

# INTERNATIONAL STANDARD

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**8770**

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## High-density polyethylene (PE-HD) pipes and fittings for soil and waste discharge (low and high temperature) systems inside buildings — Specifications

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*Tubes et raccords en polyéthylène haute densité (PE-HD) pour les systèmes d'évacuation d'eaux usées et d'eaux-vannes (à basse et à haute température) à l'intérieur des bâtiments — Spécifications*

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Reference number  
ISO 8770:1991(E)

## 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.

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.

International Standard ISO 8770 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*.

Annexes A, B, C, D, E, F and G form an integral part of this International Standard. Annex H is for information only.

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# High-density polyethylene (PE-HD) pipes and fittings for soil and waste discharge (low and high temperature) systems inside buildings — Specifications

## 1 Scope

This International Standard lays down the specifications for high-density polyethylene (PE-HD) pipes and fittings, with nominal outside diameters of 32 mm to 315 mm, intended for domestic installation inside buildings for

- a) soil and waste discharge pipelines (including the ventilation of these pipes), and
- b) internal rainwater pipes

for the transportation of domestic waste waters<sup>1)</sup> (low and high temperature).

The pipes and fittings are for jointing mainly by butt-welding, by electro-welded sockets and by sockets with elastomeric sealing rings.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 265-1:1988, *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 1043-1:1987, *Plastics — Symbols — Part 1: Basic polymers and their special characteristics*.

ISO 1133:1991, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics*.

ISO 1167:—<sup>2)</sup>, *Thermoplastics pipes for the transport of fluids — Resistance to internal pressure — Test method and basic specification*.

ISO 2506:1981, *Polyethylene pipes (PE) — Longitudinal reversion — Test methods and specification*.

ISO 3126:1974, *Plastics pipes — Measurement of dimensions*.

ISO 3607:1977, *Polyethylene (PE) pipes — Tolerances on outside diameters and wall thicknesses*.

ISO 3663:1976, *Polyethylene (PE) pressure pipes and fittings, metric series — Dimensions of flanges*.

ISO/TR 7024:1985, *Above-ground drainage — Recommended practice and techniques for the installation of unplasticized polyvinyl chloride (PVC-U) sanitary pipework for above-ground systems inside buildings*.

1) For the definition of the term "domestic waste waters" refer to annex A or, alternatively, to national regulations.  
2) To be published. (Revision of ISO 1167:1973)

**3 Symbols**

The symbols used in this International Standard are given in table 1.

**Table 1 — Symbols**

Symbol	Meaning
$D$	Nominal outside diameter of pipe
$D_{e, m}$	Mean outside diameter
$d_{s, m}$	Socket mean inside diameter
$e$	Nominal wall thickness
$e_2$	Wall thickness at socket cylindrical part
$e_3$	Wall thickness at socket groove
$l_1$	Spigot length
$l$	Nominal length of pipe
$A$	Length of engagement
$C$	Length of socket mouth

**4 Material**

**4.1** The material shall consist of polyethylene (PE) to which may be added only those additives needed to facilitate the manufacture of sound, durable pipes and fittings of good surface finish.

When required by national regulations further appropriate additives may be used to retard the flammable properties of the material.

When sealing rings are retained by means of retaining caps or rings, the retaining caps or rings may be made from polymers other than PE provided that they conform to the same functional dimensions and test requirements as applied to sockets with either loose or fixed seal rings.

**4.2** The use of the manufacturer's own clean rework material is permissible provided that it conforms to the requirements of this International Standard. No other rework material shall be used.

**4.3** Carbon black added to ensure resistance to ultraviolet light shall comply with the following requirements:

- mass content: 2,4 % ± 0,6 %

- density: 1 500 kg/m<sup>3</sup> to 2 000 kg/m<sup>3</sup>
- average particle size: 0,01 µm to 0,025 µm

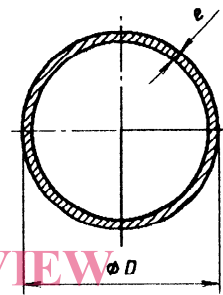
**5 Geometrical characteristics**

NOTE 1 The figures are schematic sketches only, to help demonstrate relevant dimensions. They do not necessarily represent manufactured components.

