INTERNATIONAL STANDARD

ISO 19220

Second edition
2021-07

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)

Reference number
ISO 19220:2021(E)

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Published in Switzerland

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document 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 19220:2004), which has been technically revised.

The main changes compared to the previous edition are as follows:

— references to EN standards have been changed to references to ISO standards;

— Introduction has been deleted;

— symbols have been modified.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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

1 Scope

This document 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, and for the system itself. It does not include buried pipework.

It also specifies the test parameters for the test methods referred to within this document.

This document 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.

This document 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 documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 2505, *Thermoplastics pipes — Longitudinal reversion — Test method and parameters*

ISO 2507-1, *Thermoplastics pipes and fittings — Vicat softening temperature — Part 1: General test method*

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

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

ISO 4633, *Rubber seals — Joint rings for water supply, drainage and sewerage pipelines — Specification for materials*

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

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

ISO 13255, *Thermoplastics piping systems for soil and waste discharge inside buildings — Test method for airtightness of joints*

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

EN 681-2, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 2: Thermoplastic elastomers*

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

3 Terms, definitions, symbols and abbreviated terms

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 Symbols

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_s)
e_s	wall thickness of the socket
e_g	wall thickness at the groove
l_{sz}	depth of sealing zone
l_{eff}	effective insertion depth
L_c	length of solvent cement socket
L_e	length of engagement
L_l	length of lead-in
L_p	effective length of a pipe
L_{sp}	length of spigot
L_z	design length (z-length) of a fitting
R	radius of swept fittings z
α	nominal angle of a fitting
H_{50}	drop height for 50 % failure

3.2 Abbreviated terms

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

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 document.

Other additives may be used in order to conform to national requirements on fire regulations.

Fabricated fittings or parts of fabricated fittings shall be made from pipes and/or mouldings conforming to this document, except for the requirements for wall thickness of fabricated fittings and/or mouldings made from SAN + PVC, which conform to the respective material, mechanical and physical characteristics as required in this document.

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 document is permitted. External reprocessable or recyclable material shall not be used.

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 document for fire behaviour. Attention is drawn to the need to acknowledge 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 document;

— 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 over the whole wall.

The recommended colour for pipes and fittings is grey or black.

Annex A gives information on additional characteristics.

6 Geometrical characteristics

6.1 General

All dimensions shall be measured in accordance with ISO 3126.

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

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	Nominal outside diameter	Mean outside diameter	
DN/OD	d_n	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 of a pipe, L_p, 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.

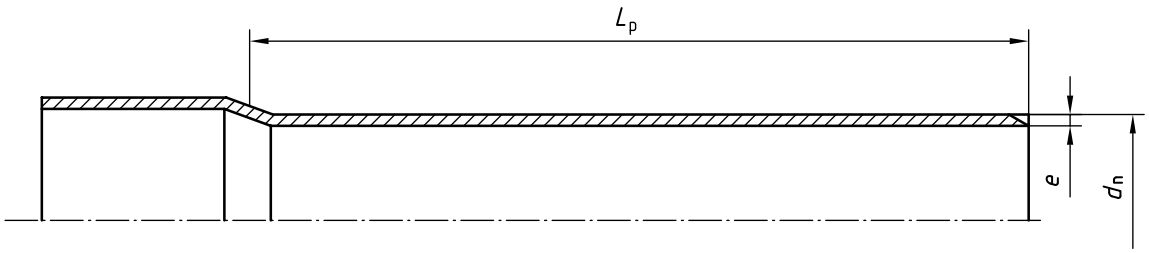
6.2.3 Chamfering

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.

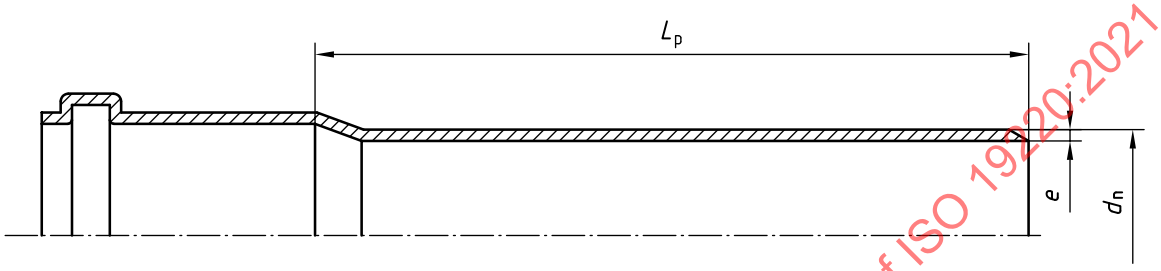
The remaining wall thickness of the end of the pipe shall be at least 1/3 of e_{min}.

