
**Plastics piping systems for soil and waste
discharge (low and high temperature)
inside buildings — Styrene copolymer
blends (SAN + PVC)**

*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 — Mélanges de copolymères de styrène (SAN + PVC)*



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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 19220 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)*.

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Introduction

Pipes and fittings conforming to this International Standard also meet the corresponding requirements of EN 1565-1 which are applicable to those pipes and fittings which, according to EN 1565-1, are intended to be used inside buildings (application area code "B", see EN 1565-1) only.

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Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Styrene copolymer blends (SAN + PVC)

1 Scope

This International Standard specifies the requirements for solid-wall styrene copolymer blend (SAN + PVC) pipes and fittings for soil and waste discharge (low and high temperature) above ground 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 SAN + PVC 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, solvent cementing or integral dual-purpose sockets, i.e. for elastomeric ring seal joints and/or for solvent cement joints.

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

ISO 8361-1, *Thermoplastics pipes and fittings — Water absorption — Part 1: General test method*

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 727, *Plastics piping and ducting systems — Thermoplastics pipes and fittings — Determination of Vicat softening temperature (VST)*

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

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

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*

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

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*

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
L_1	length of spigot
L_2	length of solvent cement 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

PVC	poly(vinyl chloride)
SAN	styrene-acrylonitrile
SAN + PVC	styrene copolymer blends
TIR	true impact rate

4 Material

4.1 SAN + PVC compound

The compound for pipes and fittings shall be a styrene copolymer blend consisting of SAN and PVC 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 made from SAN + PVC which conform to material, mechanical and physical characteristics as required in this International Standard.

NOTE Material conforming to this requirement generally contains 40 % to 60 % of SAN.

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 1565-1.

4.3 Sealing ring retaining means

Sealing rings may be retained using means made from plastics other than SAN + PVC, provided the joints conform to the requirements given in Clause 9.

4.4 Fire behaviour

No specific requirements are set by this International Standard for 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 grey or 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.

6.2 Dimensions of pipes

6.2.1 Outside diameters

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	40,3
50	50	50,0	50,3
63	63	63,0	63,3
75	75	75,0	75,4
80	80	80,0	80,4
90	90	90,0	90,4
100	100	100,0	100,4
110	110	110,0	110,4
125	125	125,0	125,4
160	160	160,0	160,5

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.
36	36	36,1	36,5
43	43	42,7	43,1
55	55	55,7	56,1

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.

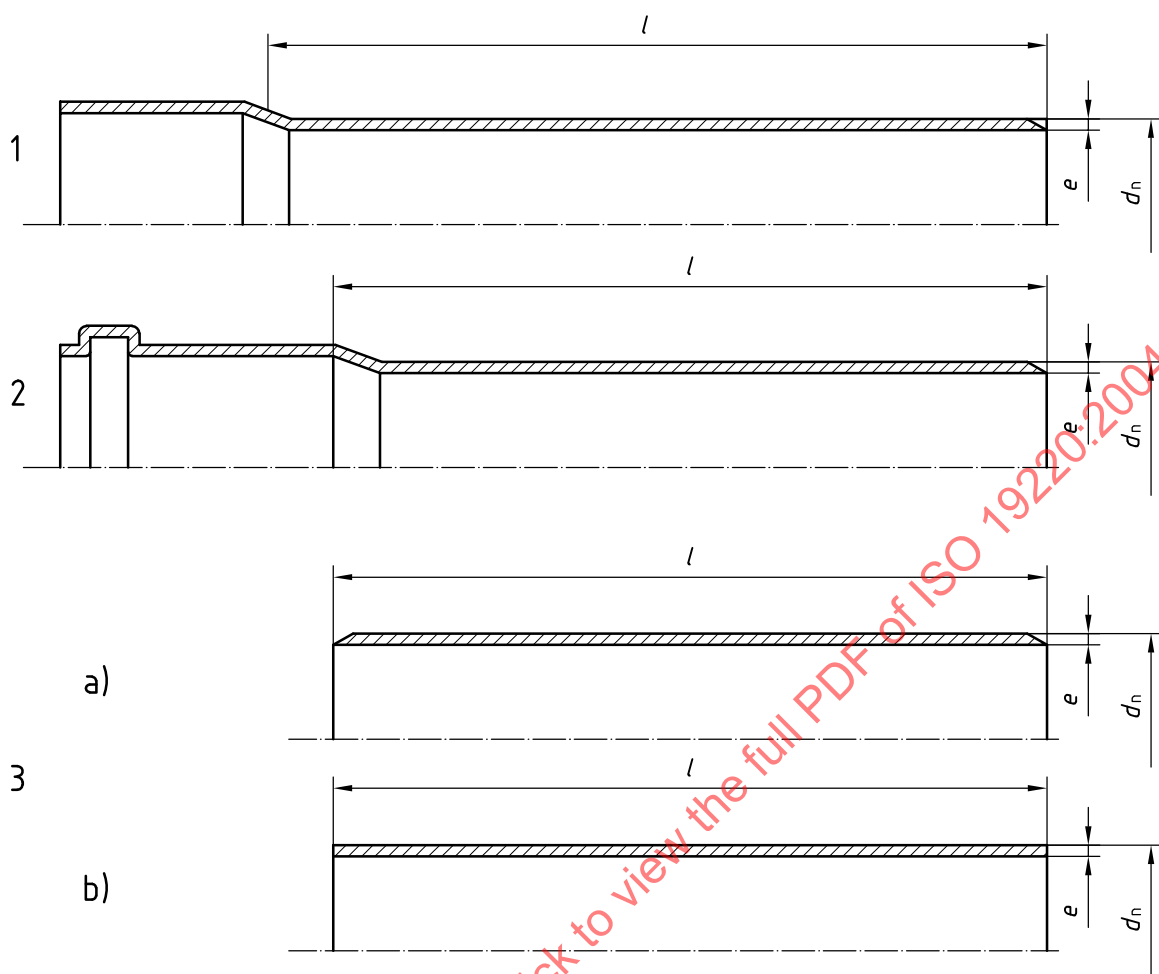
6.2.3 Chamfering

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 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 thickness

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 $e_{m,max}$.