All measurements of dimensions shall be carried out in accordance with ISO 3126.

**5.1 Pipe dimensions**

The pipe dimensions are illustrated in figure 1.



**Figure 1 — Dimensions**

**5.1.1 Outside diameter**

The nominal outside diameter  $D$  shall be in accordance with table 2.

Tolerances on mean outside diameters  $D_{e, m}$  shall be in accordance with ISO 3607.

**Table 2 — Nominal outside diameter**

Dimensions in millimetres

32	40	50	63	75	90	110	125	160	200	250	315
<p>NOTE — These values have been taken from ISO 161-1:1978, <i>Thermoplastics pipes for the transport of fluids — Nominal outside diameters and nominal pressures — Part 1: Metric series.</i></p>											

**5.1.2 Wall thickness**

The nominal wall thickness  $e$  shall be in accordance with table 3. Tolerances on wall thickness shall be in accordance with ISO 3607.

**5.1.3 Length**

The nominal length  $l$  of a pipe shall be measured as shown in figure 2.

The nominal pipe length shall be agreed between the interested parties.

The tolerance on the agreed pipe length shall be  $\pm [(0,1 \% \text{ of } l) + 10 \text{ mm}]$ , measured at a temperature of  $23 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$ .

**5.2 Fitting dimensions**

**5.2.1 Basic dimensions**

Basic dimensions of fittings shall be in accordance with ISO 265-1.

The angles of branches shall be  $45^\circ$ ,  $60^\circ$ ,  $(67,5^\circ)$ ,  $(87,5^\circ)$  or  $88,5^\circ$ , where the values given in parentheses are non-preferred.

**5.2.2 Wall thickness**

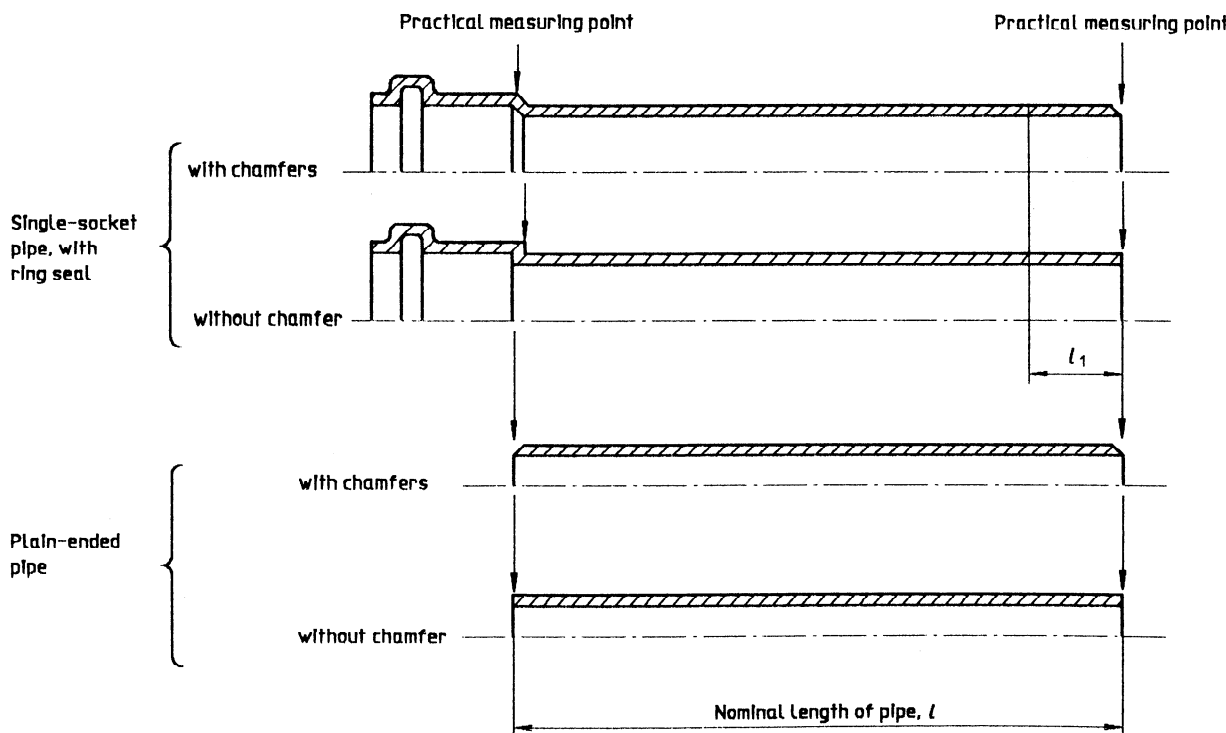
The nominal wall thickness of the body of a fitting shall be at least equal to the values given in table 3.

