INTERNATIONAL STANDARD

ISO 8772

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High-density polyethylene (PE-HD) pipes and fittings for buried drainage and sewerage systems — Specifications

Tubes et raccords en polyéthylène haute densité (PE-HD) pour les systèmes d'assainissement enterrés et les égouts souterrains — Spécifications

Reference number
ISO 8772:1991(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 8772 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*.

Annexes A, B, C, D, E and F form an integral part of this International Standard.

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INTERNATIONAL STANDARD ISO 8772:1991(E)

High-density polyethylene (PE-HD) pipes and fittings for buried drainage and sewerage systems — Specifications

1 Scope

This International Standard specifies requirements for high-density polyethylene (PE-HD) pipes, fittings and joints with nominal outside diameters from 110 mm to 2 000 mm and for fittings with elastomeric sealing rings of nominal outside diameter from 110 mm to 400 mm, serving as buried gravity drain and sewer pipes for the transportation of soil and waste discharge of domestic origin.

It may also be applied to pipes, fittings and joints for discharges of industrial origin, provided chemical and temperature resistance is taken into account.

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:—[1], *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.*

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

1) To be published. (Revision of ISO 1167:1973)

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 and mechanical strength.

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 sealing 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/m³ to 2 000 kg/m³

— 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.

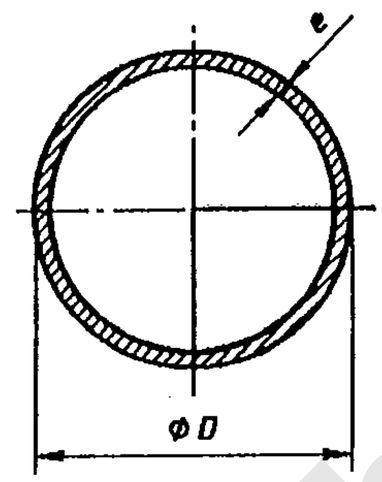

Figure 1 — Dimensions

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

D		
110	315	900
125	355	1 000
140	400	1 200
160	450	1 400
180	500	1 600
200	560	1 800
225	630	2 000
250	710	
280	800	

NOTE — These values have been taken from ISO 161-1:1978, *Thermoplastics pipes for the transport of fluids — Nominal outside diameters and nominal pressures — Part 1: Metric series*

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.

Table 3 — Nominal wall thickness

Dimensions in millimetres

Nominal outside diameter D	Pipe series S16	S12,5	S8
	Nominal wall thickness e		
110	3,4	4,2	6,6
125	3,9	4,8	7,4
140	4,3	5,4	8,3
160	4,9	6,2	9,5
180	5,5	6,9	10,7
200	6,2	7,7	11,9
225	6,9	8,6	13,4
250	7,7	9,6	14,8
280	8,6	10,7	16,6
315	9,7	12,1	18,7
355	10,9	13,6	21,1
400	12,3	15,3	23,7
450	13,8	17,2	26,7
500	15,3	19,1	29,6
560	17,2	21,4	33,2
630	19,3	24,1	37,3
710	21,8	27,2	42,1
800	24,5	30,6	47,4
900	27,6	34,4	53,3
1 000	30,6	38,2	59,3
1 200	36,7	45,9	
1 400	42,9	53,5	
1 600	49	61,2	
1 800	55,1		
2 000	61,2		

NOTE — These values are in accordance with ISO 4065:1978, *Thermoplastic pipes — Universal wall thickness table.*

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 % of l) + 10 mm], measured at a temperature of 23 °C $\pm$ 2 °C.

5.2 Dimensions of fittings

5.2.1 Basic dimensions

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

The angles of branches shall be 45°, 60°, (67,5°) or 90°, where the value given in parentheses is non-preferred.

5.2.2 Wall thickness

The nominal wall thickness of the body of a fitting shall comply with the values given in table 3. The stiffness of the body of the fitting shall be not less than the stiffness of the corresponding pipe.

5.3 Socket and spigot dimensions of pipes and fittings

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).

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

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

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

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

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.

