INTERNATIONAL STANDARD

ISO 7671

Second edition
2003-11-15

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

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 — Polypropylène (PP)

Reference number
ISO 7671:2003(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 7671 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 7671:1991), which has been technically revised.

Introduction

Pipes and fittings conforming to this International Standard also meet the requirements of EN 1451-1 which are applicable to those pipes and fittings which, according to EN 1451-1, are intended to be used inside buildings (application area code “B”, see EN 1451-1) only.

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

1 Scope

This International Standard specifies the requirements for solid-wall polypropylene (PP) 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 PP 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 for jointing by means of elastomeric sealing rings or by butt fusion.

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)

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*

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

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 effective length of a pipe

R radius of swept fittings

z design length (z-length) of a fitting

α nominal angle of a fitting

3.2 Abbreviations

MFR melt mass-flow rate

OIT oxidation induction time

PP polypropylene

PP-H polypropylene homopolymer

TIR true impact rate

4 Material

4.1 PP compound

The compound for pipes and fittings shall be PP-based material (homopolymer and/or copolymer) 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 PP which conform to material, mechanical 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 1451-1.

4.3 Melt mass-flow rate

The MFR of the PP-based material shall determined in accordance with ISO 1133:1999, set of conditions M (test temperature 230 °C, load 2,16 kg).

Pipes and fittings intended to be used for mechanical joints shall be made from materials with an MFR as follows:

MFR (230/2,16) $\leqslant$ 3,0 g/10 min

Materials for pipes and fittings for butt fusion joints shall be designated by the following classes with regard to the MFR:

Class A	MFR $\leqslant$ 0,3 g/10 min;
Class B	0,3 g/10 min $<$ MFR $\leqslant$ 0,6 g/10 min;
Class C	0,6 g/10 min $<$ MFR $\leqslant$ 0,9 g/10 min;
Class D	0,9 g/10 min $<$ MFR $\leqslant$ 1,5 g/10 min.

Only pipes and fittings made from materials of the same or adjacent MFR classes may be fused together.

4.4 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 8 min.

NOTE Requirements for thermal stability are only applicable to materials for pipes and fittings intended for butt fusion.

4.5 Sealing ring retaining means

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

4.6 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, black or white.

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.

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
200	200	200,0	200,6

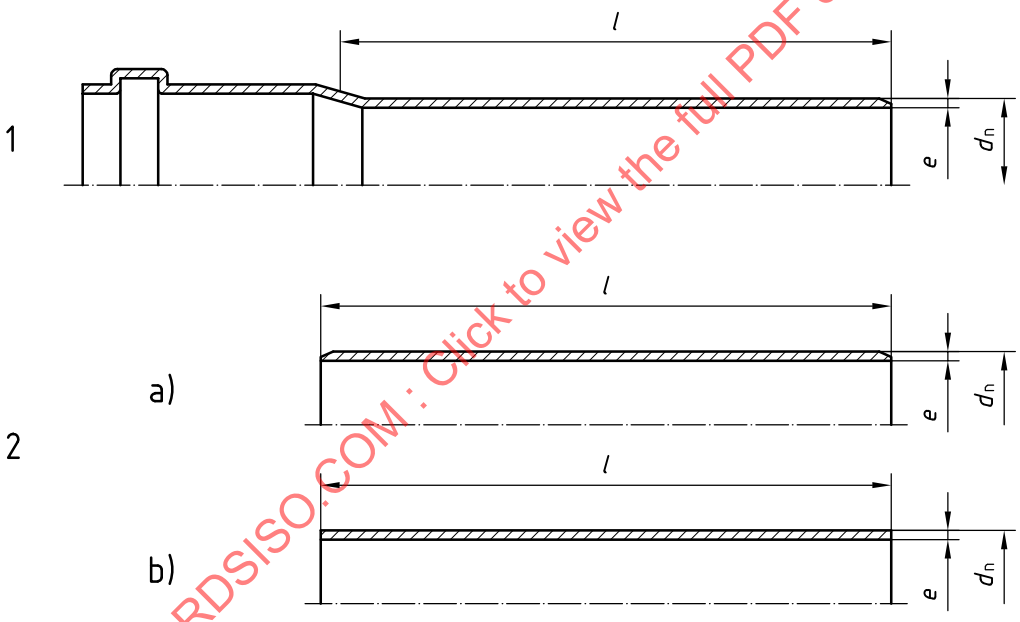
Table 2 — Mean outside diameters
(series based on inch dimensions)