6.2.4 Wall thickness

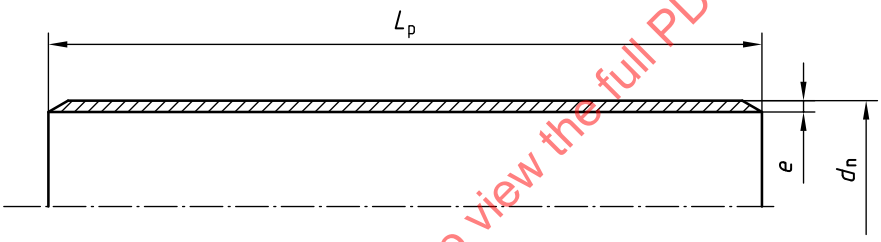
The wall thickness, e, shall conform to Table 3 or Table 4, as applicable, but for the metric series a maximum wall thickness at any point of up to 1,25 e_{min} is permitted, provided that the mean wall thickness, e_m, is less than or equal to the specified $e_{m,max}$.



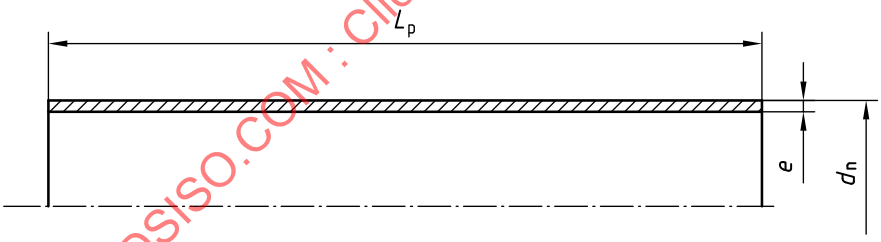
a) Solvent cement pipe



b) Ring seal pipe



c) Plain ended pipe with chamfer



d) Plain ended pipe without chamfer

Figure 1 — Effective lengths of pipes

Table 3 — Wall thicknesses (metric series)

Dimensions in millimetres

Nominal size	Nominal outside diameter	Wall thickness			
		Pipe series			
		S 25[a]		S 16,7[a]	
DN/OD	d_n	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

[a] Pipe series are defined in ISO 4065.

Table 3 *(continued)*

Nominal size	Nominal outside diameter	Wall thickness			
		Pipe series			
		S 25[a]		S 16,7[a]	
DN/OD	d_n	e_{min}	$e_{m,max}$	e_{min}	$e_{m,max}$
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	Nominal outside diameter	Wall thickness	
DN/OD	d_n	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 Figures 8 to 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 can 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_g as given in Table 8 or Table 9, as applicable.

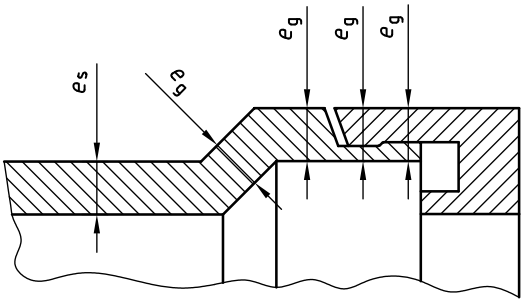


Figure 2 — Example of calculation of wall thickness of socket with retaining cap

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 document. The values for the length of engagement, L_e, 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 a 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 L_e and the maximum value of l_{sz} 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 L_l (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.

