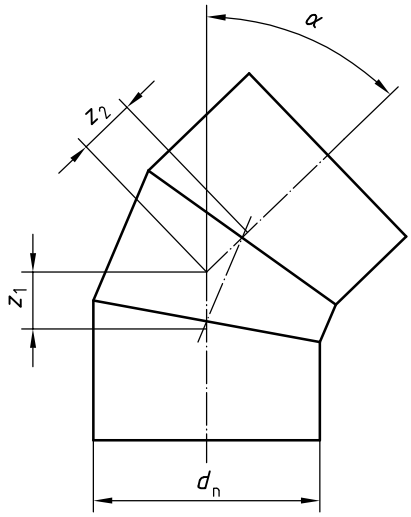

Figure 11 — Bend, butt-fused from segments

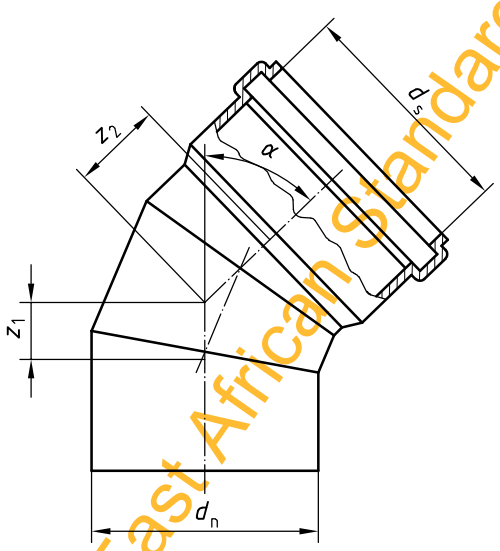

Figure 12 — Bend with single socket, butt-fused from segments

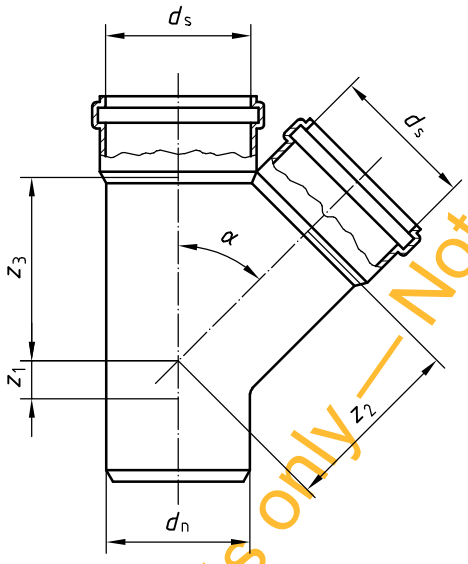

Figure 13 — Branch (unswept)

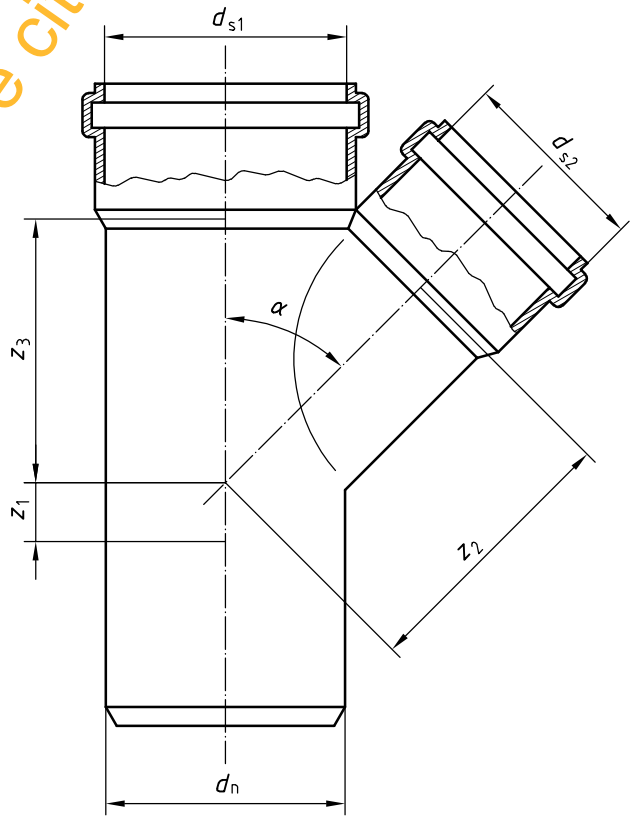

Figure 14 — Reducing branch (unswept)