Dimensions in millimetres

Nominal size DN/OD	Nominal outside diameter d_n	Mean outside diameter d_{em}	
		min.	max.
34	34	34,4	34,8
41	41	40,8	41,2
54	54	53,9	54,3

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 lengths 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 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 $e_{m,max}$.

Table 3 — Wall thicknesses
(metric series)

Dimensions in millimetres

Nominal size	Nominal outside diameter	Wall thickness			
		Pipe series			
		S 20		S 16	
DN/OD	d_n	e min.	e_m max.	e min.	e_m max.
32	32	1,8	2,2	1,8	2,2
40	40	1,8	2,2	1,8	2,2
50	50	1,8	2,2	1,8	2,2
63	63	1,8	2,2	2,0	2,4
75	75	1,9	2,3	2,3	2,8
80	80	2,0	2,4	2,5	3,0
90	90	2,2	2,7	2,8	3,3
100	100	2,5	3,0	3,2	3,8
110	110	2,7	3,2	3,4	4,0
125	125	3,1	3,7	3,9	4,5
160	160	3,9	4,5	4,9	5,6
200	200	4,9	5,6	6,2	7,1

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.
34	34	1,8	2,2
41	41	1,9	2,3
54	54	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 6 to Figure 19) 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.

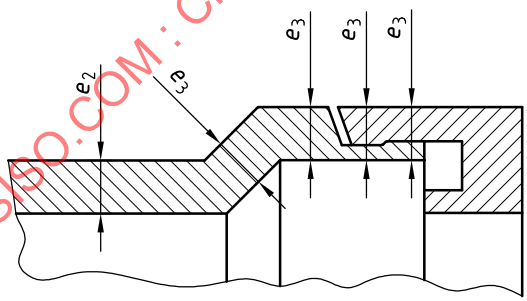


Figure 2 — Example of calculation of wall thickness of socket with retaining cap

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 or 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 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 9.

