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Polypropylene (PP) pipes and fittings (jointed by means of elastomeric sealing rings) for soil and waste discharge (low and high temperature) systems inside buildings — Specifications

Tubes et raccords en polypropylène (PP) (à jonction par bagues d'étanchéité en élastomère) pour les systèmes d'évacuation d'eaux usées et d'eaux-vannes (à basse et à haute température) à l'intérieur des bâtiments — Spécifications



Reference number
ISO 7671:1991(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 7671 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, G and H form an integral part of this International Standard. Annex J is for information only.

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Polypropylene (PP) pipes and fittings (jointed by means of elastomeric sealing rings) for soil and waste discharge (low and high temperature) systems inside buildings — Specifications

1 Scope

This International Standard lays down the specifications for polypropylene (PP) pipes and fittings, with nominal outside diameters of 32 mm to 200 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 waters¹⁾ (low and high temperature).

The pipes and fittings are for jointing by means of elastomeric sealing rings only.

This International Standard 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 in-

dicated 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 580:1990, *Injection-moulded unplasticized poly(vinyl chloride) (PVC-U) fittings — Oven test — Test method and basic specifications*.

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

ISO 3127:1980, *Unplasticized polyvinyl chloride (PVC) pipes for the transport of fluids — Determination and specification of resistance to external blows*.

ISO 3478:1975, *Polypropylene (PP) pipes — Determination of longitudinal reversion*.

ISO 3480:1976, *Polypropylene (PP) pipes — Maximum permissible longitudinal reversion*.

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*.

ISO 8283-3:—²⁾, *Plastics pipes and fittings — Dimensions of sockets and spigots for discharge systems inside buildings — Part 3: Polypropylene (PP)*.

1) For the definition of the term "domestic waste waters" refer to annex A or, alternatively, to national regulations.

2) To be published.

3 Material

3.1 The material shall consist of propylene homopolymer and/or propylene copolymer to which may be added only those additives needed to facilitate the manufacture of sound, durable pipes and fittings with good surface finish and opacity.

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

3.2 The use of the manufacturer's own clean rework material from pipes and fittings made to this standard is permitted. No other rework material shall be used.

3.3 Pipes and fittings shall be sufficiently stabilized against thermal ageing and ultraviolet (UV) light.

NOTE 1 Resistance to UV light is under study within ISO/TC 138.

4 Geometrical characteristics

4.1 Pipe dimensions

4.1.1 Nominal outside diameter

The nominal outside diameter D shall be in accordance with table 1; the permissible deviation on the outside diameter shall be in accordance with table 2.

Table 1 — Nominal outside diameter

Dimensions in millimetres

32	40	50	63	75	90	110	125	160	200
Values 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>									

Table 2 — Permissible deviation on nominal outside diameter

Dimensions in millimetres

nom.	Outside diameter	
	min.	max.
32	32	32,3
40	40	40,3
50	50	50,3
63	63	63,3
75	75	75,3
90	90	90,3
110	110	110,4
125	125	125,4
160	160	160,5
200	200	200,6

4.1.2 Wall thickness

The wall thickness shall be in accordance with table 3.

Table 3 — Wall thickness

Dimensions in millimetres

Nominal outside diameter D	Minimum wall thickness $e_{\min}$
32	1,8
40	1,8
50	1,8
63	1,8
75	1,9
90	2,2
110	2,7
125	3,1
160	4
200	4,9

4.1.3 Length of pipe

The nominal length of a pipe shall be measured as shown in figure 1. For pipes with sockets, the nominal length is considered to be the distance between the ends minus the socket depth. For practical reasons, this length is measured to the outside of the socket.

The nominal pipe length l shall be agreed between purchaser, user and manufacturer.

4.2 Dimensions of fittings

4.2.1 Basic dimensions

Basic dimensions of fittings shall be given by the manufacturer, and the dimensions shall be defined as in ISO 265-1.

4.2.2 Wall thickness

The wall thickness shall be at least equal to the minimum wall thickness of the pipe of the same size unless otherwise specified in 4.3.2.

4.3 Socket and spigot dimensions of pipes and fittings

4.3.1 Basic dimensions

Basic dimensions of sockets and spigots of pipes and fittings shall be as given in ISO 8283-3.