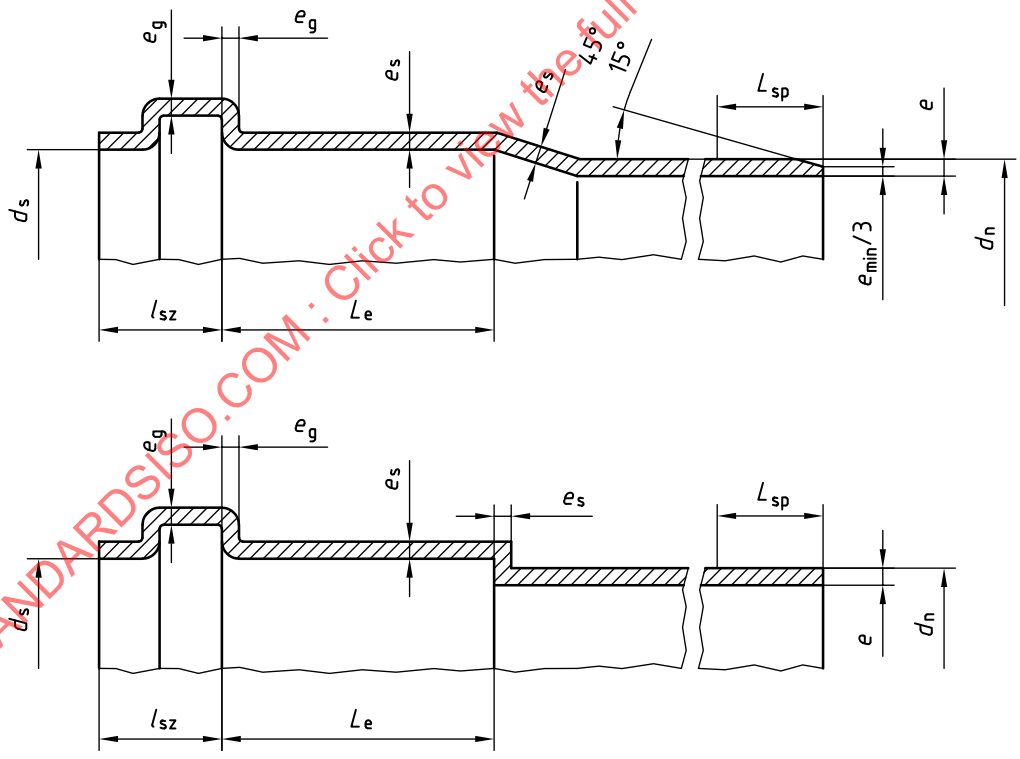


Figure 3 — Dimensions of sockets and spigot ends for ring seal joints

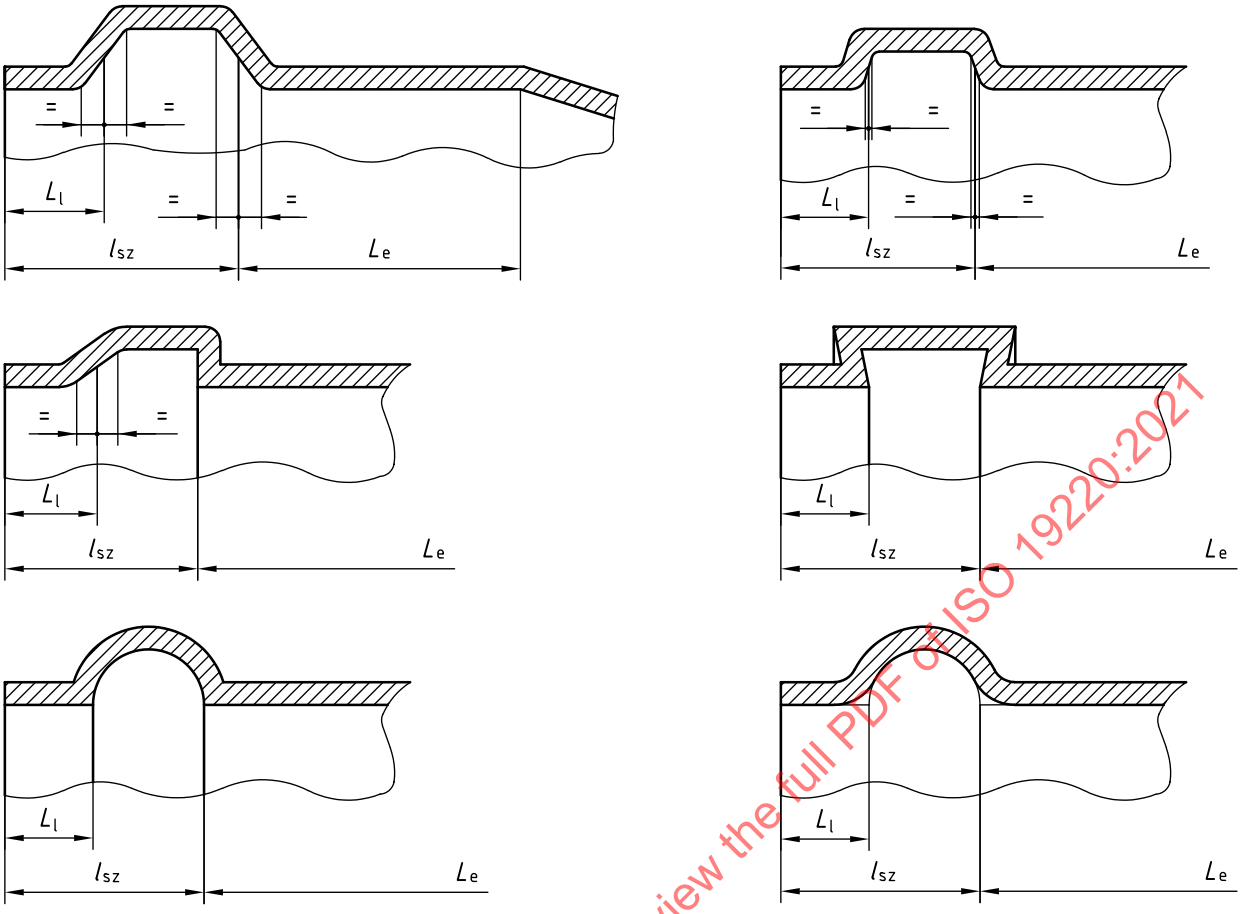


Figure 4 — Typical groove designs for type N and dual-purpose ring seal sockets

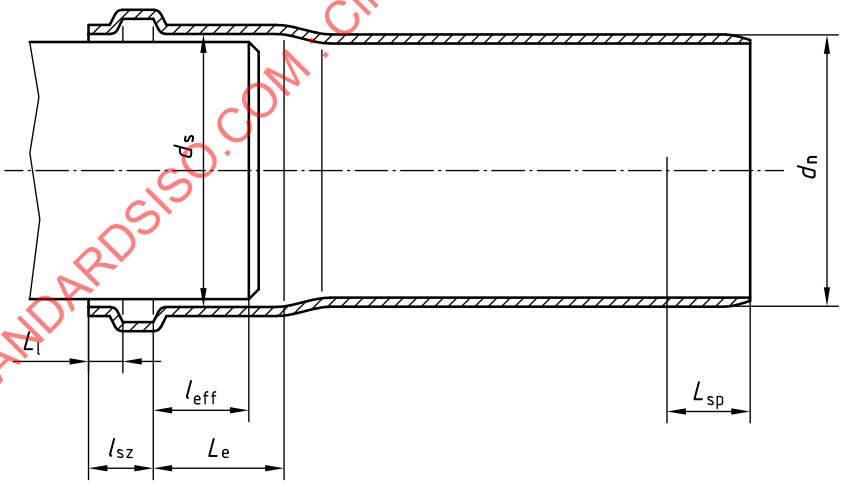


Figure 5 — Example of a type L ring seal socket

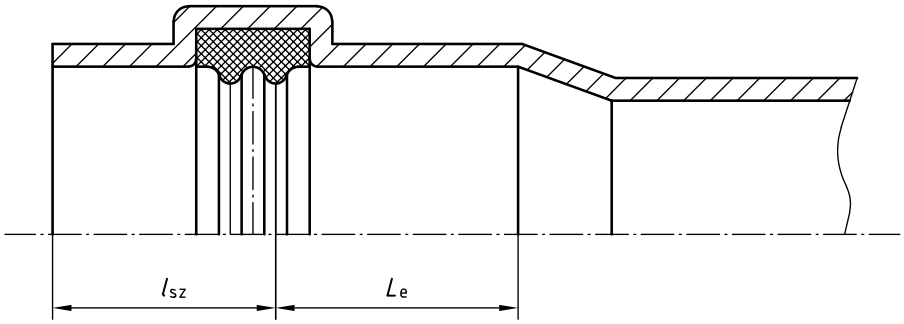


Figure 6 — Example of measurement of effective sealing point

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

Dimensions in millimetres

Nominal size	Nominal outside diameter	Mean inside diameter of socket		Other socket dimensions			Length of spigot end
DN/OD	d_n	d_{sm}		L_e	L_l	l_{sz}	L_{sp}
		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	Nominal outside diameter	Mean inside diameter of socket		Other socket dimensions			Length of spigot end
DN/OD	d_n	d_{sm}		L_e	L_l	l_{sz}	L_{sp}
		min.	max.[a]	min.	min.	max.	min.
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	Nominal outside diameter	Mean inside diameter of socket	Other socket dimensions				Length of spigot end
DN/OD	d_n	d_{sm} min.	L_e min.	L_l min.	l_{sz} max.	l_{eff} min.	L_{sp} min.
32	32	32,4		5	18		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	65	5	22	45	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_s, and the wall thickness in the groove area, e_g, shall conform to Table 8 or Table 9, as applicable.