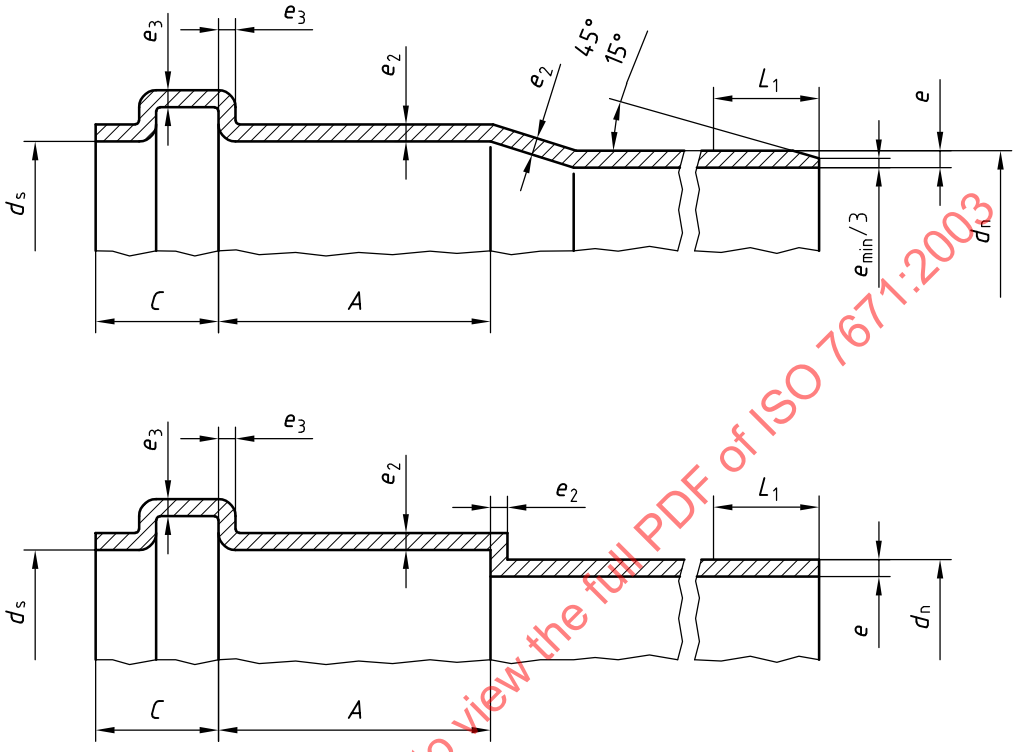


Figure 3 — Dimensions of sockets and spigot ends for ring seal joints

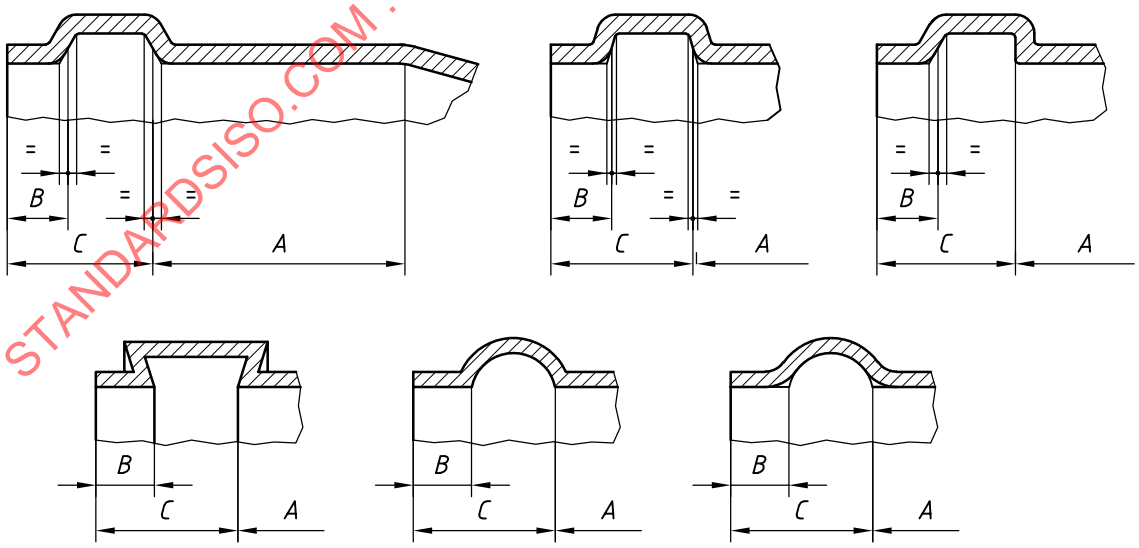


Figure 4 — Typical groove designs for ring seal sockets

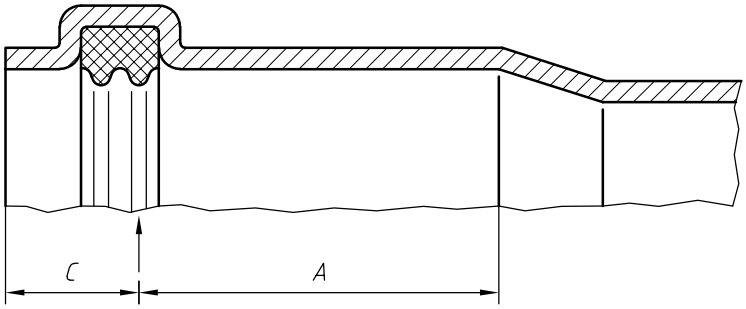


Figure 5 — Example of measurement of effective sealing point

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

Dimensions in millimetres

Nominal size	Nominal outside diameter	Socket				Spigot end
DN/OD	d_n	d_{sm} min.	A min.	B min.	C max.	L_1 min.
32	32	32,3	24	5	18	42
40	40	40,3	26	5	18	44
50	50	50,3	28	5	18	46
63	63	63,3	31	5	18	49
75	75	75,4	33	5	18	51
80	80	80,4	34	5	19	53
90	90	90,4	34	5	20	54
100	100	100,4	35	5	21	56
110	110	110,4	36	6	22	58
125	125	125,4	38	7	26	64
160	160	160,5	41	9	32	73
200	200	200,6	45	12	40	85

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	Socket				Spigot end
DN/OD	d_n	d_{sm} min.	A min.	B min.	C max.	L_1 min.
34	34	34,8	25	3,8	12	37
41	41	41,2	25	3,8	15	40
54	54	54,3	25	3,8	18	43

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