**Table 3 — Nominal wall thickness**

Dimensions in millimetres

Nominal outside diameter $D$	Nominal wall thickness $e$			
	Pipe series S16		Pipe series S12.5	
32	3			
40	3			
50	3			
63	3			
75	3			
90	3		3,5	
110	3,4		4,2	
125	3,9		4,8	
160	4,9		6,2	
200	6,2		7,7	
250	7,7		9,6	
315	9,7		12,1	

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**Figure 2 — Nominal pipe length and definitions**

**5.3 Socket and spigot dimensions of pipes and fittings**

The basic dimensions of sockets and spigots of pipes and fittings shall be calculated as follows:

$$A_{\min} = 0,2D + 18 \text{ mm, at least 28 mm}$$

$$C_{\max} = 0,2D + 18 \text{ mm}$$

$$l_{1, \min} = 0,4D + 18 \text{ mm, at least 46 mm}$$

**5.3.1 Basic dimensions**

A socket and spigot joint fitted with a sealing component complying with this International Standard shall accommodate the thermal movement due to temperature variations in waste water of a pipe of nominal length  $l$  without losing its tightness. The basic dimensions shall be in accordance with table 4 (see also figure 3).

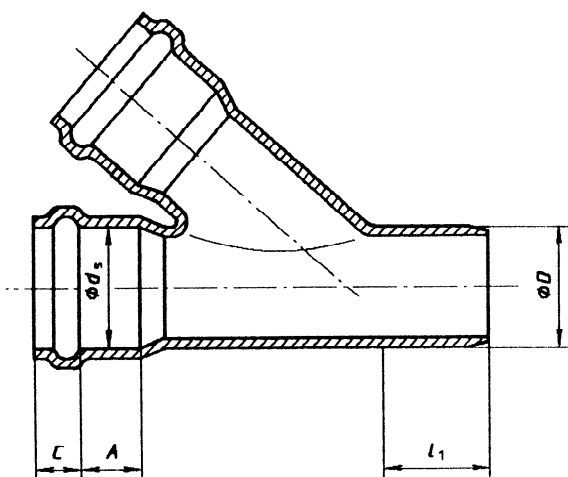
Where sealing rings are firmly fixed and have multiple sealing zones, the dimensions  $A_{\min}$  and  $C_{\max}$  (see figure 4) shall be measured to the effective sealing point as specified by the manufacturer.  $C_{\max}$  shall be checked with a gauge, as this dimension determines the tightness of the joint.

**Table 4 — Basic dimensions of sockets and spigots**

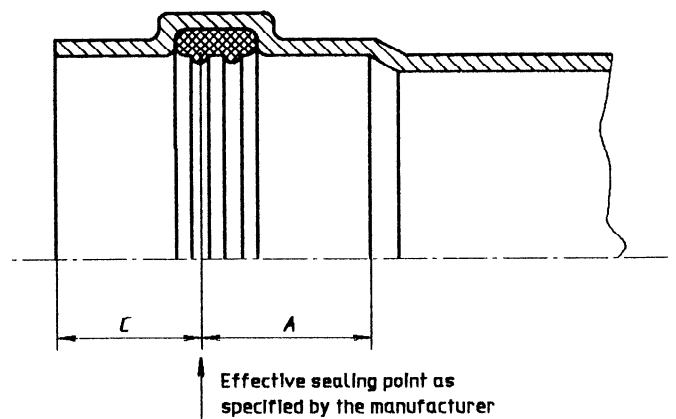
Dimensions in millimetres

Nominal outside diameter $D$	Minimum mean inside diameter of the socket $d_{s, m, \min}$	Maximum length of the socket mouth $C_{\max}$	Minimum length of engagement $A_{\min}$	Minimum length of the spigot end $l_{1, \min}$
32	32,4	25	28	46
40	40,5	26	28	46
50	50,6	28	28	46
63	63,7	31	31	49
75	75,8	33	33	51
90	91	36	36	54
110	111,1	40	40	62
125	126,3	43	43	68
160	161,6	50	50	82
200	201,9	58	58	98
250	252,4	68	68	118
315	318	81	81	144

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**Figure 3 — Basic dimensions**



**Figure 4 — Effective sealing point**

5.3.2 Wall thickness

The minimum wall thickness of sockets for sealing joints shall meet the requirements of table 5 (see figure 5 for an example).