Table 8 — Wall thicknesses of sockets (metric series)

Dimensions in millimetres

Nominal size	Nominal outside diameter	Wall thicknesses	
DN/OD	d_n	e_s min.	e_g 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	Nominal outside diameter	Wall thicknesses	
DN/OD	d_n	e_s min.	e_g 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.

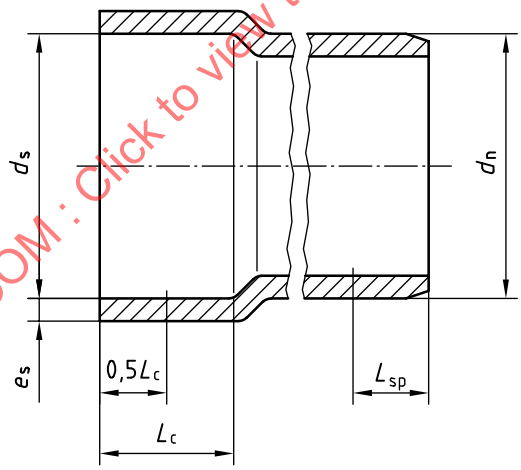


Figure 7 — Example of a type CS solvent cement socket and spigot end

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

Dimensions in millimetres

Nominal size	Nominal outside diameter	Mean inside diameter of socket[a]		Length of socket	Length of spigot end
DN/OD	d_n	d_{sm} min.	d_{sm} max.	L_c min.	L_{sp} min.
32	32	32,1	32,5	17	17
40	40	40,1	40,5	18	18

[a] Except for sockets for which the ratio $e_{s,min}/d_{em}$ 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: $d_{s,max} - d_{s,min} \leq 0{,}011 d_e$.

Table 10 *(continued)*

Nominal size DN/OD	Nominal outside diameter d_n	Mean inside diameter of socket[a] d_{sm}		Length of socket L_c	Length of spigot end L_{sp}
		min.	max.	min.	min.
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	32	30
110	110	110,2	110,7	30	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 $e_{s,min}/d_{em}$ 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: $d_{s,max} - d_{s,min} \leq 0{,}011 d_e$.