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.
34	34	1,7	1
41	41	1,8	1,1
54	54	1,8	1,1

6.4.2 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.

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 6, 7, 8, 9, 10 or 11):

— 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 12, 13, 14, 15, 16 or 17):

— 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°.

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

c) Reducers (see Figure 18).

d) Access fittings (see Figure 19).

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

e) Couplers:

— double-socket (see Figure 20);

— repair collar (see Figure 21).

f) Push-fit socket for butt fusion for pipe ends (see Figure 22).

g) Plugs (see Figure 23).

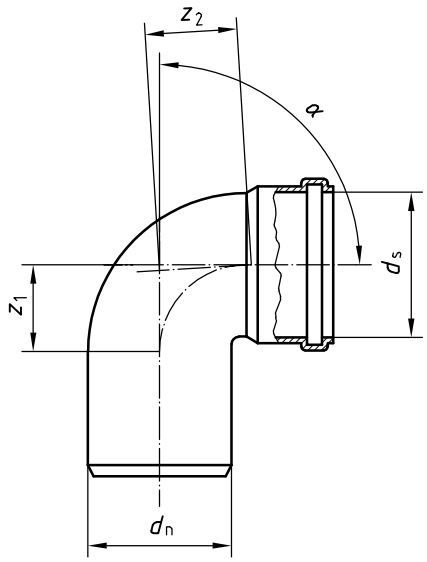


Figure 6 — Bend with single socket (unswept)

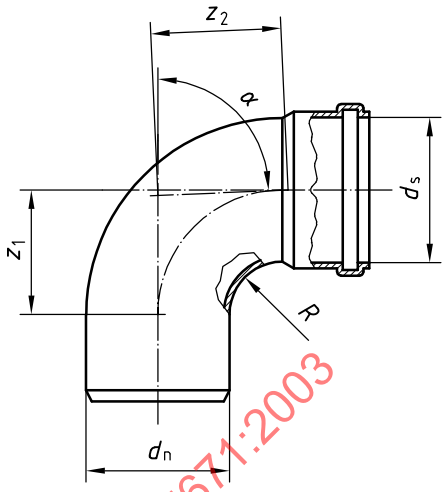


Figure 7 — Bend with single socket (swept)

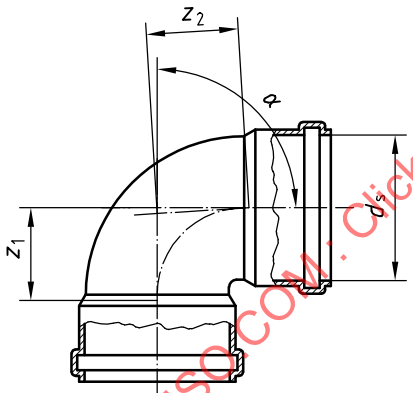


Figure 8 — Bend with only sockets (unswept)