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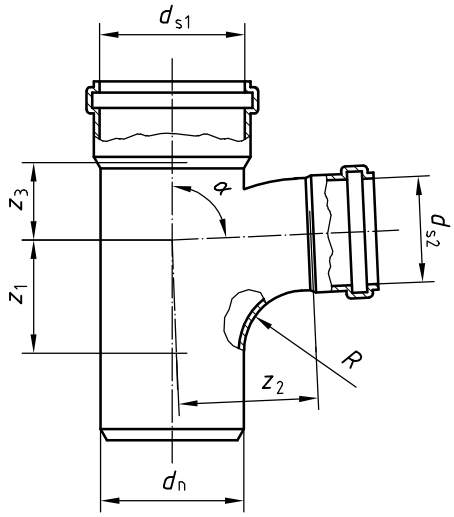

Figure 15 — Reducing branch (swept)

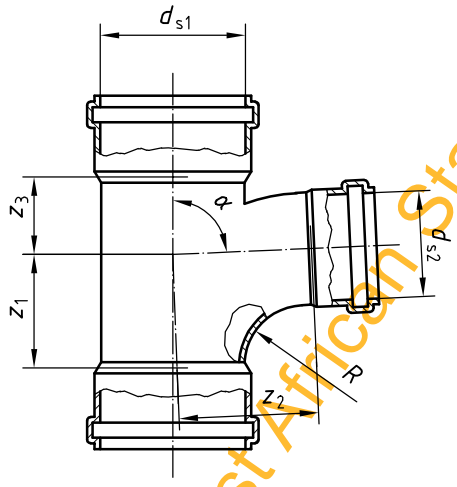

Figure 16 — Reducing branch with only sockets (swept)