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] d_{sm}		Length of socket L_c	Length of spigot end L_{sp}
		min.	max.	min.	min.
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 $e_{s,min}/d_{em}$ 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: $d_{s,max} - d_{s,min} \leq 0{,}011 d_e$.

6.4.3.2 Wall thicknesses of solvent cement sockets

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

6.5 Types of fitting

This document 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, 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 or 18):

— 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', 80°, 87°30' to 90°.

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

The nominal angle, α, 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).

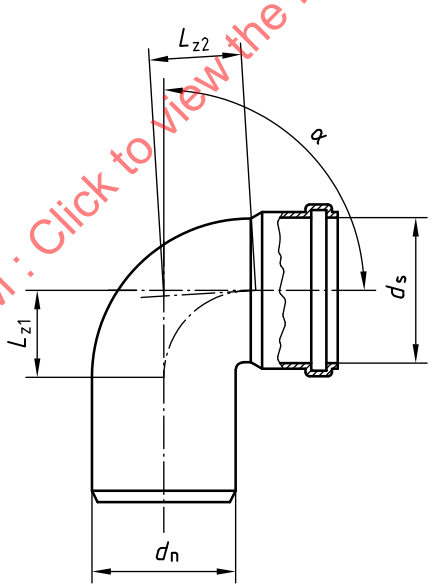


Figure 8 — Bend with single socket (unswept)

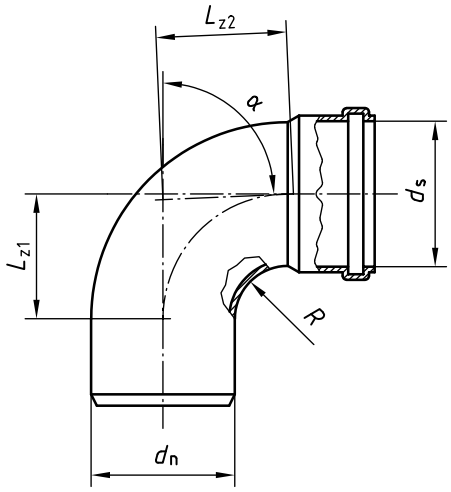


Figure 9 — Bend with single socket (swept)

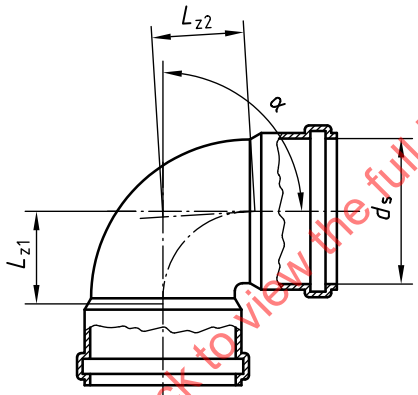


Figure 10 — Bend with only sockets (unswept)

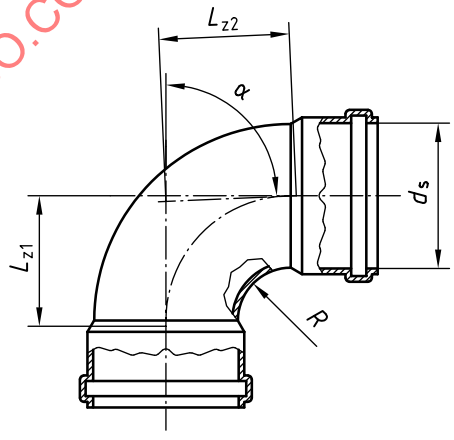


Figure 11 — Bend with only sockets (swept)

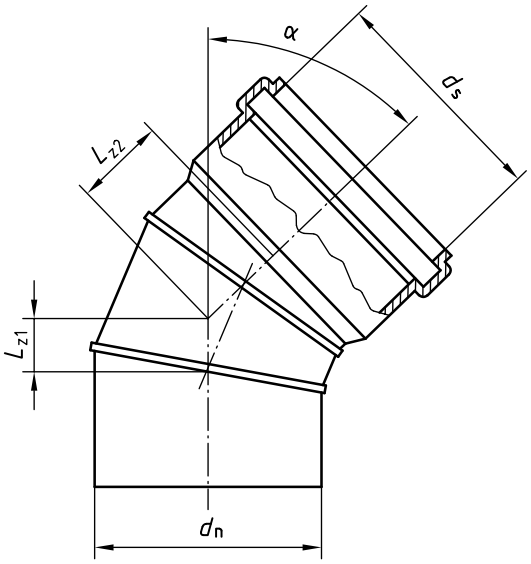


Figure 12 — Bend with single socket, solvent-cemented from segments

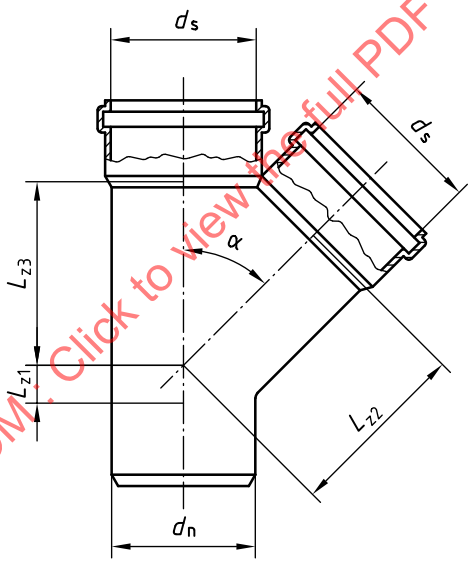


Figure 13 — Branch (unswept)