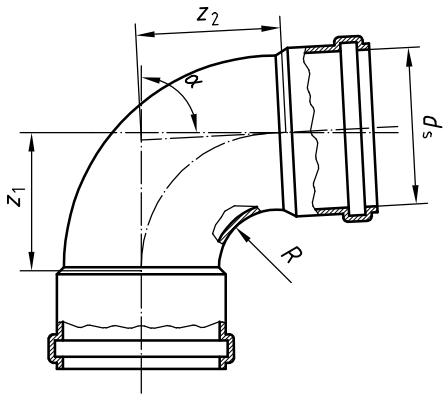


Figure 9 — Bend with only sockets (swept)

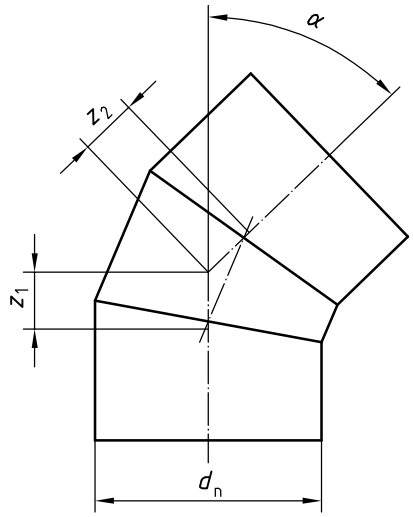


Figure 10 — Bend, butt-fused from segments

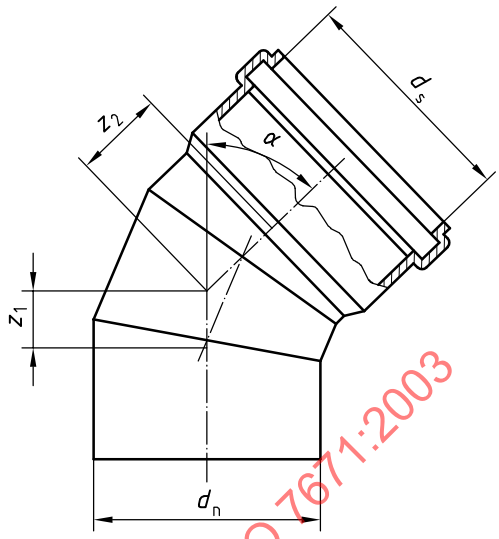


Figure 11 — Bend with single socket, butt-fused from segments

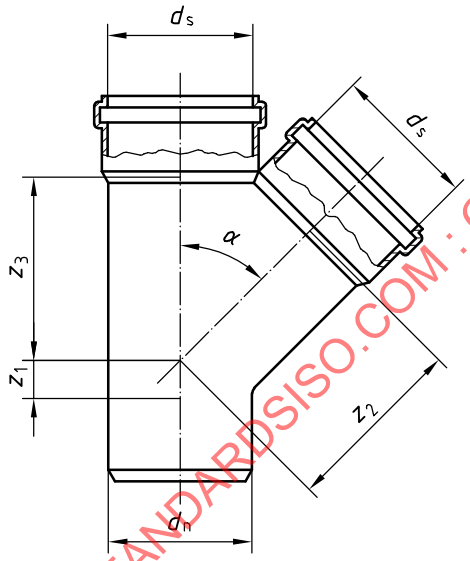


Figure 12 — Branch (unswept)