4.3.2 Wall thickness of sockets on pipes and fittings

The minimum wall thickness of sockets for seal ring joints shall meet the requirements of table 4 (see figure 2 for an example).

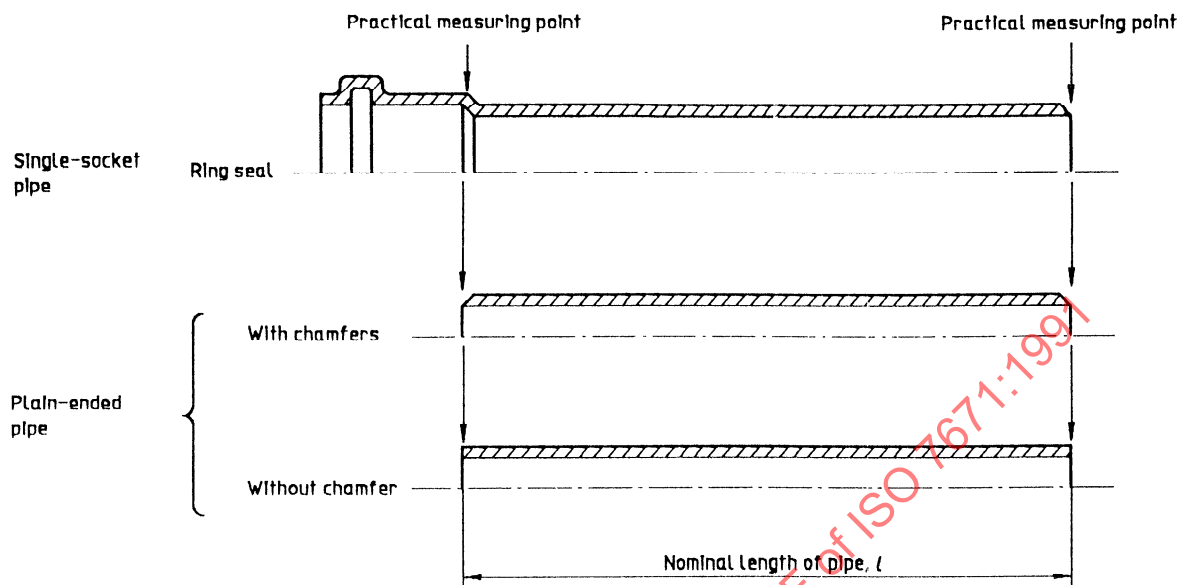


Figure 1 — Nominal pipe length and definitions

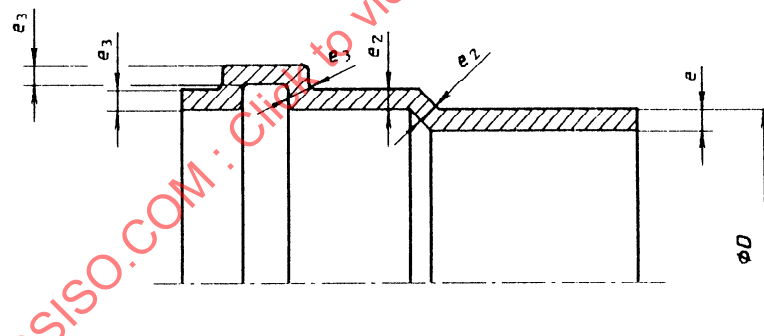


Figure 2 — Details of ring-sealed socket

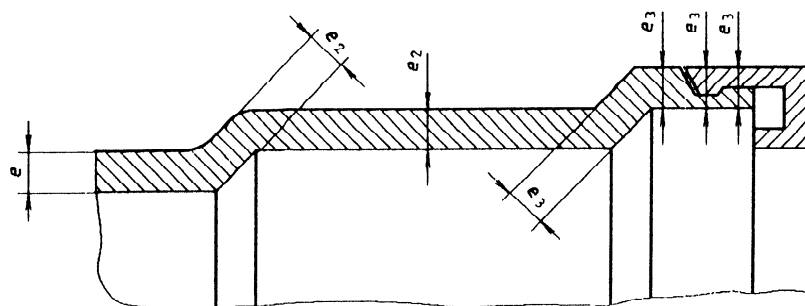


Figure 3 — Example of a seal retaining cap

When a seal ring is firmly retained by means of a seal ring retaining component (see figure 3 for an example), the wall thickness of the socket in this area and that of the seal ring retaining component may be added together to achieve the required e_3 dimension provided that they are not separated by the seal ring.