Key

- 1 solvent cement pipe
- 2 ring seal pipe
- 3 plain-ended pipes
 - a) with chamfer
 - b) without chamfer

Figure 1 — Effective lengths of pipes

Table 3 — Wall thicknesses (metric series)

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Wall thickness			
		Pipe series			
		S 25 ^a		S 16,7 ^a	
		e min.	e_m max.	e min.	e_m max.
32	32	1,8	2,2	2,2	2,7
40	40	1,8	2,2	2,2	2,7
50	50	1,8	2,2	2,2	2,7
63	63	1,8	2,2	2,2	2,7
75	75	1,8	2,2	2,5	3
80	80	1,8	2,2	2,6	3,1
90	90	1,8	2,2	2,7	3,3
100	100	2	2,5	3	3,6
110	110	2,2	2,7	3,2	3,8
125	125	2,5	3	3,7	4,3
160	160	3,2	3,8	4,7	5,3

^a Pipe series are defined in ISO 4065.

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

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Wall thickness	
		e min.	e_m max.
36	36	1,8	2,2
43	43	1,9	2,3
55	55	2	2,4

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.

6.3.2 z -lengths

The design length(s) [z -length(s)] of fittings (see Figure 8 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 8 or Table 9, as applicable.

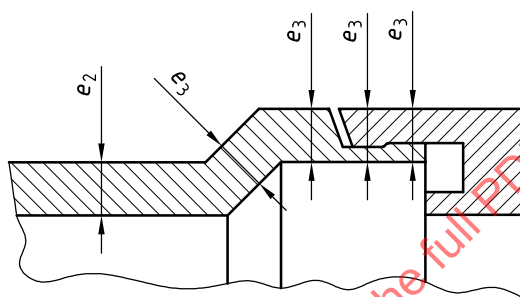


Figure 2 — Example of calculation of wall thickness of socket with retaining cap

6.4 Dimensions of sockets and pipe ends

6.4.1 Classification and designation of sockets

6.4.1.1 General

Sockets shall be classified according to the type of joint for which they are intended, as indicated in 6.4.1.2 to 6.4.1.4.

6.4.1.2 Ring seal sockets

The lengths of ring seal sockets of type N and type L and of spigot ends are designed for pipes of different lengths:

- **Type N** (normal): This socket type (see Figure 4) may be used as an expansion joint system. If this socket type is part of a fixed joint system (i.e. a system which does not in itself allow for expansion and contraction), it shall be used in conjunction with a type L (long) socket as specified in this International Standard. The values for the length of engagement, A , given in Table 5 or Table 6, as applicable, are related to a pipe length of 3 m.
- **Type L** (long): This socket type (see Figure 5) may be used as an expansion joint in fixed joint systems (i.e. systems which do not in themselves allow for expansion and contraction), whether jointed by ring seal or solvent cement or for use with sockets of type N, as applicable, where the length of pipe exceeds the maximum given for these types.

6.4.1.3 Solvent cement sockets

The classification includes the following type:

- **Type CS** (short type for solvent cement joints): This socket type (see Figure 7) may be used where jointing is carried out under controlled conditions.

6.4.1.4 Dual-purpose sockets

This socket type (see Figure 4) is intended to be used for a connection made either using a sealing ring or using solvent cement applied after removal of the sealing ring, if any.

Sockets of type N (see 6.4.1.2) may be used as dual-purpose sockets.

6.4.2 Dimensions of ring seal sockets and spigot ends

6.4.2.1 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 one of the following tables:

- Table 5 or Table 6, as applicable, for type N and dual-purpose (see Figure 4);
- Table 7 for type L (see Figure 5);

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 6 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 or Figure 5) 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 9.