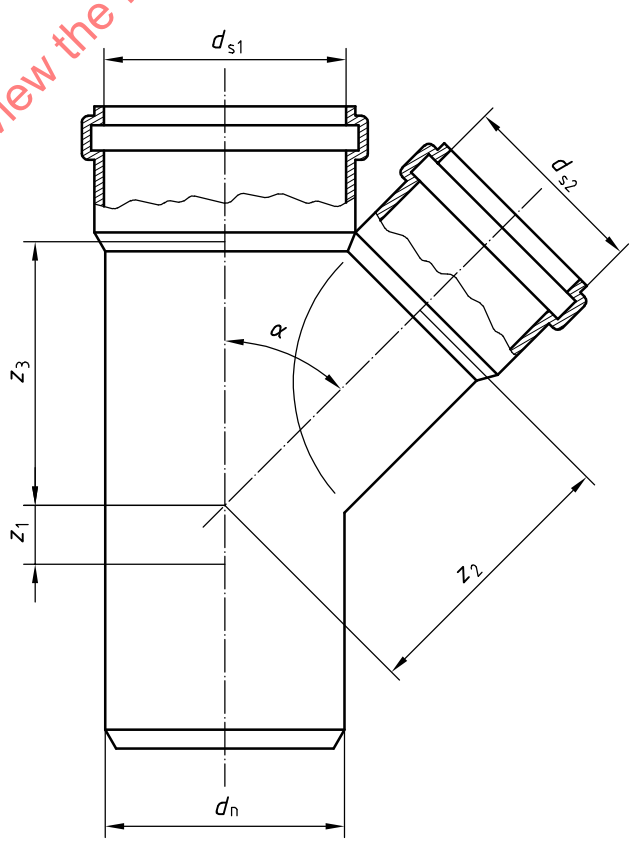


Figure 13 — Reducing branch (unswept)

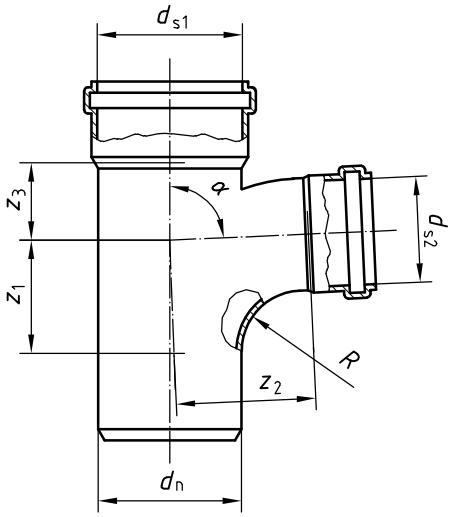


Figure 14 — Reducing branch (swept)

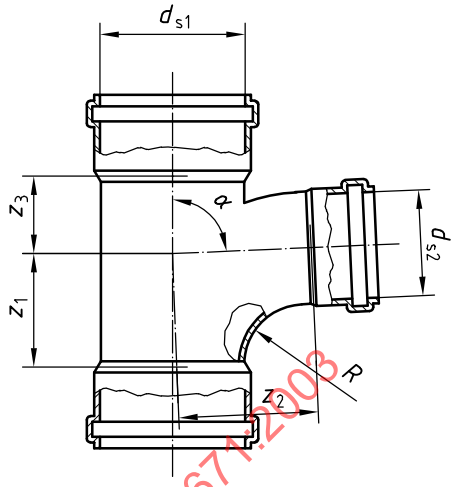


Figure 15 — Reducing branch with only sockets (swept)