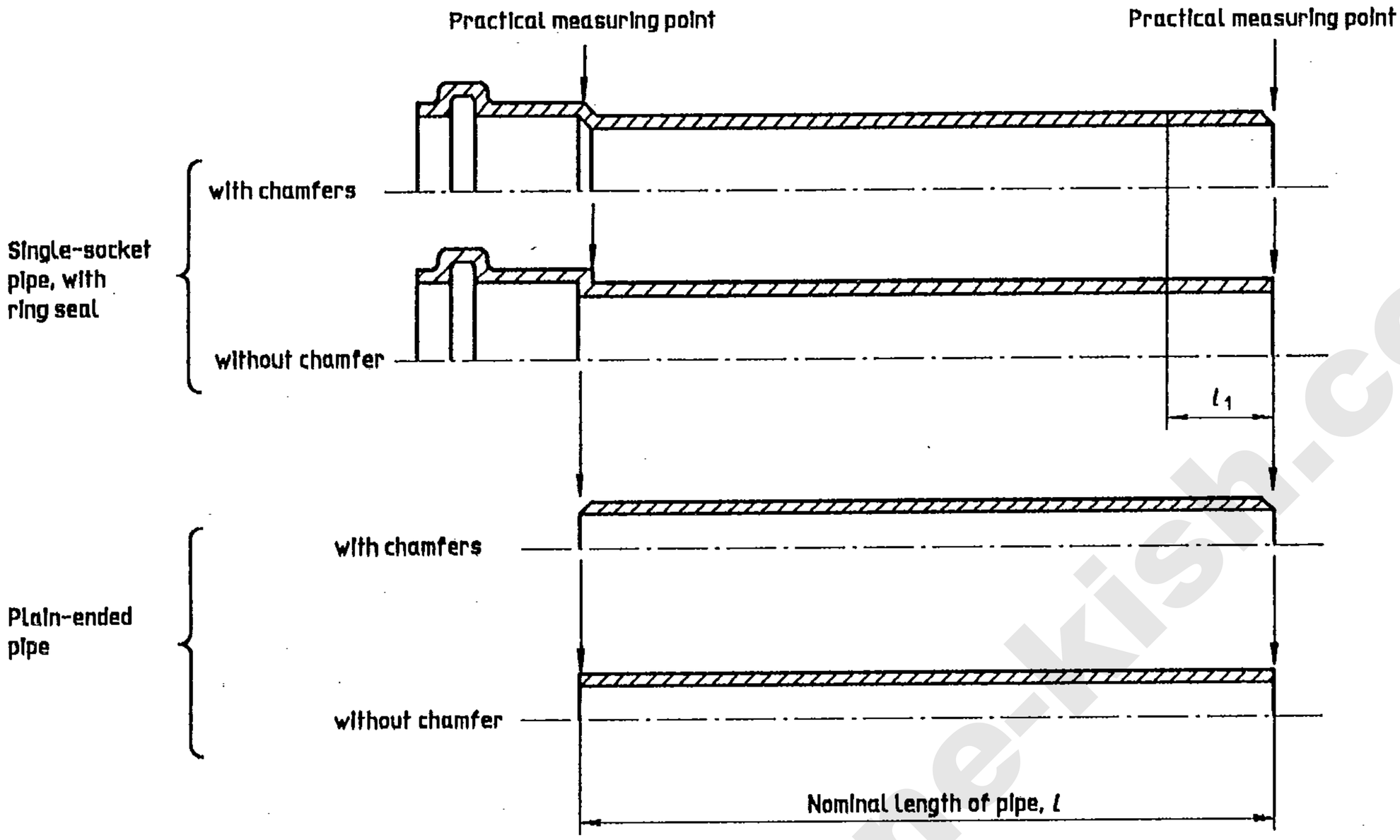

Figure 2 — Nominal pipe length and definitions

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 $l_{1,\,min}$
110	111,1	40	40	62
125	126,3	43	43	68
140	141,4	46	46	74
160	161,6	50	50	82
180	181,7	54	54	90
200	201,9	58	58	98
225	227,1	63	63	108
250	252,4	68	68	118
280	282,6	74	74	130
315	318	81	81	144
355	358,3	85	85	160
400	403,7	98	98	178