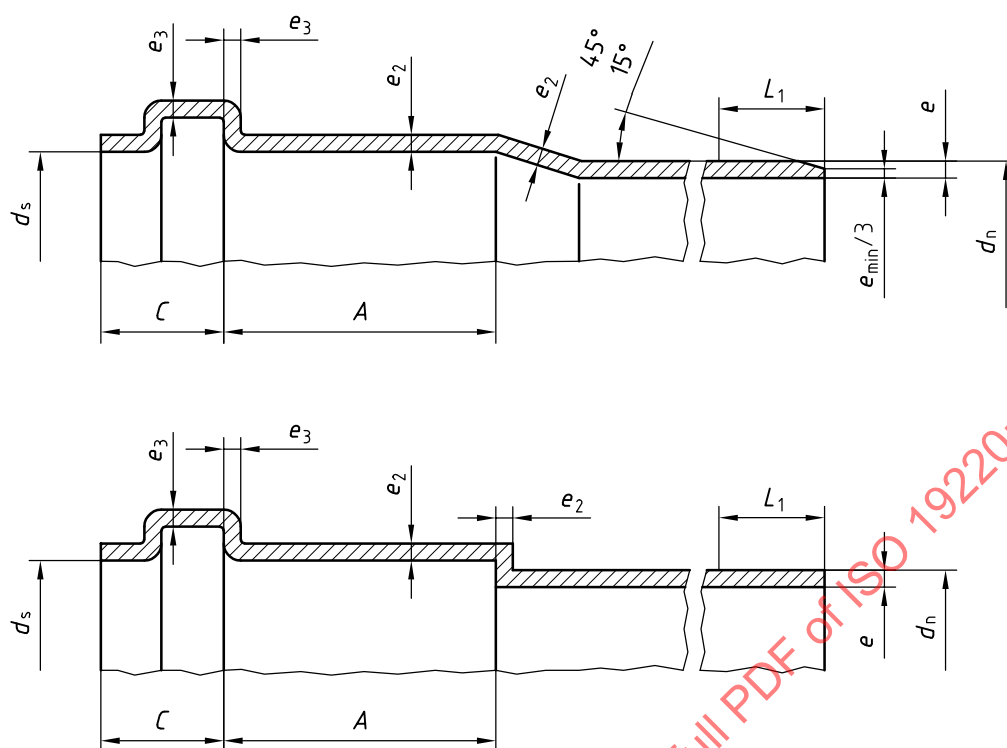


Figure 3 — Dimensions of sockets and spigot ends for ring seal joints

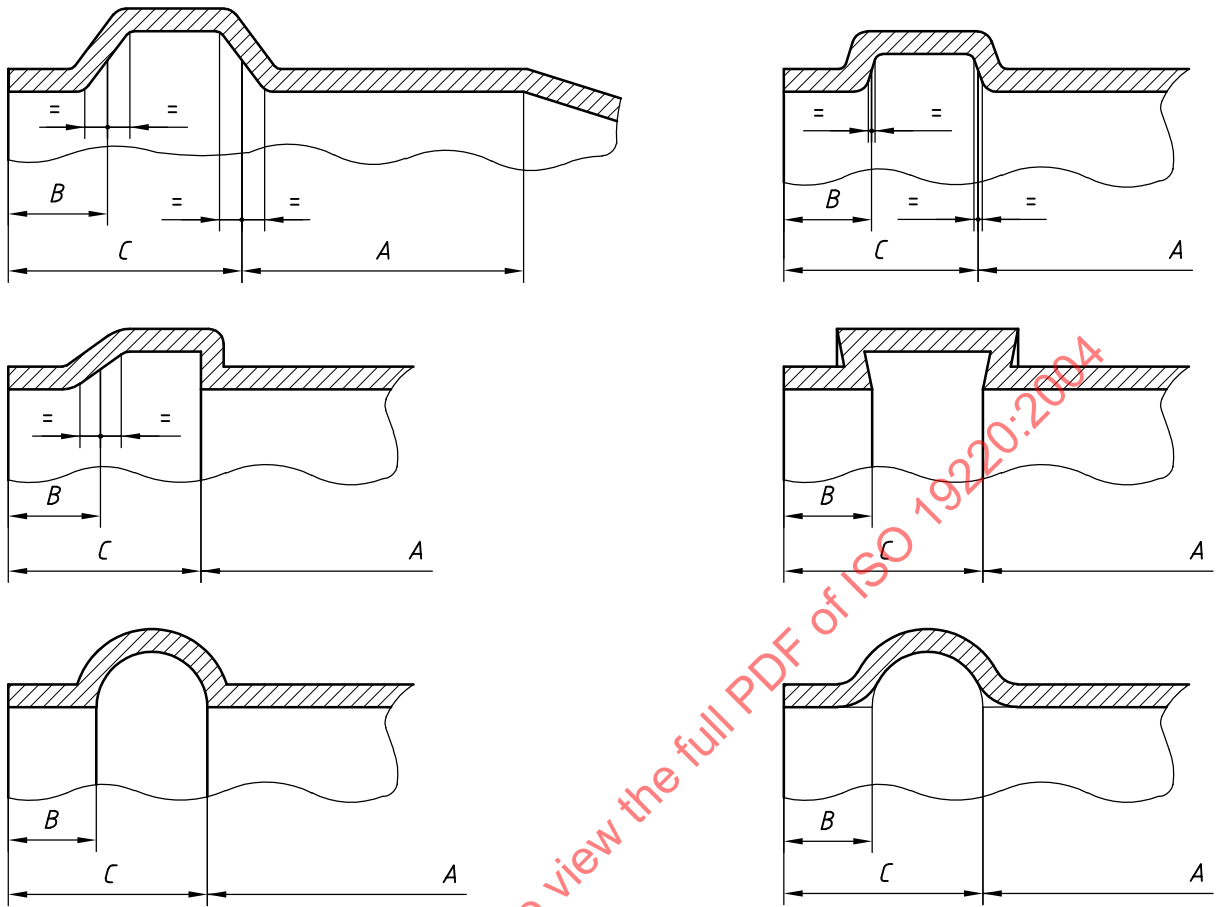


Figure 4 — Typical groove designs for type N and dual-purpose ring seal sockets

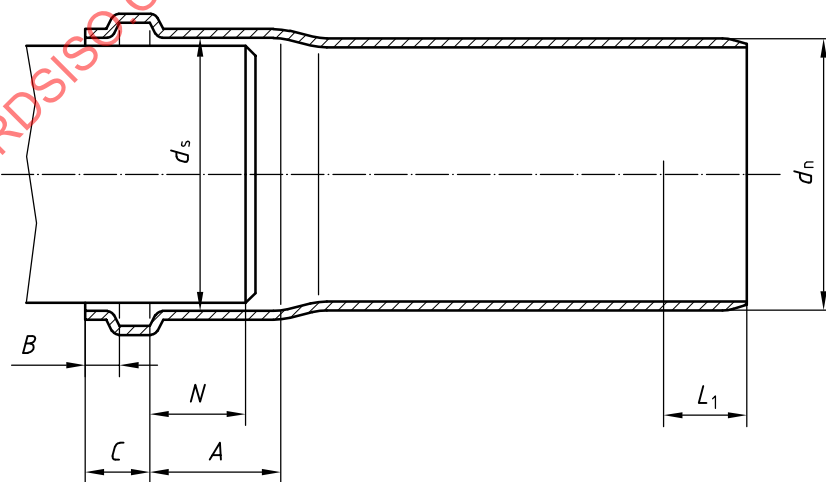


Figure 5 — Example of a type L ring seal socket

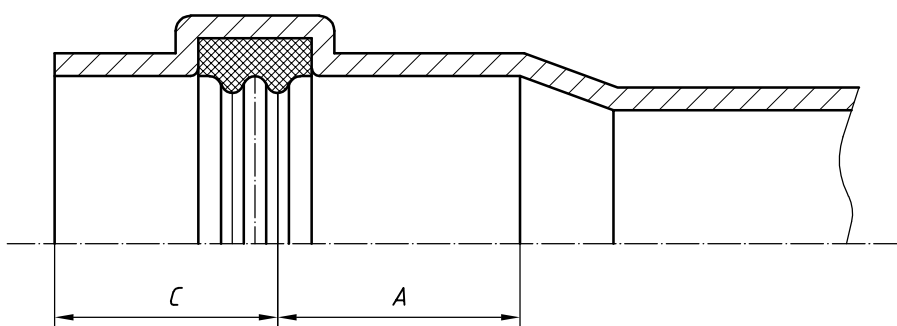


Figure 6 — Example of measurement of effective sealing point

Table 5 — Diameters and lengths of type N and dual-purpose ring seal sockets and spigot ends (metric series)