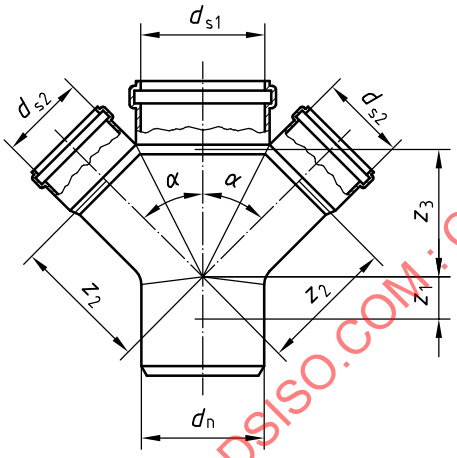


Figure 16 — Double branch

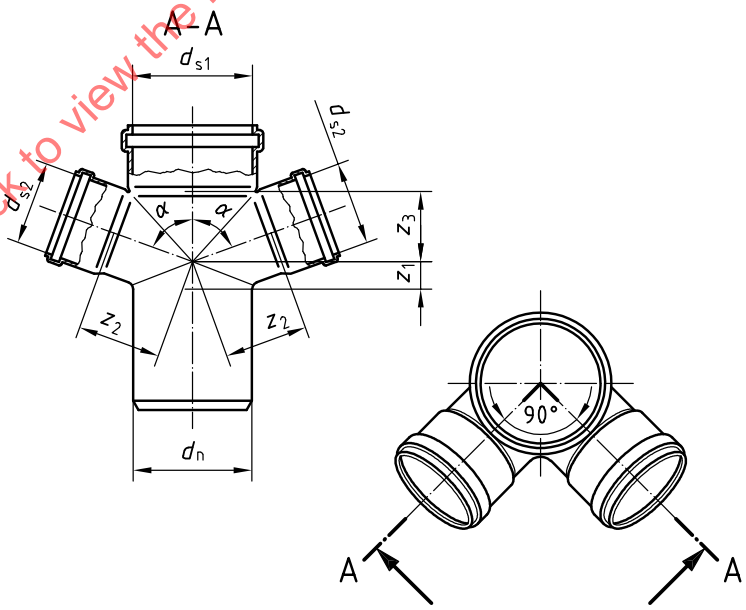


Figure 17 — Angular double branch

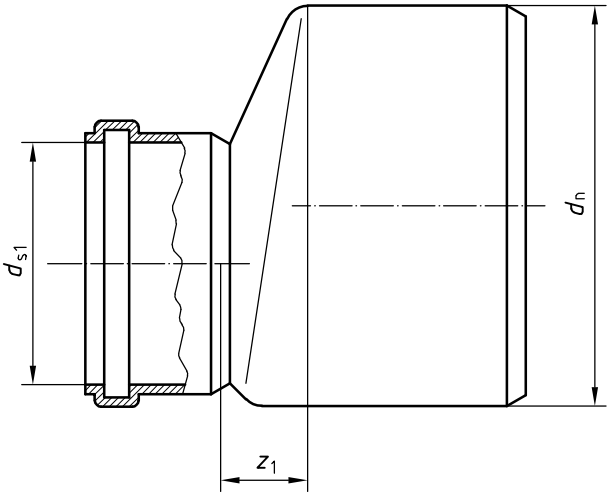


Figure 18 — Reducer

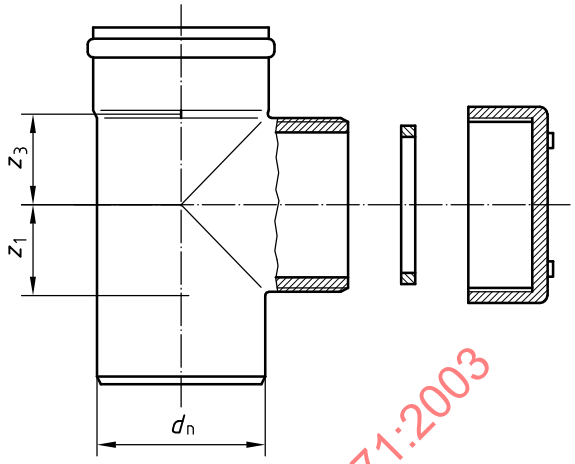


Figure 19 — Access fitting with round cleaning hole

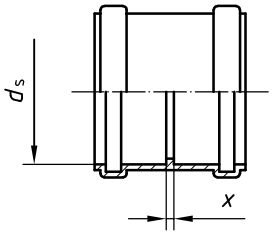


Figure 20 — Double-socket (coupler)

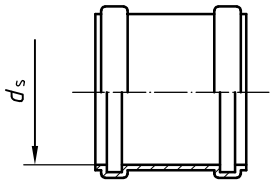


Figure 21 — Repair collar

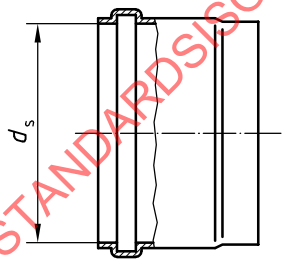


Figure 22 — Push-fit socket for butt fusion of pipe ends

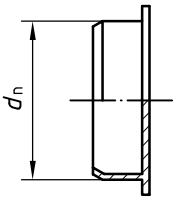


Figure 23 — Plug

7 Mechanical characteristics of pipes

7.1 General characteristics

When determined in accordance with the method specified in Table 9, using the parameters indicated, the general mechanical characteristics of pipes shall conform to the requirements given in Table 9.