When a sealing ring is firmly retained by means of a retaining component (see figure 6 for an example), the wall thickness of the socket in this area and that of the retaining component may be added together to achieve the required  $e_3$  dimension provided that they are not separated by the sealing ring.

In all cases, the components shall meet the functional test requirements specified in clause 8.

5.3.3 Inside diameter

The minimum mean inside diameter  $d_{s, m, min}$  of the cylindrical part of the socket is calculated as follows:

$$d_{s, m, min} = 1,009D + 0,1 \text{ mm}$$

The values shall be in accordance with table 4.

NOTE 2 The maximum mean inside diameter  $d_{s, m, max}$  depends on the sealing ring shape, dimensions and hardness specified by the manufacturer.

Table 5 — Minimum wall thickness of sockets on pipe ends and fittings

Dimensions in millimetres

Nominal outside diameter $D$	Pipe series			
	S16		S12,5	
	Minimum wall thickness			
	$e_{2, min}$	$e_{3, min}$	$e_{2, min}$	$e_{3, min}$
32	2,7	2,3	2,7	2,3
40	2,7	2,3	2,7	2,3
50	2,7	2,3	2,7	2,3
63	2,7	2,3	2,7	2,3
75	2,7	2,3	2,7	2,3
90	2,7	2,3	3,2	2,7
110	3,1	2,6	3,8	3,2
125	3,6	3	4,4	3,6
160	4,5	3,791	5,6	4,7
200	5,6	4,7	7	5,8
250	7	5,8	8,7	7,2
315	8,8	7,3	10,9	9,1