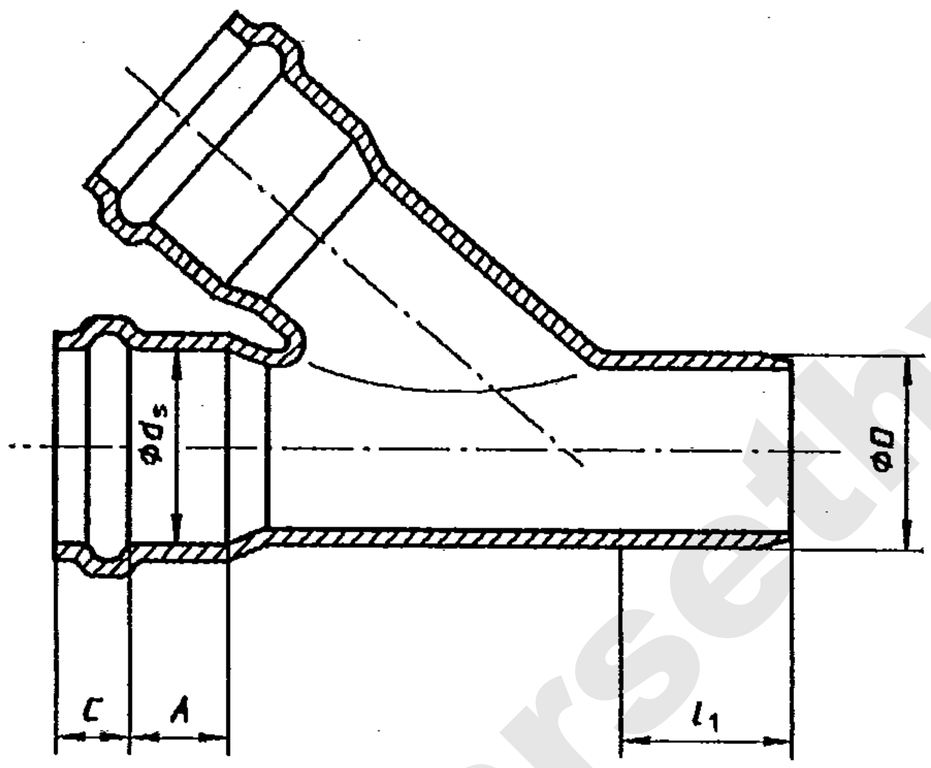

Figure 3 — Basic dimensions

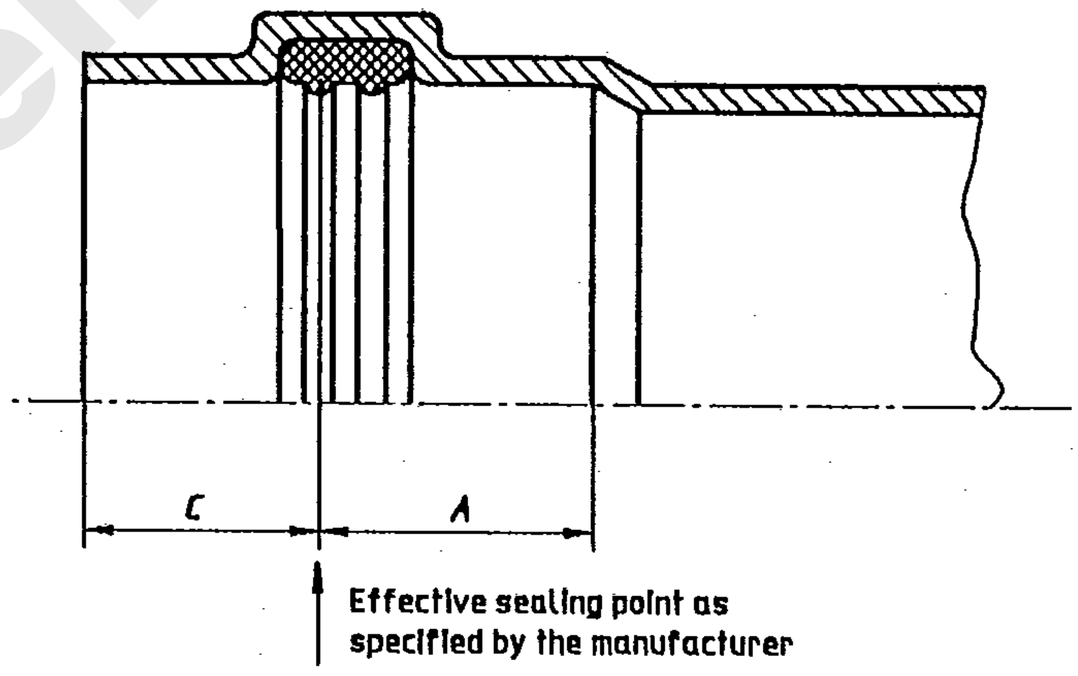

Figure 4 — Effective sealing point

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).

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

Dimensions in millimetres

Nominal outside diameter D	Pipe series S16		Pipe series S12,5		Pipe series S8	
	Minimum wall thickness					
	$e_{2,\,min}$	$e_{3,\,min}$	$e_{2,\,min}$	$e_{3,\,min}$	$e_{2,\,min}$	$e_{3,\,min}$
110	3,1	2,6	3,8	3,2	6	5
125	3,6	3	4,4	3,6	6,7	5,6
140	3,9	3,3	4,9	4,1	7,5	6,3
160	4,5	3,7	5,6	4,7	8,6	7,2
180	5	4,2	6,3	5,2	9,7	8,1
200	5,6	4,7	7	5,8	11,8	9
225	6,3	5,2	7,8	6,5	12,1	10,1
250	7	5,8	8,7	7,2	13,4	11,1
280	7,8	6,5	9,7	8,1	15	12,5
315	8,8	7,3	10,9	9,1	16,9	14,1
355	9,9	8,2	12,3	10,2	19	15,9
400	11,1	9,3	13,8	11,5	21,4	17,8