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Mean inside diameter of socket		Other socket dimensions			Length of spigot end
		d_{sm}		A	B	C	L_1
		min.	max. ^a	min.	min.	max.	min.
32	32	32,3	32,7	24	5	18	42
40	40	40,3	40,7	26	5	18	44
50	50	50,3	50,7	28	5	18	46
63	63	63,3	63,7	31	5	18	49
75	75	75,4	75,7	33	5	18	51
80	80	80,4	80,7	34	5	18	52
90	90	90,4	90,7	36	5	20	56
100	100	100,4	100,7	36	6	21	57
110	110	110,4	110,8	36	6	22	58
125	125	125,4	125,9	38	7	26	64
160	160	160,5	161,0	41	9	32	73

^a Required for dual-purpose sockets only.

Table 6 — Diameters and lengths of type N and dual-purpose ring seal sockets and spigot ends
(series based on inch dimensions)

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Mean inside diameter of socket		Other socket dimensions			Length of spigot end L_1 min.
		d_{sm} min.	max. ^a	A min.	B min.	C max.	
36	36	36,5	37,2	25	3,8	12	37
43	43	43,1	43,8	25	3,8	15	40
55	55	56,1	56,8	25	3,8	18	43

^a Required for dual-purpose sockets only.

Table 7 — Diameters and lengths of type L ring seal sockets and spigot ends (metric series)

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Mean inside diameter of socket d_{sm} min.	Other socket dimensions				Length of spigot end L_1 min.
			A min.	B min.	C max.	N min.	
32	32	32,4	65	5	18	45	35
40	40	40,4		5	18		36
50	50	50,4		5	18		38
63	63	63,4		5	18		40
75	75	75,4		5	20		43
80	80	80,4		5	22		44
90	90	90,4		5	23		46
100	100	100,5		6	25		50
110	110	110,5		6	26		54
125	125	125,5		7	28		60
160	160	160,6		9	32		74

6.4.2.2 Wall thicknesses of ring seal sockets

The wall thickness of the socket, e_2 , and the wall thickness in the groove area, e_3 , shall conform to Table 8 or Table 9, as applicable.

Table 8 — 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	1,7	1
40	40	1,7	1
50	50	1,7	1
63	63	1,7	1
75	75	1,7	1
80	80	1,7	1
90	90	1,7	1
100	100	1,8	1,1
110	110	2	1,3
125	125	2,3	1,4
160	160	2,9	1,8

Table 9 — 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.
36	36	1,7	1
43	43	1,8	1,1
55	55	1,8	1,1

6.4.3 Dimensions of solvent cement sockets and spigot ends

6.4.3.1 Diameters and lengths

The diameters and lengths of solvent cement sockets and spigot ends (see Figure 7) shall conform to Table 10 or Table 11, as applicable.

Solvent cement joints are intended to be used only in conjunction with those joints and practices which accommodate expansion and contraction in conformity with the relevant installation techniques. Joints made using solvent cement are rigid and do not in themselves allow for expansion and contraction due to temperature variations.

Within the tolerances necessary for manufacturing, solvent cement sockets shall be approximately cylindrical.

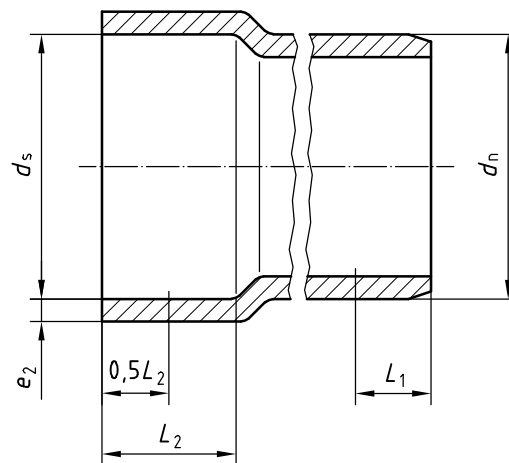


Figure 7 — Example of a type CS solvent cement socket and spigot end

Table 10 — Diameters and lengths of type CS solvent cement sockets and spigot ends (metric series)

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Mean inside diameter of socket ^a		Length of socket L_2 min.	Length of spigot end L_1 min.
		min.	max.		
32	32	32,1	32,5	17	17
40	40	40,1	40,5	18	18
50	50	50,1	50,5	20	20
63	63	63,1	63,5	23	23
75	75	75,1	75,5	25	25
80	80	80,1	80,5	26	26
90	90	90,1	90,5	28	28
100	100	100,1	100,6	30	30
110	110	110,2	110,7	32	32
125	125	125,2	125,8	35	35
160	160	160,2	160,9	42	42

^a Except for sockets for which the ratio $e_{2,min}/d_{em}$ is less than 0,035, the tolerance on ovality of any cross-sectional plane of inside diameter, d_s , of the socket shall conform to the following condition: $d_{s,max} - d_{s,min} \leq 0,011d_e$.

Table 11 — Diameters and lengths of type CS solvent cement sockets and spigot ends
(series based on inch dimensions)

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Mean inside diameter of socket ^a		Length of socket L_2 min.	Length of spigot end L_1 min.
		min.	max.		
36	36	36,1	36,7	18	18
43	43	42,7	43,3	21	21
55	55	55,7	56,3	27	27

^a Except for sockets for which the ratio $e_{2,min}/d_{em}$ is less than 0,035, the tolerance on ovality of any cross-sectional plane of inside diameter, d_s , of the socket shall conform to the following condition: $d_{s,max} - d_{s,min} \leq 0,011d_e$.