The minimum values of e_3 given in table 4 apply only to those parts of the ring seal zone where the liquid in the pipe comes into contact with the fitting. For those parts that do not come into contact with the liquid, i.e. beyond the designated ring seal point, thinner walls are permitted.

Table 4 — Minimum wall thickness of sockets on pipes and fittings

Dimensions in millimetres

Nominal outside diameter D	e_2 1) min.	e_3 2) min.
32	1,7	1
40	1,7	1
50	1,7	1
63	1,7	1
75	1,8	1,1
90	2	1,3
110	2,5	1,5
125	2,8	1,8
160	3,6	2,2
200	4,5	2,7

1) $e_2 = 0,9 e$
2) $e_3 = 0,55 e$

Retaining caps or rings may be made to other designs and from polymers other than PP provided that they conform to the same functional dimensions and test requirements as applied to sockets with either loose or fixed seal rings.

In all cases, the components shall meet the functional test requirements specified in clause 7.

5 Mechanical test requirements

5.1 Pipe impact strength

The true impact rate (TIR) shall be not higher than 5 % when tested in accordance with ISO 3127 and under the test conditions specified in annex B.

5.2 Fitting impact strength (type test)

Five fittings of each diameter and type applicable (homopolymer or copolymer) shall be conditioned for at least 30 min at a temperature of $23\text{ °C} \pm 2\text{ °C}$ for homopolymers and $0\text{ °C} \pm 1\text{ °C}$ for copolymers. Within 10 s after the conditioning

treatment, each fitting shall be dropped freely in various positions on to a flat concrete floor from the heights specified below:

- for $D \leq 75\text{ mm}$, drop from $(2 \begin{smallmatrix} +0,1 \\ 0 \end{smallmatrix})\text{ m}$;
- for $D > 75\text{ mm}$, drop from $(1 \begin{smallmatrix} +0,1 \\ 0 \end{smallmatrix})\text{ m}$.

If none of the specimens is damaged in the test, the fittings shall be accepted. If one fitting is damaged, the test shall be repeated with five further fittings. None of these last five fittings shall be damaged.

NOTE 2 In the context of this test, "damage" means any visible split or any complete breakage in the body of the fitting. Surface scratches, scuffing, or chipping of edges which may occur in the test does not constitute damage.

6 Physical test requirements

6.1 Longitudinal reversion of pipes

The longitudinal reversion of the pipes shall not exceed 2 % as indicated in ISO 3480 and shall be determined in accordance with ISO 3478 (oven or liquid bath).

6.2 Oven test of fittings

When tested in accordance with annex C, fittings shall not exhibit excessive blistering, delamination, cracking or weldline splitting. Near to normal injection points, the depth of penetration of cracks, etc., shall not exceed 50 % of the wall thickness at that point. When fittings are moulded by end gating (for example, ring or diaphragm) techniques, the depth of penetration of cracks, etc., shall be not greater than 25 % of the corresponding socket depth.

7 Functional test requirements (type tests)

7.1 Watertightness

Joints between pipes and fittings, pipes and pipes, and fittings and fittings shall not leak when tested in accordance with annex D.

7.2 Airtightness

Joints between pipes and fittings, pipes and pipes, and fittings and fittings shall remain airtight when tested in accordance with annex E.

7.3 Elevated-temperature cycling test

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

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

8 Elastomeric sealing elements

All elastomeric sealing elements shall be as specified by the manufacturer of the fittings.

The sealing elements shall not have a detrimental effect on the pipes or fittings, i.e. they shall not cause the test assembly to fail the functional tests.

9 Delivery conditions

The internal and external surfaces of pipes and fittings shall be smooth and free from grooving, blistering and any other surface defect. 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 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.

10.1 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 values of z_2 and z_3 shall be as specified by the authorities in each country.

10.2 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).

10.3 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.

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

PP (homopolymer pipes)

PP-C (copolymer pipes)

PP (homopolymer and copolymer fittings)

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)

Determination of resistance to external blows

B.1 Test method and apparatus

See ISO 3127.