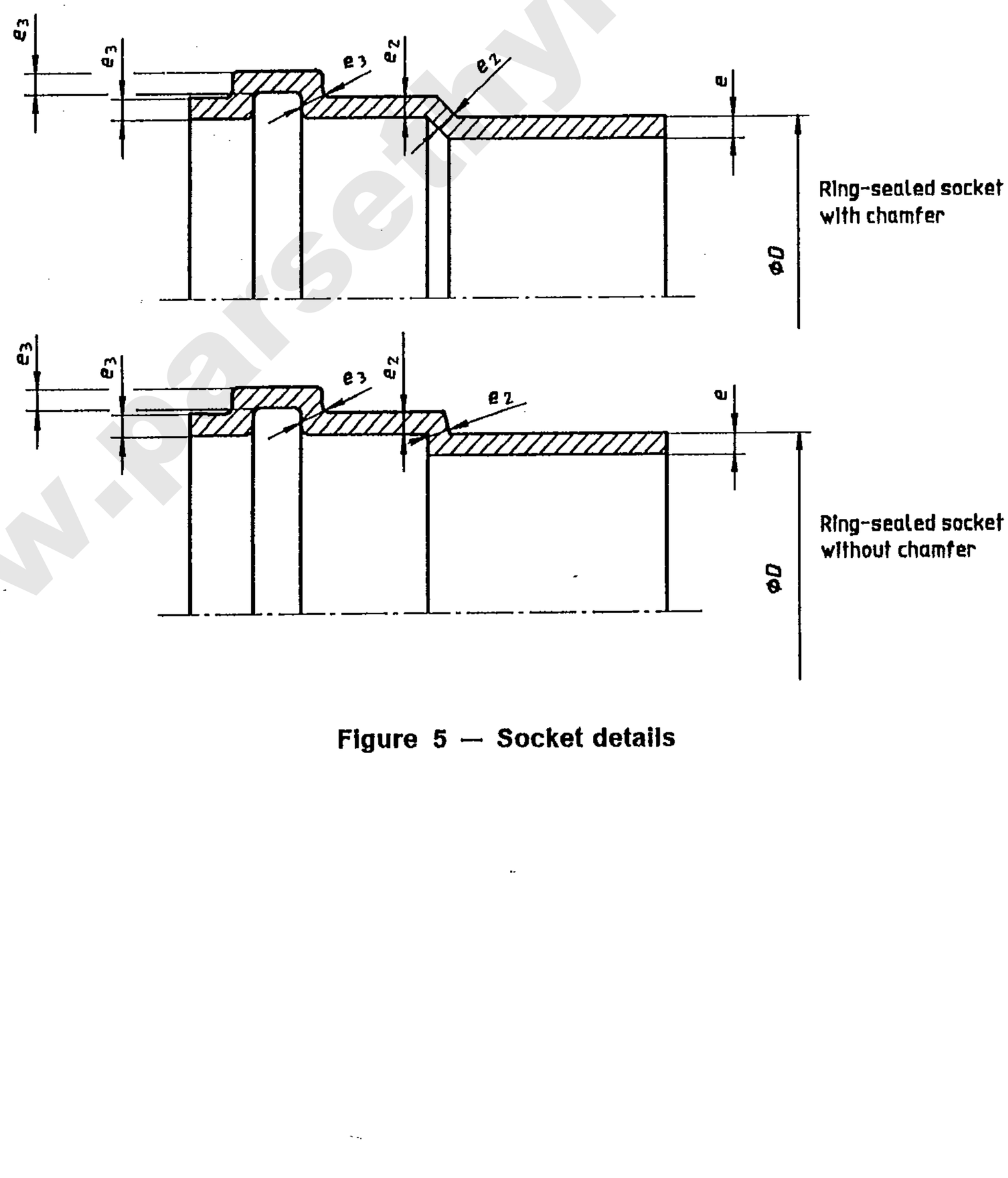

Figure 5 — Socket details

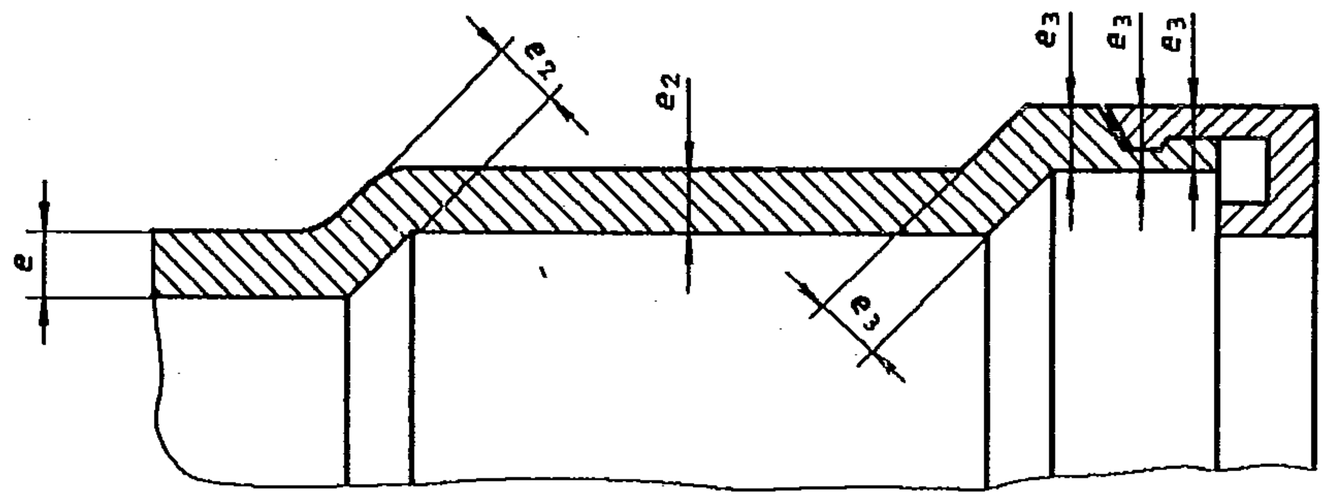

Figure 6 — Example of a seal retaining cap

Where 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.