The mass and drop height of the striker used in determining the impact resistance (round-the-clock method) as specified in Table 9 are given in Table 10 or Table 11, as applicable.

Table 9 — General mechanical characteristics of pipes

Characteristic	Requirements	Test parameters		Test method
PP-copolymer				
Impact resistance (round-the-clock method)	TIR $\leqslant$ 10 %	Type of striker for:		EN 744
		$d_n < 110$ mm	Type d25	
		$d_n \geqslant 110$ mm	Type d90	
		Mass of striker	Table 10 or Table 11, as applicable	
		Drop height of striker	Table 10 or Table 11, as applicable	
		Conditioning medium	Water or air	
		Conditioning and test temperature	(0 ± 1) °C [a]	
		Conditioning period	60 min	
PP-H				
Impact resistance (round-the-clock method)	TIR $\leqslant$ 10 %	Type of striker for:		EN 744
		$d_n < 110$ mm	Type d25	
		$d_n \geqslant 110$ mm	Type d90	
		Mass of striker	Table 10 or Table 11, as applicable	
		Drop height of striker	Table 10 or Table 11, as applicable	
		Conditioning medium	Air	
		Conditioning and test temperature	(23 ± 2) °C	
		Conditioning period	60 min	

[a] In the event of indirect testing, the preferred temperature is (23 ± 2) °C.

Table 10 — 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
200	200	2,0	2 000

Table 11 — 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 $^{+20}_{0}$
34	34	0,5	600
41	41	0,5	800
54	54	0,5	1 000

7.2 Additional characteristics

Pipes made from PP copolymers 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 12.

The pipes shall be marked in accordance with Table 17.

Table 12 — Additional mechanical characteristics of pipes

Characteristic	Requirements	Test parameters		Test method
Impact resistance [a] (staircase method)	$H_{50} \geqslant 1$ 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 $\leqslant d_n \leqslant$ 43 mm	1,25 kg	
		50 mm $\leqslant d_n \leqslant$ 63 mm	2 kg	
		75 mm $\leqslant d_n \leqslant$ 80 mm	2,5 kg	
		90 mm $\leqslant d_n \leqslant$ 100 mm	3,2 kg	
		$d_n = 110$ mm	4 kg	
		$d_n = 125$ mm	5 kg	
		$d_n = 160$ mm	8 kg	
		d_n = 200 mm	10 kg	
[a] For PP copolymers only.				

8 Physical characteristics

8.1 Physical characteristics of pipes

When determined in accordance with the methods specified in Table 13, using the parameters indicated, the physical characteristics of pipes shall conform to the requirements given in Table 13.

Table 13 — Physical characteristics of pipes

Characteristic	Requirements	Test parameters		Test method
Longitudinal reversion [a]	$\leqslant$ 2 % The pipe shall exhibit no bubbles or cracks	Test temperature Immersion time	(150 ± 2) °C 30 min	EN 743:1994 Method A: Liquid
		or		
		Test temperature Immersion time	(150 ± 2) °C 60 min	EN 743:1994 Method B: Air
Melt mass-flow rate (MFR)	Permitted max. deviation when processing the compound into pipe: 0,2 g/10 min	Test temperature Load	230 °C 2,16 kg	ISO 1133:1999 Set of conditions M
[a] 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 14 and Table 15, using the parameters indicated, the physical characteristics of fittings shall conform to the requirements given in Table 14 or Table 15, as applicable.