Should any test specimen show excessive distortion after impacting, further testing on this specimen shall be discontinued; further specimens shall be taken to continue the testing, to ensure a cumulative total number of strikes.

B.2 Test conditions

The test temperature shall be 20 °C $\pm$ 2 °C for homopolymers and 0 °C $\pm$ 1 °C for copolymers.

The mass of the falling weight and the fall height shall be selected from table B.1.

Table B.1 — Mass and fall height

Nominal outside diameter <i>D</i> mm	Mass of falling weight g +10 0	Fall height mm +20 0
32	500	1 000
40	500	1 000
50	500	1 000
63	500	2 000
75	500	2 000
90	1 000	2 000
110	1 000	2 000
125	2 000	2 000
160	2 000	2 000
200	2 000	2 000
NOTE — The values for flame retardant homopolymer pipes are under discussion.		

Annex C (normative)

Oven test for fittings

C.1 Apparatus

C.1.1 Oven, in which the fittings can be exposed to a temperature of $150\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.

C.2 Test pieces

Select three test pieces from each type of fitting.

C.3 Test procedure

See ISO 580.

Annex D (normative)

Watertightness test

D.1 Apparatus

D.1.1 Apparatus, to which the test assembly can be connected, allowing a controlled water pressure to be applied.

D.1.2 Precision pressure gauge.

D.2 Test assembly

Pipes, fittings and joints in accordance with this International Standard in all other respects shall be used.

The connection (joint) shall be made in accordance with the manufacturer's instructions.

D.3 Procedure

If the joint to be tested permits deflection, perform the test with the test assembly under the maximum possible deflection of the axis without forcing.

Connect the test assembly (see clause D.2) to the precision pressure gauge (D.1.2). By allowing water to enter the test assembly, gradually increase the internal pressure from 0 MPa to 0,05 MPa (0 bar to 0,5 bar) over a period of not greater than 15 min and maintain the pressure of 0,05 MPa (0,5 bar) for at least 15 min.

D.4 Test requirement

The test requirement (see 7.1) shall be fulfilled for all types of test assembly, including those combining minimum spigot ends and maximum sockets.

Annex E (normative)

Airtightness test

E.1 Apparatus

E.1.1 Apparatus, to which the test assembly can be connected, allowing a controlled air pressure to be applied.

A suitable apparatus is shown in figure E.1.

E.1.2 Precision pressure gauge or manometer.

E.2 Test assembly

Pipes, fittings and joints in accordance with this International Standard in all other respects shall be used.

The connection (joint) shall be made in accordance with the manufacturer's instructions.

The test assembly shall consist of a specimen of pipe mounted in two clamped blocks. Seal one end of the pipe with a plug that has a combined water and air inlet. Insert any fitting or joint into the open end of the pipe. The joint or fitting shall then be sealed at all open ends with plugs, one of which has a water outlet and shut-off valve mounted centrally in the sealing plug.

E.3 Procedure

E.3.1 Apply a strong solution of soapy water or detergent around the annular space between the mouth of the fitting and the pipe.

E.3.2 Open the water outlet valve and close the air inlet valve on the pipe shut-off.

E.3.3 Open the water inlet valve. When the assembly is half full, that is to say when water flows from the outlet, close the water inlet and outlet valves.

E.3.4 Open the air inlet valve and increase the internal air pressure to $0,01 \text{ MPa} \pm 0,001 \text{ MPa}$ ($0,1 \text{ bar} \pm 0,01 \text{ bar}$) at ambient temperature. Maintain this pressure for 5 min.

E.3.5 Note, during this 5 min period, any leaks which occur between the mouth of the fitting and the pipe, and which are evident by the formation of bubbles.

E.3.6 Deflect the pipe manually in the socket of the fitting until it reaches the maximum permissible deflection for the particular joint under test. Carry out this deflection at 0° , 90° , 180° and 270° (see figure E.1), maintaining it for 1 min in each of these directions.

E.4 Test requirements

No water leaks shall occur, but if bubbles appear at any time during the test, a new application of soapy water or detergent shall be made. If there is still a continuous emission of bubbles during the test, the joint shall be deemed not to meet the requirements of the test.

The test requirements (see 7.2) shall be fulfilled for all types of test assembly, including those combining minimum spigot ends and maximum sockets.