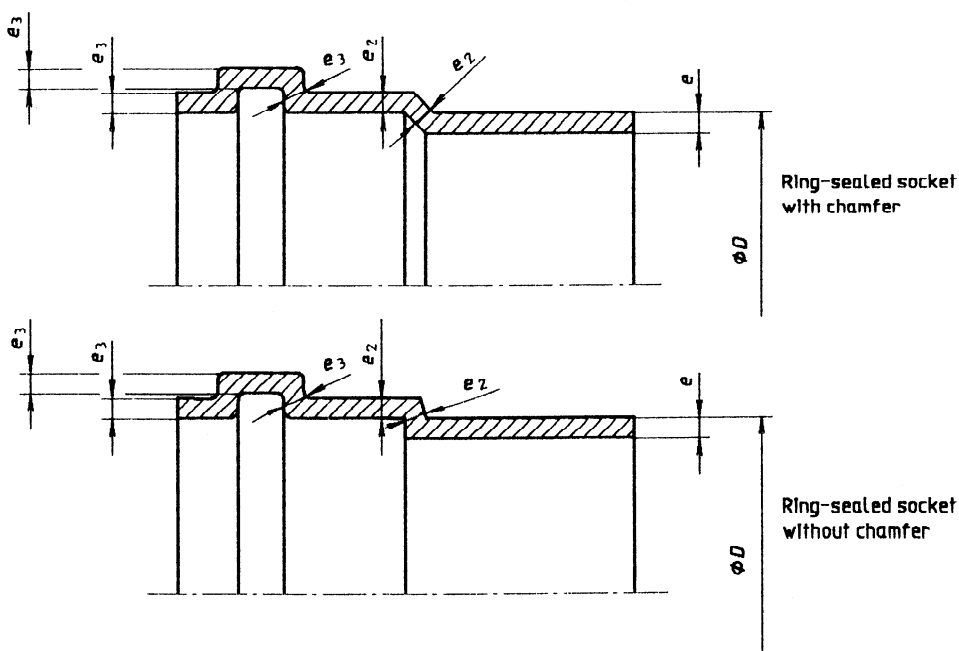


Figure 5 — Socket details

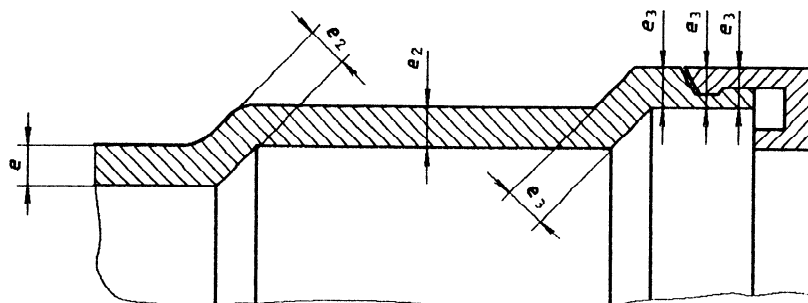


Figure 6 — Example of a seal retaining cap

## 6 Mechanical test requirements

The resistance to internal pressure of the pipe and fitting material shall be confirmed by a hydrostatic internal pressure test in accordance with ISO 1167. The test parameters are given in table 6.

Five test pieces (selected at random) of the same nominal outside diameter shall be tested.

The test pieces shall be in pipe form. They are either extruded from the pipe material or, in the case of fittings made of a material different from that of the pipes, injection-moulded to pipe form from the fitting material.

If any of the five test pieces bursts before the specified period of test has elapsed, the test shall be stopped and repeated with a second set of five test pieces taken at random from the batch. In the retest all test pieces shall meet the requirement or the material shall be considered to have failed the test.

Table 6 — Internal pressure test data

Water temperature °C	Test time h	Induced stress MPa 1)
80 ± 1	170	3,9
1) 1 MPa = 1 N/mm <sup>2</sup>		

## 7 Physical test requirements

### 7.1 Longitudinal reversion of pipes

The longitudinal reversion of pipes, as determined in accordance with ISO 2506 at a temperature of 110 °C, shall not exceed 3 %.

### 7.2 Oven test for fittings

After testing in accordance with annex B, fittings shall not exhibit excessive blistering, delamination, cracking or signs of weld-line splitting. Weld lines may become pronounced during the test, but this shall not be considered as a failure. Deviations from the original geometric shape shall not be deemed a failure either. In the vicinity of injection points, the depth of penetration of cracks, etc., shall be less than 50 % of the local wall thickness.

### 7.3 Melt flow rate

The melt flow rate of pipes and fittings shall be tested in accordance with ISO 1133. The melt flow rate (MFR) shall be in the range  $0,3 \text{ g}/10 \text{ min} \leq \text{MFR} (190, 5) \leq 1 \text{ g}/10 \text{ min}$ .

## 8 Functional test requirements

The functional testing shall be repeated wherever there is any change in the material, design or dimensions of the fittings.

### 8.1 Watertightness

Joints between pipes and fittings, pipes and pipes, and fittings and fittings shall not leak when tested in accordance with annex C at an ambient temperature of  $23 \text{ °C} \pm 5 \text{ °C}$ .

### 8.2 Airtightness

Joints between pipes and fittings, pipes and pipes, and fittings and fittings shall remain airtight when tested in accordance with annex D at an ambient temperature of  $23 \text{ °C} \pm 5 \text{ °C}$ .



### 8.3 Elevated-temperature cycling

The test assembly used shall meet the requirements given in either annex E or annex F. Where national standards specify which of these two tests is to be used, they shall be complied with.

Annex G specifies the information to be provided and the symbols to be used in the test report.

## 9 Jointing

Pipes and fittings which comply with the specifications of this International Standard may be connected to each other in the following various ways.

### 9.1 Butt-welded joint

The joint shall be made in accordance with the instructions given by the pipe manufacturer.

### 9.2 Elastomeric sealing ring socket joint

The socket joint shall comply with the specifications of this International Standard. The dimensions of the sealing elements are dependent on the specific system and shall meet the manufacturer's specification. These elements shall not have a detrimental effect on the pipe or fittings, as demonstrated by the functional requirements.

Further requirements will be stated in future specifications (for rubber sealing rings for drainage purposes, see ISO 4633:1983, *Rubber seals — Joint rings for water supply, drainage and sewerage pipelines — Specification for materials*).