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/mm²		

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 A, 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 g/10 min ⩽ MFR (190, 5) ⩽ 1 g/10 min.

8 Functional test requirements — Sockets with elastomeric sealing ring

8.1 Internal hydrostatic pressure

When tested using the method described in annex B, at an ambient temperature of 23 °C ± 5 °C, the joint shall withstand an internal water pressure of 0,05 MPa (0,5 bar) without leakage.

8.2 External hydrostatic or internal negative air pressure

When tested using the method described in annex C, at an ambient temperature of 23 °C ± 5 °C, the joint shall withstand either an external water pressure of 0,05 MPa (0,5 bar) or an internal negative air pressure of 0,03 MPa (0,3 bar) [i.e. 0,07 MPa (0,7 bar) absolute pressure].

8.3 Diameter distortion

When tested using the method described in annex D, at an ambient temperature of 23 °C ± 5 °C, the joint shall withstand an internal water pressure of 0,05 MPa (0,5 bar) without leakage.

8.4 Angular deflection

When tested using the method described in annex E, at an ambient temperature of 23 °C ± 5 °C, the joint shall withstand an internal water pressure of 0,05 MPa (0,5 bar) without leakage.

8.5 Combined test (alternative to the tests specified in annex B, annex C, annex D and annex E)

When tested using the method described in annex F, at an ambient temperature of 23 °C ± 5 °C, the joint shall perform satisfactorily in the combination indicated, i.e. no leakage shall occur during stage d) of the test, and during stage e) the pressure shall not rise by more than 10 % of the required negative test pressure (0,03 MPa) (see 8.2).

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 specifications. These elements shall not have a detrimental effect on the pipe or fittings, as demonstrated by the functional requirements.

Further requirements will be the subject of 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 product 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 metres 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;

— 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).

11.3 Sealing rings

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

— 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

Annex A
(normative)

Oven test for fittings

A.1 Apparatus

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

A.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.

A.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 $e \leqslant 8$ 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.

Annex B
(normative)

Internal hydrostatic pressure test

B.1 Apparatus

The apparatus shall consist of end-sealing devices of size and design appropriate to the type of joint assembly under test.

The sealing devices shall not exert axial loads on the joint assembly prior to the application of the test pressure.

B.2 Procedure

Connect one end-sealing device to a source of hydrostatic pressure. Provide a bleed valve to enable all air to be vented when hydrostatic pressure is applied. Raise the hydrostatic pressure slowly over a period of not less than 15 min to 0,05 MPa (0,5 bar) and maintain this pressure for at least 15 min.

Annex C
(normative)

External hydrostatic or internal negative air pressure test

The test apparatus shall be the same as that described in annex B except that means shall be provided for applying external water pressure (see figure C.1), or alternatively for providing an equivalent negative pneumatic pressure (partial vacuum) inside the test assembly (see figure C.2). When tested by the vacuum method, the leaktightness shall be measured with a precision vacuum manometer.

During the test period of 15 min, the external water pressure shall not diminish by more than, or the variation in negative atmospheric pressure shall not exceed, 10 % of the required negative testing pressure.