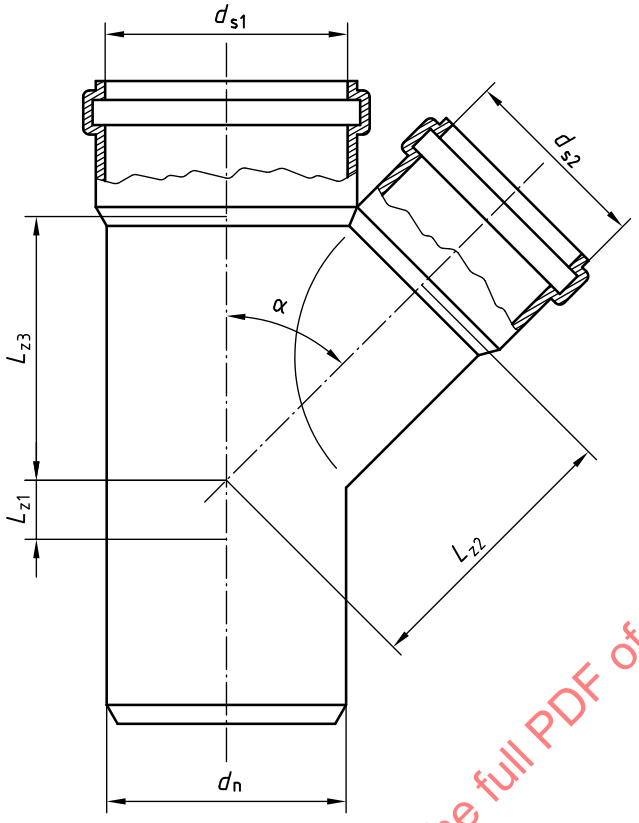


Figure 14 — Reducing branch (unswept)

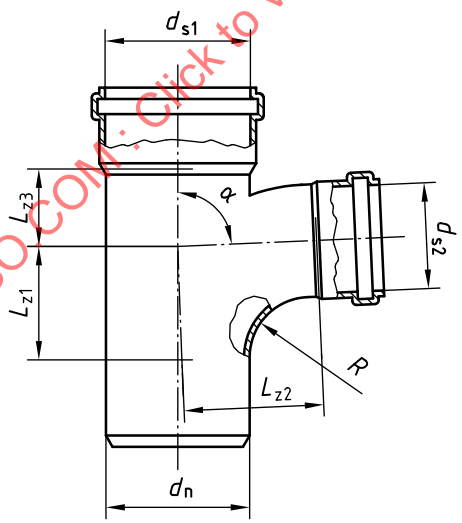


Figure 15 — Reducing branch (swept)

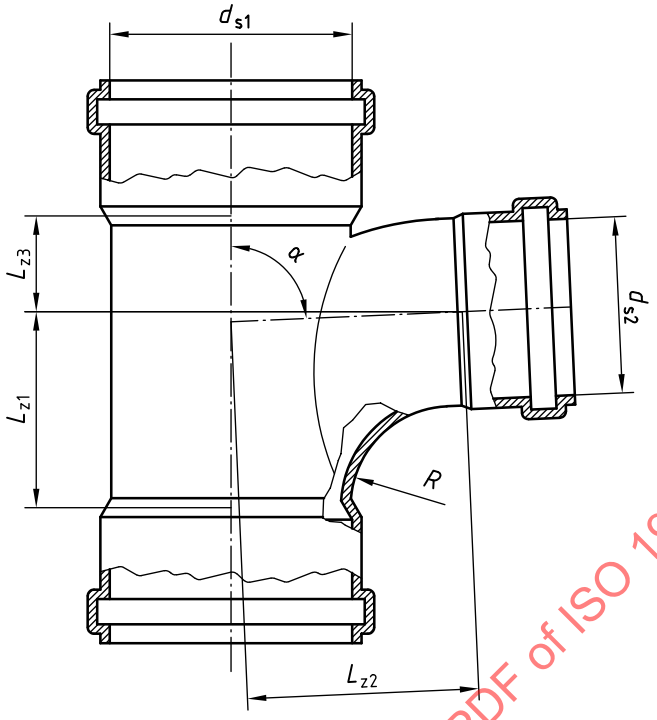


Figure 16 — Reducing branch with only sockets (swept)