6.4.3.2 Wall thicknesses of solvent cement sockets

The wall thicknesses of solvent cement sockets, e_2 , shall conform to Table 8 or Table 9, as applicable.

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 8, 9, 10, 11 or 12):

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

The nominal angle, a , 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 or 18):

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

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

c) Saddle branches and reducing saddle branches (see Figure 19).

The nominal angle, a , may be selected from the following: 45°, 67°30', 80°, 87°30' to 90°.

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

d) Reducers (see Figure 20).

e) Access fittings (see Figure 21).

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

f) Couplers:

- double-socket (see Figure 22);
- repair collar (see Figure 23).

g) Plugs (see Figure 24).

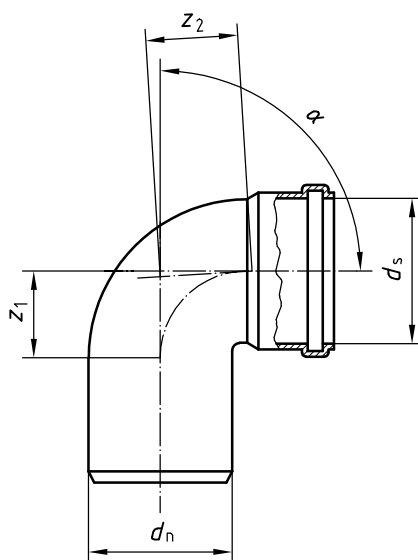


Figure 8 — Bend with single socket (unswept)

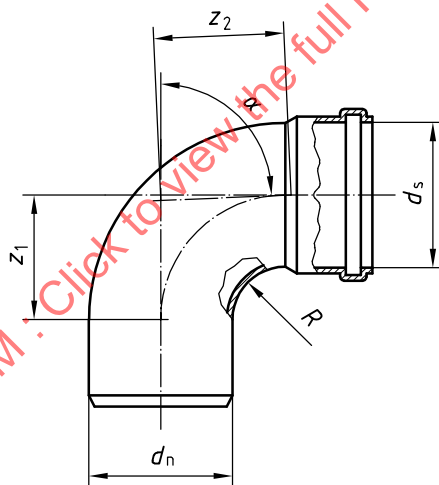


Figure 9 — Bend with single socket (swept)

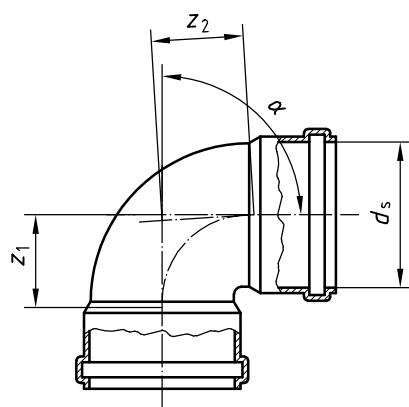


Figure 10 — Bend with only sockets (unswept)

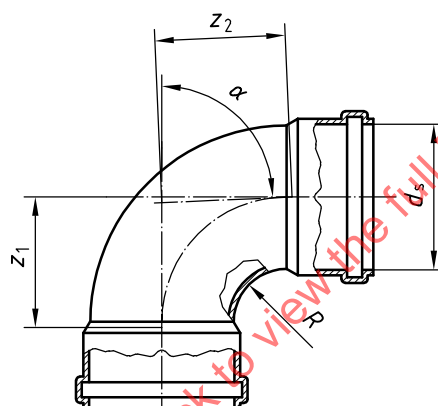


Figure 11 — Bend with only sockets (swept)

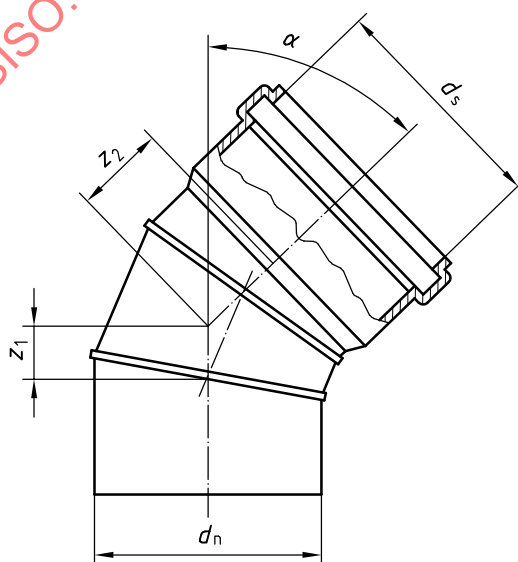


Figure 12 — Bend with single socket, solvent-cemented from segments

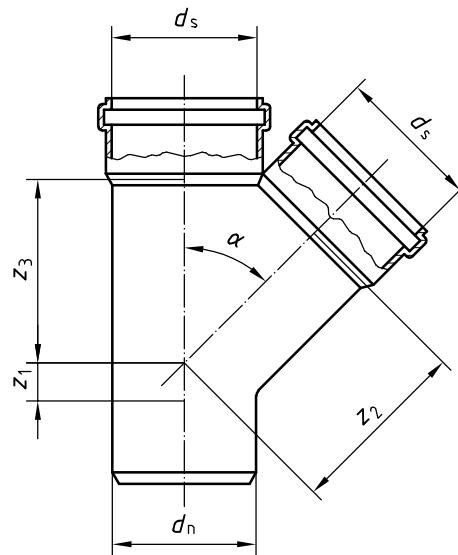


Figure 13 — Branch (unswept)