### 9.3 Flanged joint

The flanges shall comply with ISO 3663 or be the subject of a technical agreement between the interested parties.

### 9.4 Other joints

When using other jointing methods, such as mechanical, socket fusion, ring seal compression fittings or electro-welded sockets, the recommendations given by the manufacturer shall be followed.

## 10 Delivery conditions

### 10.1 Appearance

The internal and external surfaces of pipes and fittings shall be smooth and free from grooving, blistering and any other surface discontinuities. The materials shall not contain visible impurities or pores. Pipe ends shall be cleanly cut, and the ends

of pipes and fittings shall be square with the axis of the pipe.

### 10.2 Colour

The colour of pipes and fittings shall normally be black. However, other colours may be supplied as agreed between the interested parties.

## 11 Marking

Pipes, fittings and sealing rings shall be marked clearly and indelibly so that legibility is maintained for the life of the products under normal conditions of storage, weather and use.

The markings may be integral with the product or on a label. The markings shall not damage the product.

### 11.1 Pipes

Pipes shall be marked with at least the following information:

- manufacturer's name or trade mark;
- pipe material;
- nominal diameter of pipe;
- nominal wall thickness of pipe;
- manufacturing information, in plain text or in code, providing traceability of the production period to within the year and month and the production site if the manufacturer is producing at several national or international sites;
- the number of this International Standard.

Pipes with a nominal laying length up to and including  $z_2$  metres shall be marked at least once. Pipes with a nominal laying length greater than  $z_2$  shall be marked at intervals of  $z_3$  metres at the most. The value of  $z_2$  and  $z_3$  shall be as specified by the authorities in each country.

### 11.2 Fittings

Fittings shall be marked with at least the following information:

- manufacturer's name or trade mark;
- fitting material (may be given on packing only in the case of PVC, provided this information is not required on each article by national authorities);
- nominal diameter of fitting;

- classification (where applicable);
  - values of angles, if any;
  - manufacturing information, in plain text or in code, providing traceability of the production period to within the year and month and the production site if the manufacturer is producing at several national or international sites (may be given on packing only, provided this information is not required on each article by national authorities);
  - the number of this International Standard (may be given on packing only, provided this information is not required on each article by national authorities).
- manufacturer's name or trade mark;
  - nominal dimension of ring;
  - manufacturing information, in plain text or in code, providing traceability of the production period to within the year and the production site if the manufacturer is producing at several national or international sites.

No markings are required on sealing rings which are moulded to pipes or fittings or any other marked component.

**11.4 Designation of the material** (in accordance with ISO 1043-1)

PE-HD

**11.3 Sealing rings**

Sealing rings shall be marked with at least the following information:

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## Annex A (normative)

### Definition of domestic waste waters

**domestic waste waters:** Waters discharged and diverted into the sewage system, in particular

- a) waters that have become altered in composition and have become fouled (or impure) by being used domestically (including waters from flushing systems containing human excrement and, if necessary or authorized, animal excrement, and

waters from normal households, offices, old people's homes, hotels, schools, etc.), and

- b) rainwater, if a separate discharge channel is not available.

Such waters never have a temperature exceeding 100 °C continuously for more than 2 min and have a pH value normally in the range pH 2 to pH 12.

## Annex B (normative)

### Oven test for fittings (standards.iteh.ai)

#### B.1 Apparatus

**B.1.1 Oven**, in which the fittings can be exposed to a temperature of 110 °C ± 2 °C.

#### B.2 Test pieces

Select three test pieces, which shall be complete fittings, from each type of fitting.

If the fitting incorporates an elastomeric sealing ring, this shall be removed before testing.

#### B.3 Procedure

Heat the oven to 110 °C ± 2 °C. Put the test pieces in the oven and arrange them so that they are standing on one of their sockets, avoiding all contact with other test pieces or the sides of the oven.

Allow the oven to return to a temperature of 110 °C ± 2 °C and then leave the test pieces in the oven for 60 min if the wall thickness  $e \leq 8$  mm or 120 min if  $e > 8$  mm.

Remove the test pieces from the oven taking care not to deform or damage them.

Allow the test pieces to cool in air until they can be handled and examined.