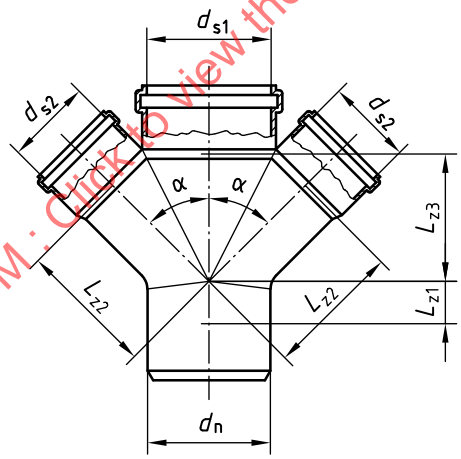


Figure 17 — Double branch

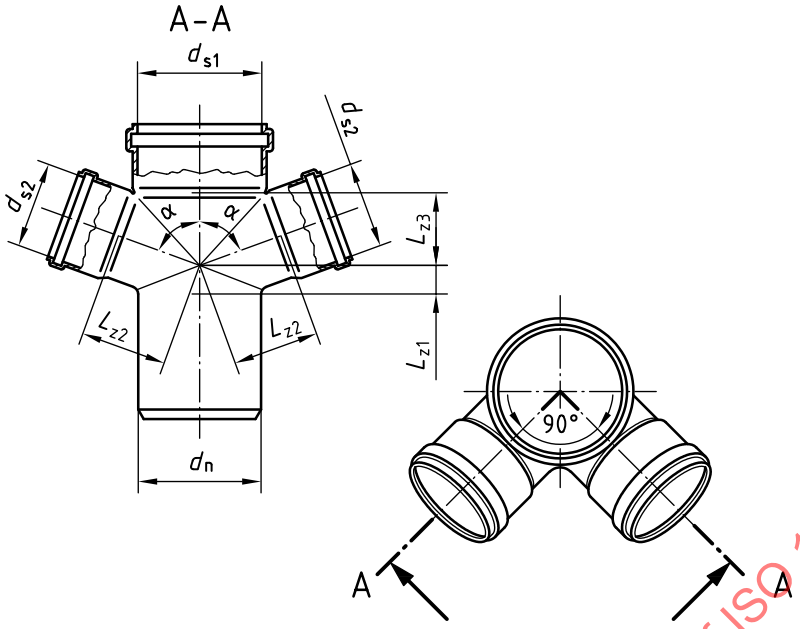


Figure 18 — Angular double branch

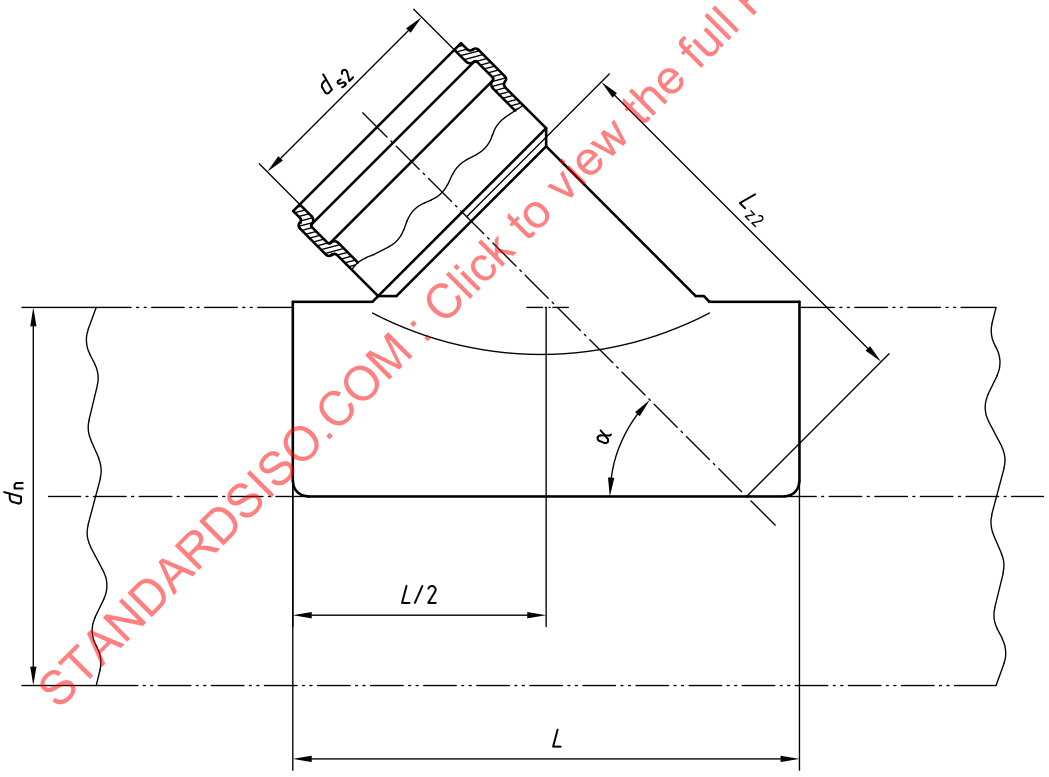


Figure 19 — Saddle branch

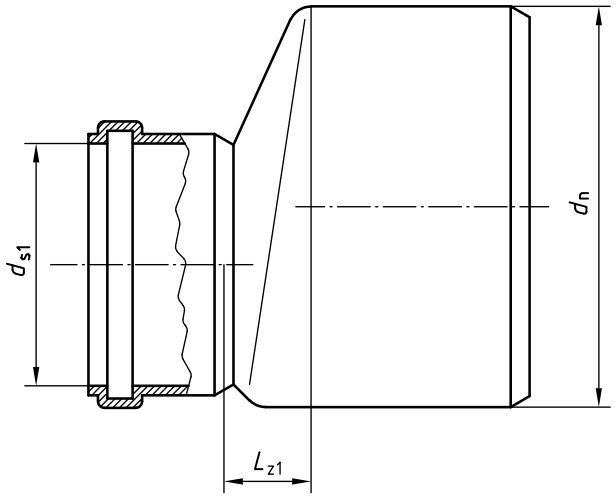


Figure 20 — Reducer

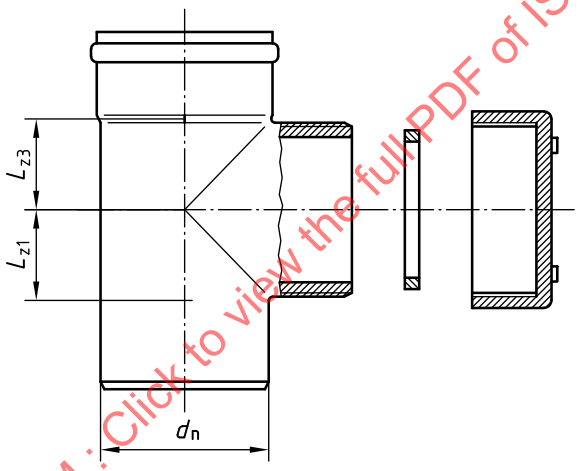


Figure 21 — Access fitting with round cleaning hole

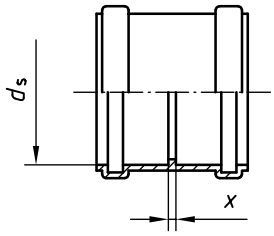


Figure 22 — Double-socket (coupler)

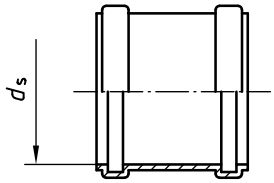


Figure 23 — Repair collar

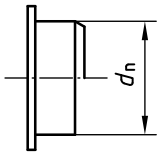


Figure 24 — Plug

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 ≤ 10 %	Type of striker for:		ISO 3127
		d_n < 110 mm	Type d25	
		d_n ≥ 110 mm	Type d90	
		Mass of striker Drop height of striker	Table 13 or Table 14, as applicable	
		Conditioning medium	Water or air	
		Conditioning and test temperature	(0 ± 1) °C	
		Conditioning period	60 min	

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

Table 13 *(continued)*

Nominal size DN/OD	Nominal outside diameter d_n	Mass of striker kg +0,01 0	Drop height of striker +20 0
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 °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)	$H_{50} \geq 1$ m Max.: 1 break below 0,5 m	Conditioning and test temperature	(0 ± 1) °C	EN 1411
		Type of striker	Type d90	
		Mass of striker for:		
		32 mm $d_n \leq 40$ mm	1,25 kg	
		50 mm $d_n \leq 63$ mm	2 kg	
		75 mm $d_n \leq 80$ mm	2,5 kg	