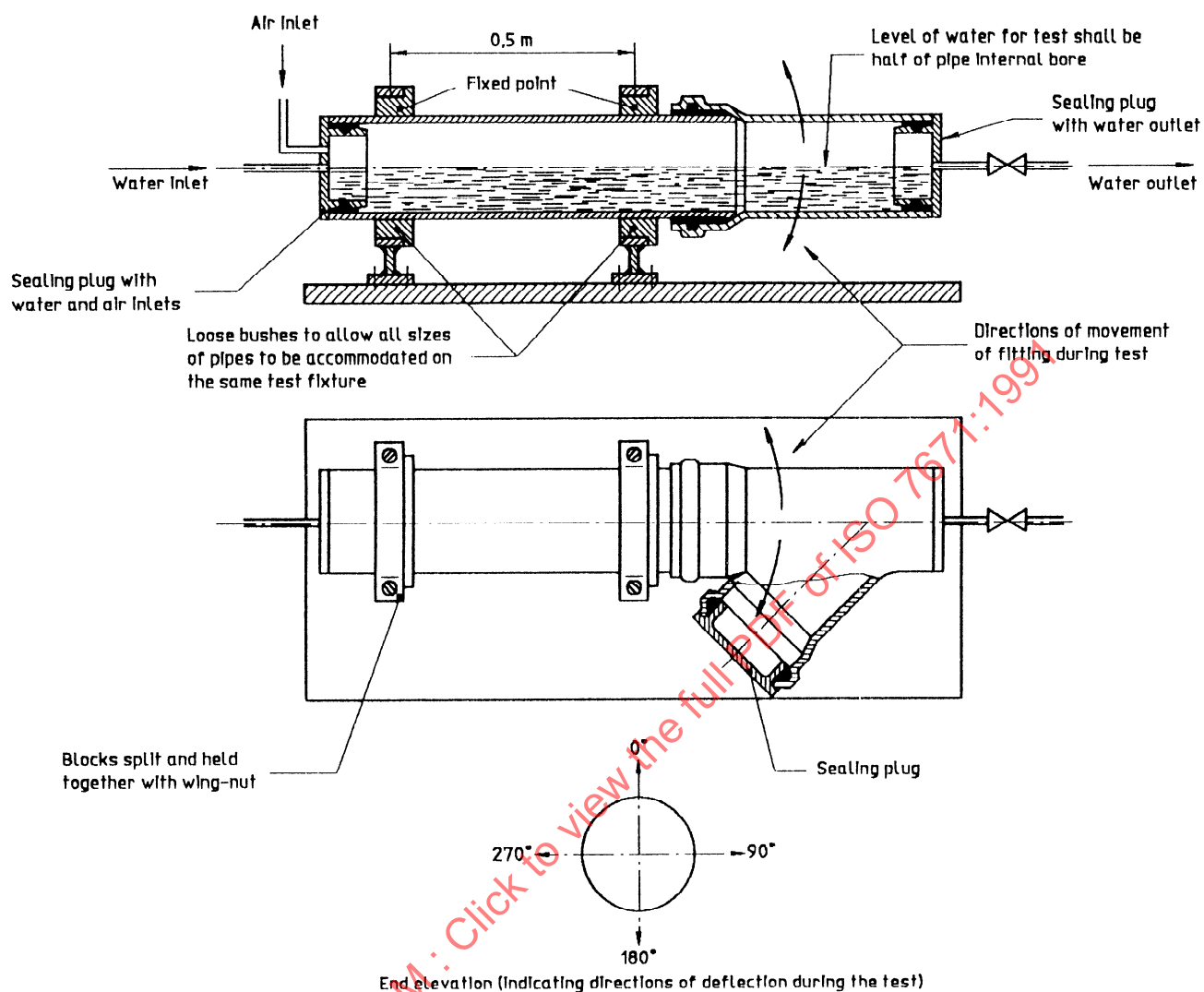


Figure E.1 — Test assembly for airtightness test

Annex F (normative)

Elevated-temperature cycling test — 1 500-cycle test

F.1 Test assembly

The test assembly shall consist of a vertical stack of pipes with fittings and two near-horizontal pipe assemblies with fittings in accordance with figure F.1. Installation shall be carried out on a firm wall or frame with guide and anchor brackets, with no other support of the test assembly.