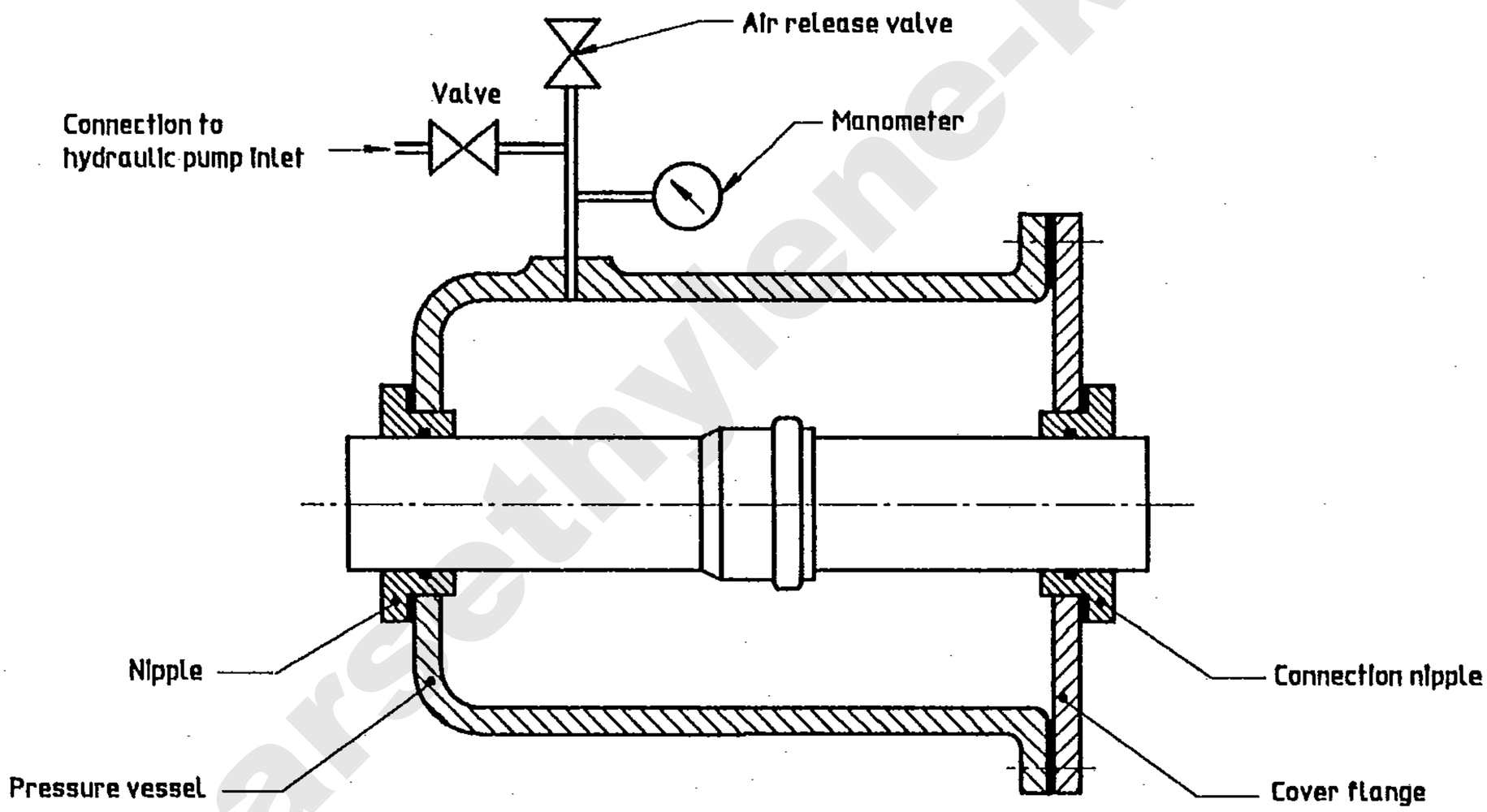

Figure C.1 — Test equipment for external hydrostatic pressure test

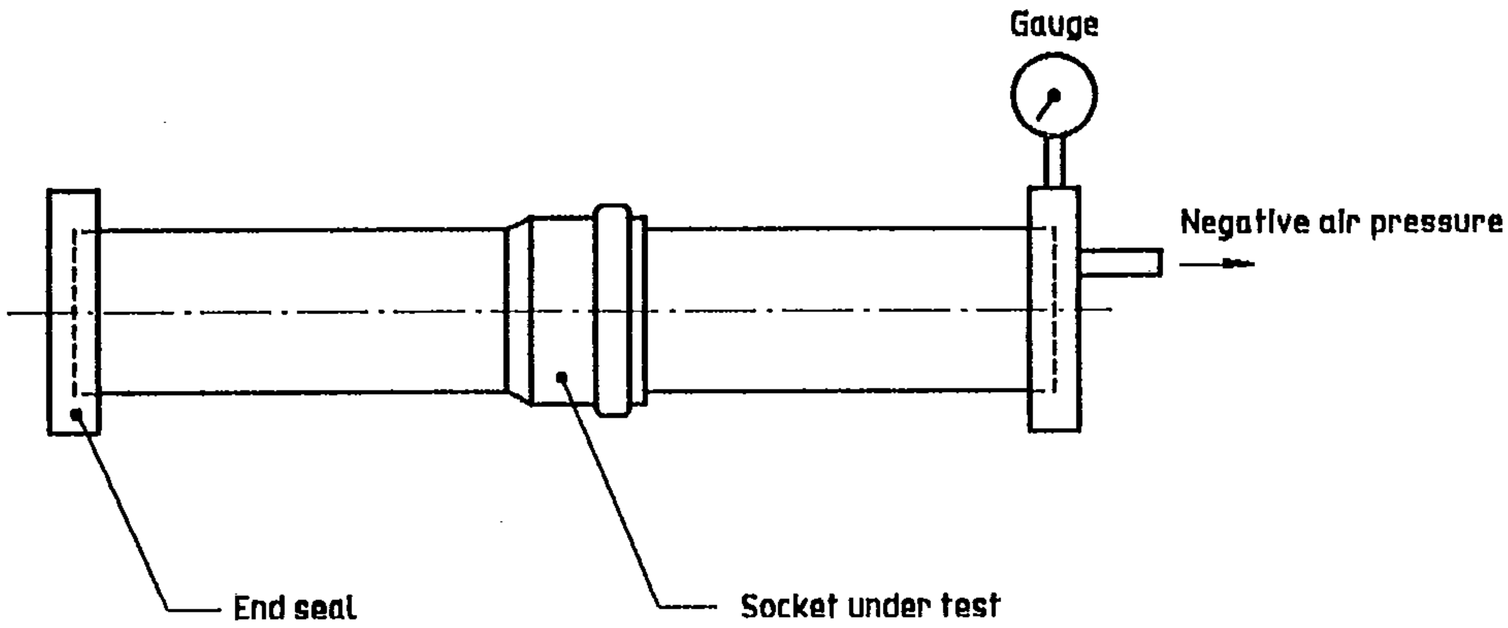

Figure C.2 — Apparatus for the internal negative air pressure test

Annex D
(normative)

Diameter distortion test

The general features of the apparatus shall be as shown in figure D.1 and the apparatus shall be capable of permitting simultaneously the application of a constant distorting load and an increasing internal hydrostatic pressure. The distorting load shall be applied by means of a hydraulic jack acting on a beam which is free to move in the vertical plane through the axis of the pipe. A jig may be provided to hold the connecting pipes in the socket of the fitting against the end thrust due to the test pressure. The apparatus shall not otherwise support the joint against the internal test pressure.