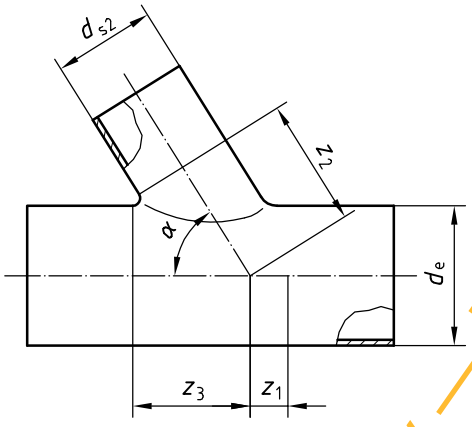

Figure 17 — Butt fusion branch

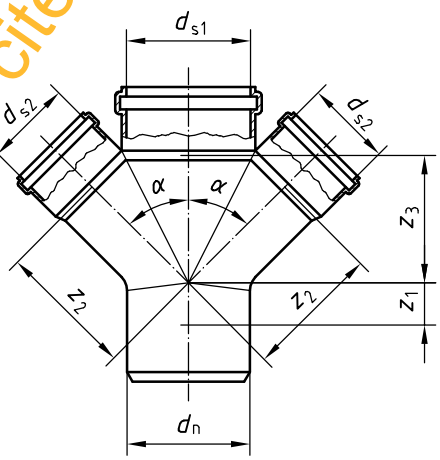

Figure 18 — Double branch

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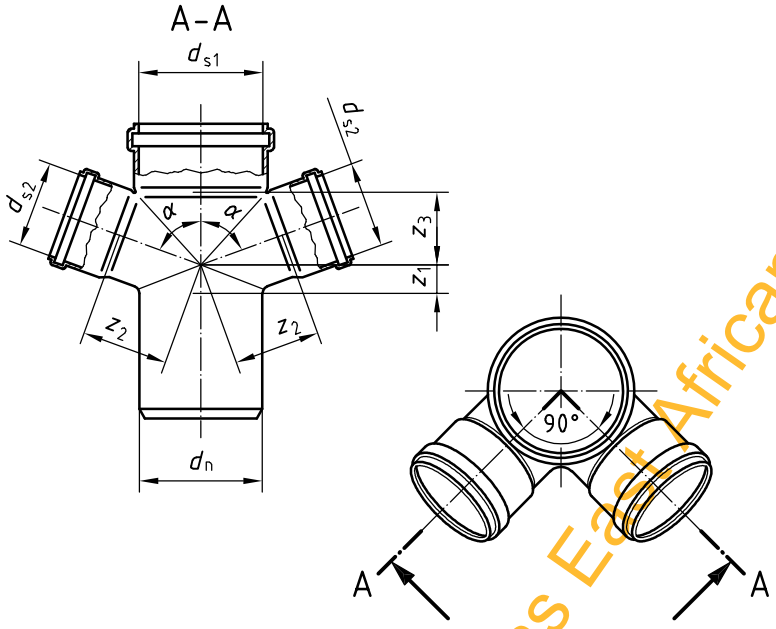

Figure 19 — Angular double branch

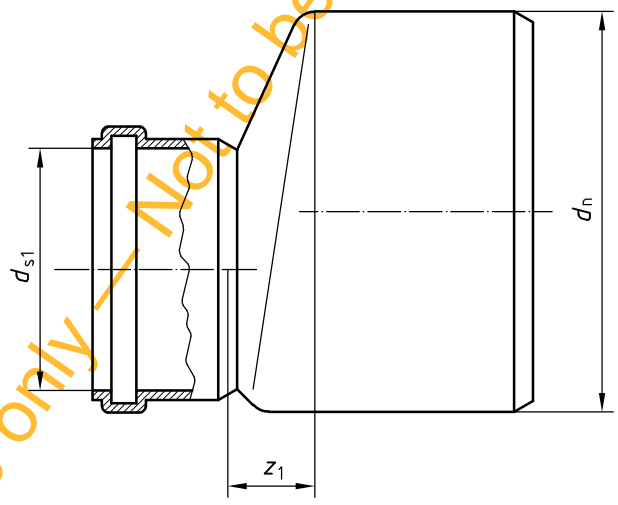

Figure 20 — Reducer

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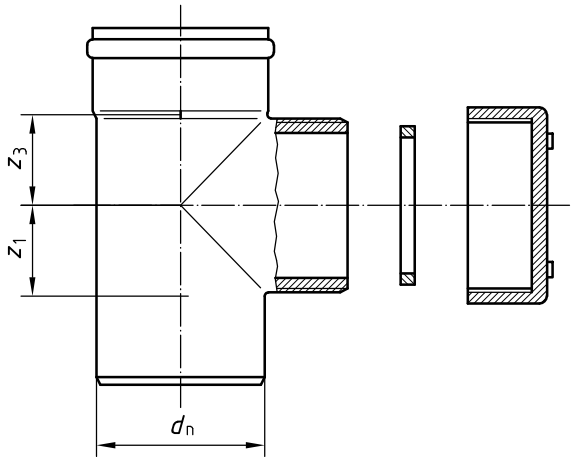

Figure 21 — Access fitting with round cleaning hole

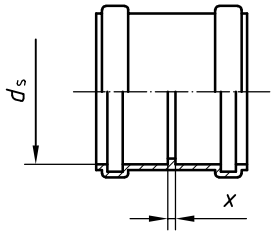

Figure 22 — Double-socket (coupler)

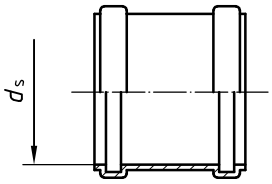

Figure 23 — Repair collar

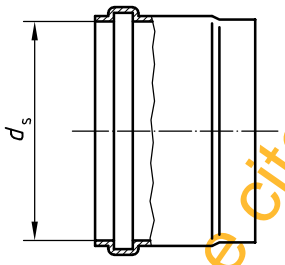

Figure 24 — Push-fit socket for butt fusion of pipe ends

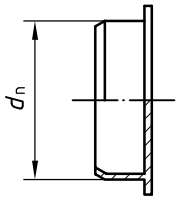

Figure 25 — Plug

7 Physical characteristics

7.1 Physical characteristics of pipes

When determined in accordance with the methods specified in Table 10, using the parameters indicated, the physical characteristics of pipes shall conform to the requirements given in Table 10.