Anchor brackets shall be located directly below or behind the sockets of each pipe length. Guide brackets shall be placed not less than 10*D* apart for near-horizontal assemblies. (An exception to this is the first pipe in the near-horizontal line from the inlet, where possible sagging is to be measured.)

Room for expansion of pipes shall be provided for all spigot ends of pipes, but not for the spigot ends of fittings. The entry of hot water into the test assembly shall be direct; there shall be no heat-absorbing intermediate pieces.

F.2 Procedure

F.2.1 Carry out a watertightness test on the test assembly under the conditions described in G.3.1.

F.2.2 Subject the test assembly to the passage of hot and cold water according to the following schedule for 1 500 cycles:

- a) 30 l of water at a temperature of $93\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$

(measured at the point of entry) over a period of 1 min (30 l/min);

- b) rest and drain period of 1 min;

- c) 30 l of water at a temperature of $15\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ (measured at the point of entry) over a period of 1 min (30 l/min);

- d) rest and drain period of 1 min.

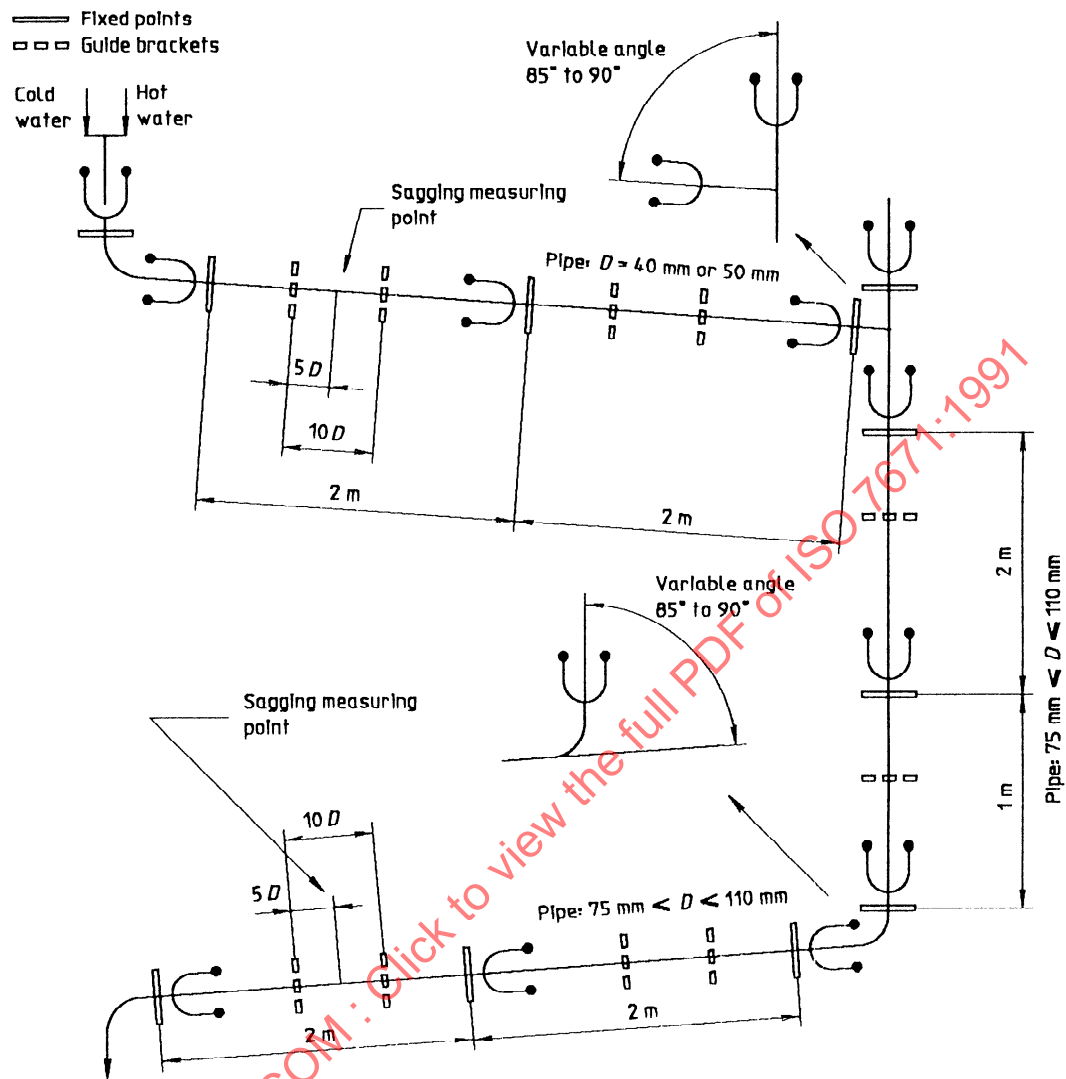
F.3 Test requirements

F.3.1 On completion of the test, fill the test assembly with water, at a temperature not exceeding $20\text{ }^{\circ}\text{C}$, to a head of 0,5 m. Leave for a minimum period of 15 min and then visually check for leaks. Any leakage shall be deemed a failure of the test assembly.

F.3.2 Check for sagging between guide brackets at a distance of 5*D* from any individual bracket. Any sagging greater than 0,1*D* shall be deemed a failure.

F.4 General information

See annex H.



NOTE – The fittings shall be assembled without undue stresses. The test assembly illustrated is only representative and the positions of the joints are not mandatory but should follow appropriate installation techniques (see ISO/TR 7024) and the manufacturer's instructions.

Figure F.1 — Test assembly for elevated-temperature cycling test (1 500 cycles)

Annex G

(normative)

Elevated-temperature cycling test — 5-cycle test

G.1 Test assembly

The test assembly shall consist of a vertical stack of pipes with fittings and two near-horizontal pipe assemblies with fittings in accordance with figure G.1. Installation shall be carried out on a firm wall or frame with guide and anchor brackets, with no other support of the test assembly.