The distortion load shall be applied to the pipe so as to cause a 5 % reduction in the original outside diameter of the pipe measured at a distance of approximately $0{,}5D$ (with a minimum of 100 mm) from the mouth of the socket. With the distortion load maintained, the water pressure shall be increased slowly to 0,05 MPa (0,5 bar) over a period of not less than 15 min and shall be maintained at this pressure for at least 15 min.

Dimensions in millimetres

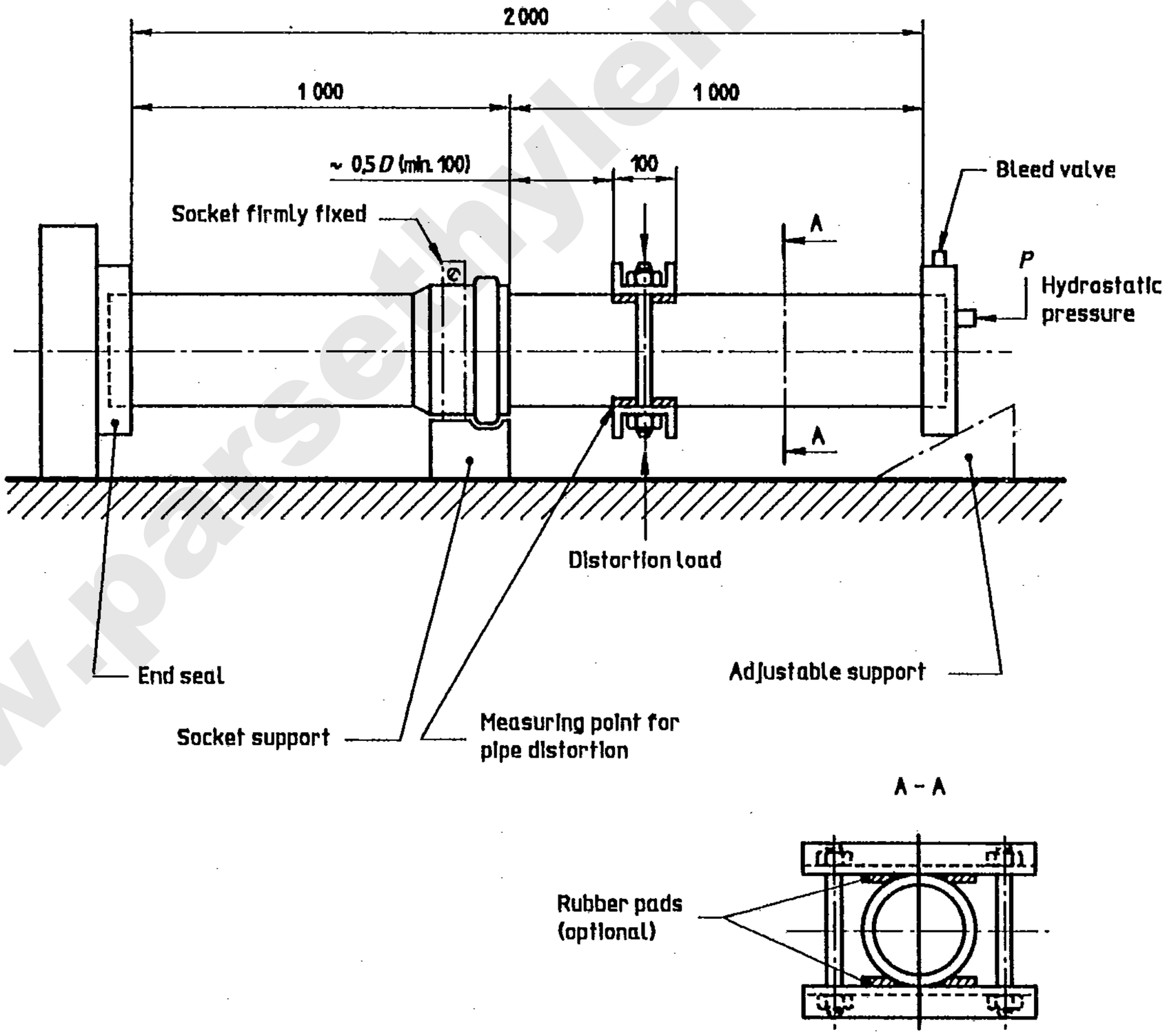

Figure D.1 — Diameter distortion test equipment

Annex E
(normative)

Angular deflection test

The apparatus shall be capable of axially deflecting an assembled pipe joint, either by supporting the socket and displacing the ends of the pipe, or alternatively by supporting the ends of the pipe and displacing the socket; it shall also be capable of permitting application of the test pressure as described in annex B.