Table 10 — Physical characteristics of pipes

Characteristic	Requirements	Test parameters		Test method
Longitudinal reversion [a]	⩽ 3 % The pipe shall exhibit no bubbles or cracks	Test temperature Immersion time	(110 ± 2) °C 30 min	EN 743:1994 Method A: Liquid
		or		
		Test temperature Immersion time for: $e \leqslant 8$ mm $e > 8$ mm	(110 ± 2) °C 60 min 120 min	EN 743:1994 Method B: Air
Melt mass-flow rate (MFR)	Permitted max. deviation when processing the compound into a pipe: 0,2 g/10 min	Temperature Load	190 °C 5 kg	ISO 1133:1997 Set of conditions T

[a] The choice of method A or method B is the responsibility of the manufacturer.

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7.2 Physical characteristics of fittings

When determined in accordance with the methods specified in Table 11 and Table 12, using the parameters indicated, the physical characteristics of fittings shall conform to the requirements given in Table 11 or Table 12, as applicable.

Table 11 — Physical characteristics of fittings

Characteristic	Requirements	Test parameters		Test method
Effects of heating	[a]	Test temperature Heating time	(110 ± 2) °C 60 min	EN 763:1994 Method A: Air oven
[a] 1) The depth of any cracks, delaminations or blisters shall not exceed 20 % of the wall thickness around the injection point(s). No part of the weld line shall be open to a depth of more than 20 % of the wall thickness. 2) When fittings are manufactured from pipes, the pipes shall conform to the requirements given in Table 10. 3) Mouldings that are used for fabricated fittings may be tested separately.				

Table 12 — Physical characteristics of fabricated fittings

Characteristic	Requirement	Test parameters		Test method
Watertightness [a]	No leakage	Water pressure Duration	0,5 bar 1 min	EN 1053
[a] Only for fabricated fittings made from more than one piece. A sealing ring retaining element is not considered as a piece.				

8 Performance requirements

When determined in accordance with the methods specified in Table 13, using the parameters indicated, the fitness-for-purpose characteristics of the joints and the system shall conform to the requirements given in Table 13.

Table 13 — Fitness-for-purpose characteristics of the system

Characteristic	Requirement	Test parameters	Test method
Watertightness [a]	No leakage	Shall conform to EN 1053	EN 1053
Airtightness [a]	No leakage	Shall conform to EN 1054	EN 1054
Elevated-temperature cycling	No leakage before or after test Sagging for DN $\leqslant$ 50: $\leqslant$ 3 mm Sagging for DN $>$ 50: $\leqslant 0{,}05 d_n$	Shall conform to EN 1055	Test assembly a) (Figure 1 and/or 3) of EN 1055:1996
[a] Not required for butt fusion joints.			

9 Sealing rings

9.1 Sealing rings shall not have any detrimental effects on the properties of the pipe or fitting.

9.2 Various designs of sealing ring for ring seal sockets are permitted provided that the joints produced using them conform to the requirements specified in Clause 8.

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

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10 Marking

10.1 General

10.1.1 Marking elements shall be labelled or printed or formed directly on the component in such a way that legibility is maintained during storage, weathering, handling and installation, as well as during the subsequent use of the component.

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

10.1.2 Marking on a pipe or fitting shall not initiate cracks or other defects likely to prevent conformity to the requirements of this International Standard.

10.2 Minimum required marking of pipes

The minimum marking required for pipes is specified in Table 14.

Pipes shall be marked at intervals of, at the maximum, 1 m, and at least once per pipe. Pipes with a length less than 1 m may be marked with a label at least once per pipe.