		90 mm $d_n \leq 100$ mm	3,2 kg	
		$d_n = 110$ mm	4 kg	
		$d_n = 125$ mm	5 kg	
		$d_n = 160$ 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	≥ 90 °C	Shall conform to ISO 2507-1 Conditioning	a	ISO 2507-1
Vicat softening temperature (VST) after conditioning in water	≥ 80 °C	Shall conform to ISO 2507-1 Conditioning	16 h in water at 90 °C	ISO 2507-1
Longitudinal reversion[b]	≤ 5 % The pipe shall exhibit no bubbles or cracks	Test temperature Immersion time	(150 ± 2) °C 15 min	ISO 2505 Liquid bath
		or		
		Test temperature Immersion time	(150 ± 2) °C 60 min	ISO 2505 Air oven
Water absorption	≤ 3 %	Test temperature Immersion time	(90 ± 2) °C 20 h	ISO 8361-1

[a] 2 h in an oven with air circulation at (90 ± 2) °C, then cool for (15 ± 1) min at (23 ± 2) °C and (50 ± 5) % relative humidity, then maintain for 5 min at a temperature at least 50 °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	≥ 90 °C	Shall conform to ISO 2507-1 Conditioning	a	ISO 2507-1
Vicat softening temperature (VST) after conditioning in water	≥ 80 °C	Shall conform to ISO 2507-1 Conditioning	16 h in water at 90 °C	ISO 2507-1
Effects of heating	b	Test temperature Heating time	(150 ± 2) °C 30 min	ISO 2505 Air oven

[a] 2 h in an oven with air circulation at (90 ± 2) °C, then cool for (15 ± 1) min at (23 ± 2) °C and (50 ± 5) % relative humidity, then maintain for 5 min at a temperature at least 50 °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.