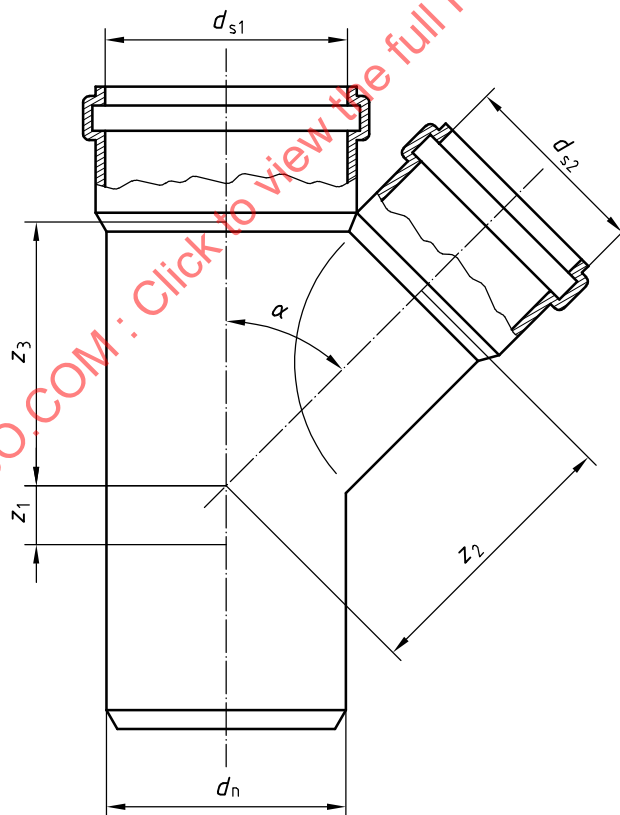


Figure 14 — Reducing branch (unswept)

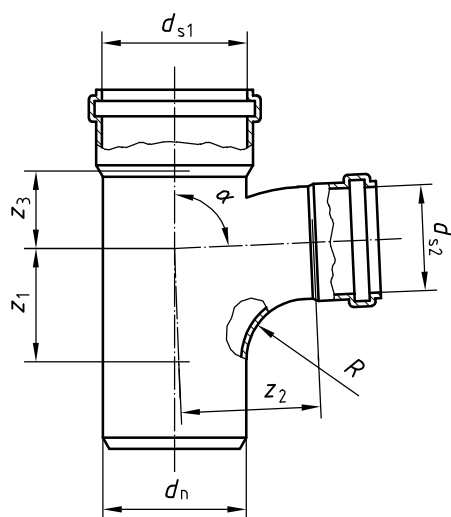


Figure 15 — Reducing branch (swept)

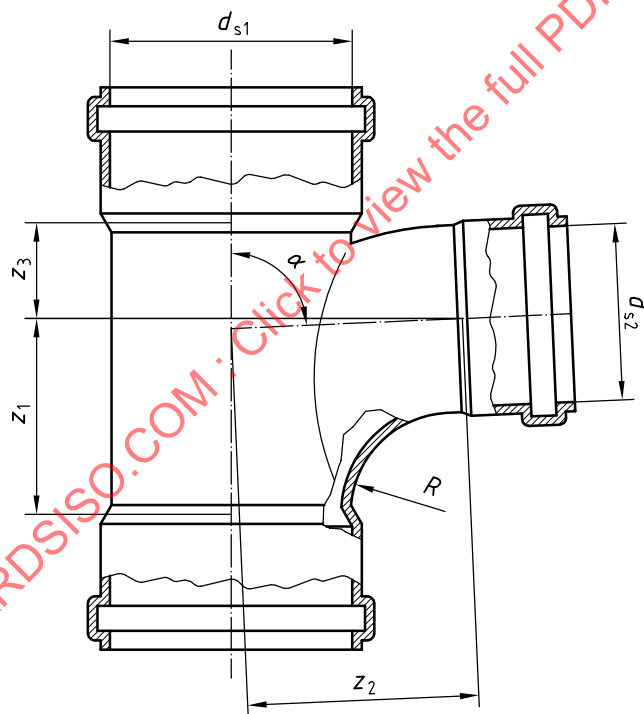


Figure 16 — Reducing branch with only sockets (swept)