Table 14 — Minimum required marking of pipes

Item	Marking or symbol
Number of this International Standard	ISO 8770
Manufacturer's name and/or trade mark	XXX
Nominal size	e.g. DN 110
Minimum wall thickness	e.g. 3,4
Material	PE
Type of socket	e.g. Type N
Manufacturer's information	[a]

[a] To ensure traceability, the following details shall be given:
- the production period (year and month), in figures or in code;
- a name or code for the production site if the manufacturer is producing at different sites.

10.3 Minimum required marking of fittings

The minimum marking required for fittings is specified in Table 15, whereby the manufacturer's information may be either on the fitting or on the packaging. If the manufacturer's information is on the packaging, it shall be determined by national requirements.

Table 15 — Minimum required marking of fittings

Item	Marking or symbol
Number of this International Standard	ISO 8770
Manufacturer's name and/or trade mark	XXX
Nominal size	e.g. DN 110
Minimum wall thickness	e.g. 3,4
Nominal angle	e.g. 67°30′
Material	PE
Type of socket	e.g. Type N
Manufacturer's information	[a]

[a] To ensure traceability, the following details shall be given:
- the production period (year and month), in figures or in code;
- a name or code for the production site if the manufacturer is producing at different sites.

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11 Installation of piping systems

For the installation of pipes and fittings conforming to this International Standard, national and/or local requirements and relevant codes of practice shall apply.

In addition, the pipe manufacturer may give a recommended practice for installation which covers the transport, storage and handling of the pipes and fittings as well as to the installation in accordance with the applicable national and/or local instructions.

For external above-ground applications, additional requirements depending on the climate shall be agreed between the manufacturer and the purchaser.

Guidance on installation may be found in ISO/TR 7024.

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Annex A
(informative)

Additional characteristics of PE pipes and fittings

A.1 General

EN 476 specifies the general requirements for components used in discharge pipes, drains and sewers for gravity systems. Pipes and fittings conforming to this International Standard fully meet these requirements. Additional information is given in this annex.

A.2 Material characteristics

Pipes and fittings conforming to this International Standard generally have the following characteristics:

— Modulus of elasticity $E_{1\ min} \geqslant 700$ MPa;

— Average density $\approx 0{,}94$ g/cm^3;

— Average coefficient of linear expansion $\approx 0{,}2$ mm/m·K;

— Thermal conductivity $\approx 0{,}4$ W/m·K;

— Specific heat capacity $\approx 2\,300$ J/kg·K to 2 900 J/kg·K;

— Surface resistance $> 10^{13}\ \Omega$.

A.3 Chemical resistance

PE piping systems conforming to this International Standard are resistant to corrosion by water with a wide range of pH-values such as soil and waste water, rain water, surface water and ground water.

If piping systems conforming to this International Standard are to be used for waste water contaminated with chemicals, such as industrial discharges, their chemical and temperature resistance will also have to be taken into account.

Guidance is given on the chemical resistance of PE in ISO/TR 10358 and for rubber materials in ISO/TR 7620.

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[2] ISO 161-2, *Thermoplastics pipes for the conveyance of fluids — Nominal outside diameters and nominal pressures — Part 2: Inch-based series*

[3] ISO 3633, *Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Unplasticized poly(vinyl chloride) (PVC-U)*

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

[5] ISO/TR 7024, *Above-ground drainage — Recommended practice and techniques for the installation of unplasticized polyvinyl chloride (PVC-U) sanitary pipework for above-ground systems inside buildings*

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

[7] ISO 7671, *Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Polypropylene (PP)*

[8] ISO 7675, *Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Chlorinated poly(vinyl chloride) (PVC-C)*

[9] ISO 7682, *Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Acrylonitrile-butadiene-styrene (ABS)*

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

[11] ISO 19220, *Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Styrene copolymer blends (SAN + PVC)*

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

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

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

[15] EN 1453-1, *Plastics piping systems with structured-wall pipes for soil and waste discharge (low and high temperature) inside buildings — Unplasticized poly(vinyl chloride) (PVC-U) — Part 1: Specifications for pipes and the system*

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

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

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

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

[20] EN 12056-1, *Gravity drainage systems inside buildings — Part 1: General and performance requirements*

[21] ENV 13801, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Thermoplastics — Recommended practice for installation*

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

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2) Obtainable from national standards institutes.

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