A jig shall be provided which will hold the connecting pipes in the sockets against the end thrust due to the hydrostatic pressure. The apparatus shall not otherwise support the joint against the internal test pressure. The spigot end shall be fully inserted.

The total deflection consists of $\alpha + \beta$ (see figure E.1), where α is defined as the free angle and depends on the design of the socket, and will not be evaluated. β is the forced angle and is the additional deflection required to give the total angular deflection for the test.

The forced angle β shall be 2°.

The test assembly shall be completely filled with water and left in this condition for not less than 5 min with the angular deflection maintained; the water pressure shall then be increased slowly to 0,05 MPa (0,5 bar) over a period of not less than 15 min and shall be maintained at this pressure for at least 15 min.

The test shall be performed with the test assembly deflected in both the horizontal and the vertical direction.

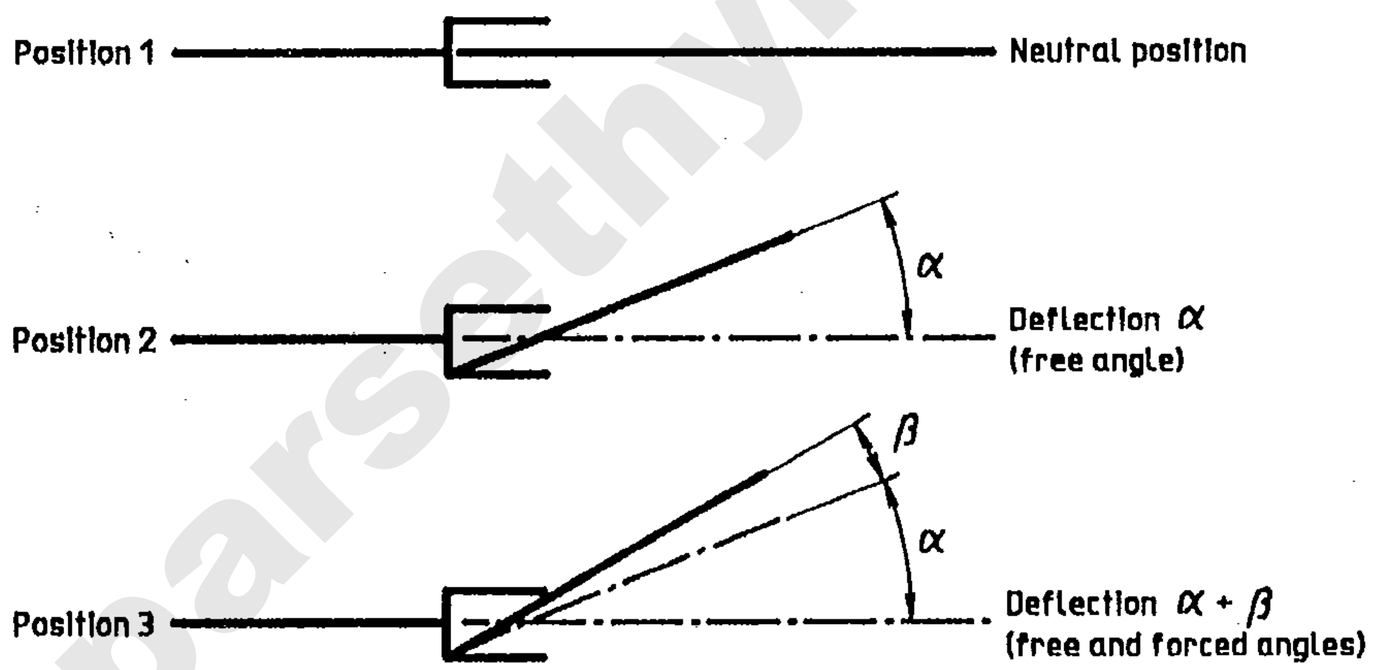

Figure E.1 — Angular deflection test

Annex F
(normative)

Combined test

This method of test is an alternative to the tests specified in annex B, annex C, annex D and annex E.

The combined test shall be carried out in accordance with the following sequence.

a) Fill the test assembly with water as specified in annex B.

b) Carry out the distortion of the pipe as described in annex D. No additional hydrostatic pressure shall be applied.

c) Then apply the angular deflection as described in annex E, maintaining the distortion.

d) After applying the distortion and the angular deflection to the test assembly, increase slowly the internal water pressure of the test assembly over a period of not less than 15 min to 0,05 MPa (0,5 bar), and maintain this pressure for at least 15 min.

e) Carry out the internal negative air pressure test as described in annex C, combined with the diameter distortion test (annex D) and the angular deflection test (annex E).

UDC [621.643.06 + .2]-036.742.2:696.133

Descriptors: drainage, drainpipes, polyethylene, plastics products, plastic tubes, pipe fittings, specifications, dimensions, tests, test equipment.

Price based on 15 pages