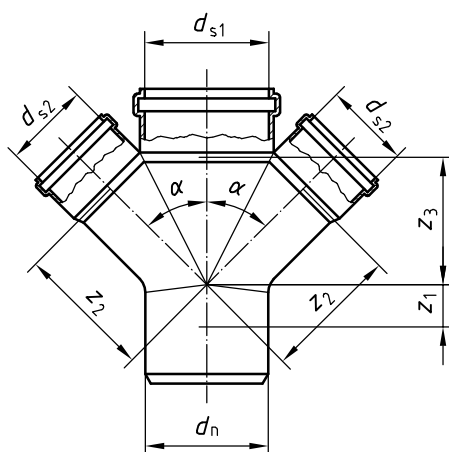


Figure 17 — Double branch

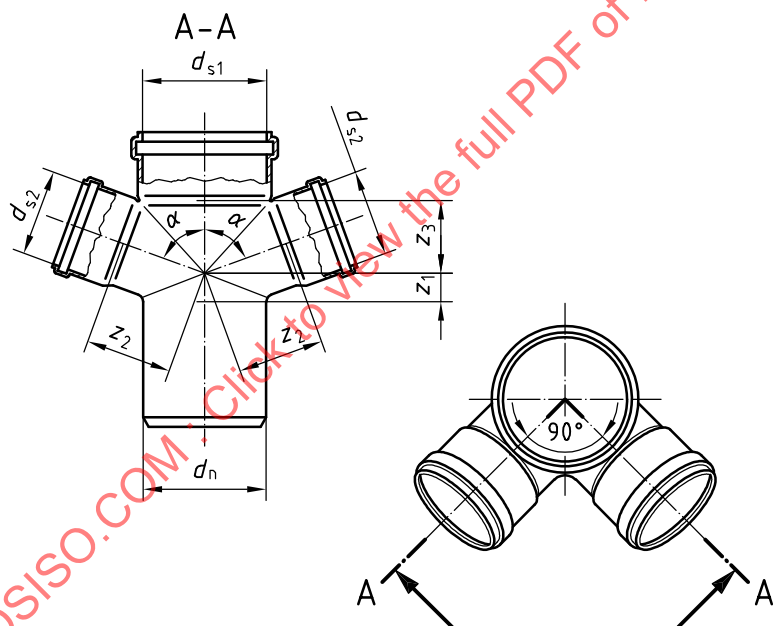


Figure 18 — Angular double branch

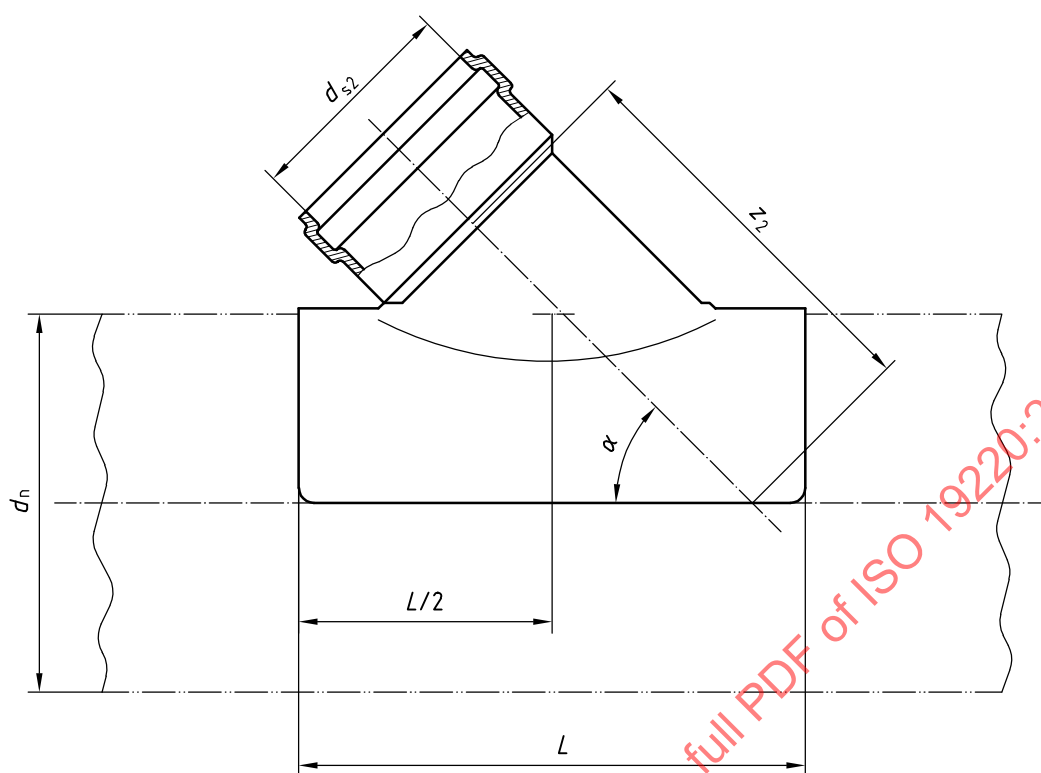


Figure 19 — Saddle branch

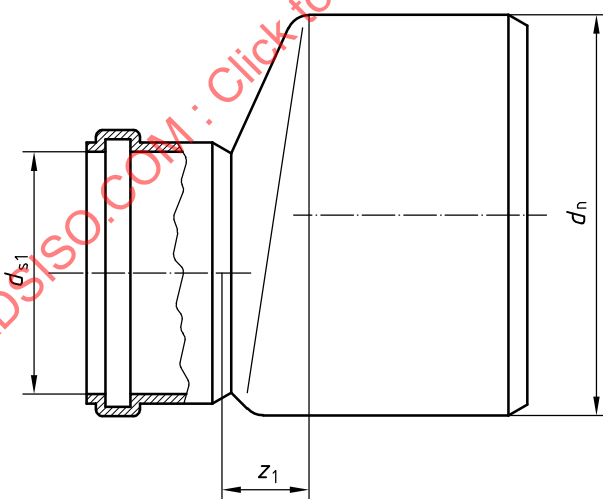


Figure 20 — Reducer

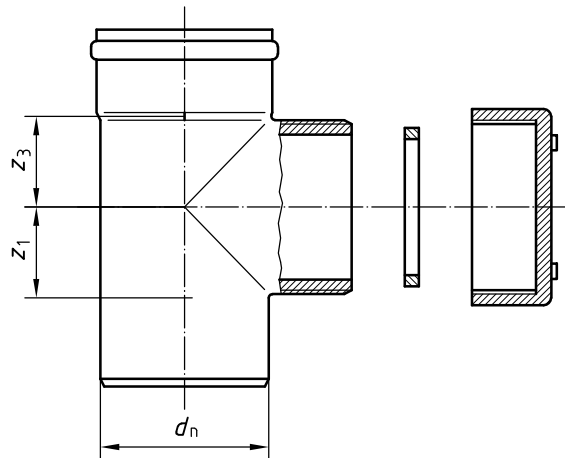


Figure 21 — Access fitting with round cleaning hole

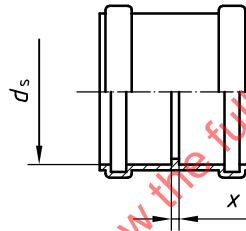


Figure 22 — Double-socket (coupler)

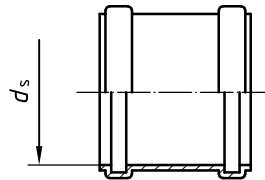


Figure 23 — Repair collar

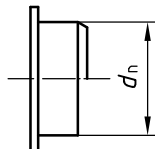


Figure 24 — Plug

7 Mechanical characteristics of pipes

7.1 General characteristics

When determined in accordance with the method specified in Table 12, using the parameters indicated, the general mechanical characteristics of pipes shall conform to the requirements given in Table 12.

The mass and drop height of the striker used in determining the impact resistance (round-the-clock method) as specified in Table 12 are given in Table 13 or Table 14, as applicable.

Table 12 — General mechanical characteristics of pipes

Characteristic	Requirements	Test parameters		Test method
Impact resistance (round-the-clock method)	$TIR \leq 10 \%$	Type of striker for: $d_n < 110 \text{ mm}$ $d_n \geq 110 \text{ mm}$ Mass of striker Drop height of striker Conditioning medium Conditioning and test temperature Conditioning period	Type d25 Type d90 Table 13 or Table 14, as applicable Table 13 or Table 14, as applicable Water or air (0 ± 1) °C 60 min	EN 744

**Table 13 — Mass and drop height of striker for impact resistance (round-the-clock method)
(metric series)**

Dimensions in millimetres			
Nominal size DN/OD	Nominal outside diameter d_n	Mass of striker kg $+0,01$ 0	Drop height of striker $+20$ 0
32	32	0,5	600
40	40	0,5	800
50	50	0,5	1 000
63	63	0,8	1 000
75	75	0,8	1 000
80	80	0,8	1 000
90	90	0,8	1 200
100	100	0,8	1 200
110	110	0,8	2 000
125	125	1,25	2 000
160	160	1,6	2 000

Table 14 — Mass and drop height of striker for impact resistance (round-the-clock method)
(series based on inch dimensions)

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Mass of striker kg $+0,01$ 0	Drop height of striker $+20$ 0
36	36	0,5	600
43	43	0,5	800
55	55	0,5	1 000

7.2 Additional characteristics

Pipes intended to be used in areas where installation is usually carried out at temperatures below $-10\text{ }^{\circ}\text{C}$ shall additionally conform to the requirements of an impact test (staircase method), as specified in Table 15.

The pipes shall be marked in accordance with Table 20.

Table 15 — Additional mechanical characteristics of pipes

Characteristic	Requirements	Test parameters		Test method
Impact resistance (staircase method)	$H_{50} \geq 1\text{ m}$	Conditioning and test temperature	$(0 \pm 1)\text{ }^{\circ}\text{C}$	EN 1411
	Max.: 1 break below 0,5 m	Type of striker	Type d90	
		Mass of striker for:		
		$32\text{ mm} \leq d_n \leq 40\text{ mm}$	1,25 kg	
		$50\text{ mm} \leq d_n \leq 63\text{ mm}$	2 kg	
		$75\text{ mm} \leq d_n \leq 80\text{ mm}$	2,5 kg	
		$90\text{ mm} \leq d_n \leq 100\text{ mm}$	3,2 kg	
		$d_n = 110\text{ mm}$	4 kg	
		$d_n = 125\text{ mm}$	5 kg	
		$d_n = 160\text{ mm}$	8 kg	

8 Physical characteristics

8.1 Physical characteristics of pipes

When determined in accordance with the methods specified in Table 16, using the parameters indicated, the physical characteristics of pipes shall conform to the requirements given in Table 16.

Table 16 — Physical characteristics of pipes

Characteristic	Requirements	Test parameters		Test method
Vicat softening temperature (VST) after conditioning in air	$\geq 90\text{ }^{\circ}\text{C}$	Shall conform to EN 727 Conditioning	^a	EN 727
Vicat softening temperature (VST) after conditioning in water	$\geq 80\text{ }^{\circ}\text{C}$	Shall conform to EN 727 Conditioning	16 h in water at $90\text{ }^{\circ}\text{C}$	EN 727
Longitudinal reversion ^b	$\leq 5\text{ }%$ The pipe shall exhibit no bubbles or cracks	Test temperature	$(150 \pm 2)\text{ }^{\circ}\text{C}$	EN 743:1994
		Immersion time	15 min	Method A: Liquid
		or		
		Test temperature	$(150 \pm 2)\text{ }^{\circ}\text{C}$	EN 743:1994
		Immersion time	30 min	Method B: Air
Water absorption	$\leq 3\text{ }%$	Test temperature	$(90 \pm 2)\text{ }^{\circ}\text{C}$	ISO 8361-1
		Immersion time	20 h	

^a 2 h in an oven with air circulation at $(90 \pm 2)\text{ }^{\circ}\text{C}$, then cool for $(15 \pm 1)\text{ min}$ at $(23 \pm 2)\text{ }^{\circ}\text{C}$ and $(50 \pm 5)\text{ }%$ relative humidity, then hold for 5 min at a temperature at least $50\text{ }^{\circ}\text{C}$ lower than the expected softening temperature.

^b The choice of method A or method B is the responsibility of the manufacturer.

8.2 Physical characteristics of fittings

When determined in accordance with the methods specified in Table 17 and Table 18, using the parameters indicated, the physical characteristics of fittings shall conform to the requirements given in Table 17 or Table 18, as applicable.

Table 17 — Physical characteristics of fittings

Characteristic	Requirements	Test parameters		Test method
Vicat softening temperature (VST) after conditioning in air	$\geq 90\text{ }^{\circ}\text{C}$	Shall conform to EN 727 Conditioning	^a	EN 727
Vicat softening temperature (VST) after conditioning in water	$\geq 80\text{ }^{\circ}\text{C}$	Shall conform to EN 727 Conditioning	16 h in water at $90\text{ }^{\circ}\text{C}$	EN 727
Effects of heating	^b	Test temperature	$(150 \pm 2)\text{ }^{\circ}\text{C}$	EN 763:1994
		Heating time	30 min	Method A: Air oven
Water absorption	$\leq 3\text{ }%$	Test temperature	$(90 \pm 2)\text{ }^{\circ}\text{C}$	ISO 8361-1
		Immersion time	20 h	

^a 2 h in an oven with air circulation at $(90 \pm 2)\text{ }^{\circ}\text{C}$, then cool for $(15 \pm 1)\text{ min}$ at $(23 \pm 2)\text{ }^{\circ}\text{C}$ and $(50 \pm 5)\text{ }%$ relative humidity, then hold for 5 min at a temperature at least $50\text{ }^{\circ}\text{C}$ lower than the expected softening temperature.

^b The depth of any cracks, delaminations or blisters shall not exceed 50 % of the wall thickness around the injection point(s). No part of the weld line shall be open to a depth of more than 50 % of the wall thickness. At all other points on the surface, the depth of any cracks or delaminations shall not exceed 30 % of the wall thickness at that point.

When fittings are manufactured from pipes, the pipes shall conform to the requirements given in Table 12 and Table 16.

Mouldings that are used for fabricated fittings may be tested separately.