Anchor brackets shall be located directly below or behind the sockets of each pipe length. Guide brackets for near-horizontal assemblies shall be positioned as shown in figure G.1.

It shall be checked that the test assembly exhibits no sagging greater than $0,1D$ at the mid-point between two guide brackets (see figure G.1).

Devices shall be provided, and positioned as indicated in figure G.1, to measure any sagging f_1 and f_2 of the test assembly.

Room for expansion of pipes shall be provided for all spigot ends of pipes, but not for the spigot ends of fittings. The entry of hot water into the test assembly shall be direct; there shall be no heat-absorbing intermediate pieces.

G.2 Procedure

G.2.1 Test the assembly for watertightness and airtightness in accordance with G.3.1 and G.3.2.

G.2.2 Subject the test assembly to the passage of hot and cold water according to the following schedule for 5 cycles:

- a) circulation of water at $93\text{ °C} \pm 2\text{ °C}$ for 15 min, at a flow-rate of 0,3 l/s (18 l/min);
- b) circulation of water at $15\text{ °C} \pm 5\text{ °C}$ for 10 min, at a flow-rate of 0,3 l/s (18 l/min).

During the cycling test

- a) check that the temperature of the water remains constant within the specified limits,
- b) note any leaks from the test assembly and any "incidents" which may have an influence on the results,

- c) record the sagging f_1 and f_2 between guide brackets.

G.2.3 After completion of the cycling test, carry out the watertightness test again, as described in G.3.1.

G.3 Tightness test procedures

G.3.1 Watertightness

Carry out the following procedure:

- a) Seal off the lower end of the test assembly.
- b) Apply a pressure of at least 0,01 MPa (0,1 bar) to each joint by filling the installation with water.
- c) Maintain the pressure for a period of 1 min.
- d) Take note of any leaks at each joint.

G.3.2 Airtightness

Carry out the following procedure:

- a) Seal off the ends of the test assembly.
- b) Coat the annular space between spigot and socket ends of joints with soapy water.
- c) Apply an air pressure of 0,01 MPa (0,1 bar) at ambient temperature.
- d) Maintain the pressure for a period of 1 min.
- e) Take note of any leaks, evident through the formation of bubbles.

G.4 Test requirements

G.4.1 The joints shall remain watertight and airtight before and after the 5-cycle test.

G.4.2 The sagging at the mid-point between two guide brackets shall not exceed $0,1D$.

G.5 General information

See annex H.

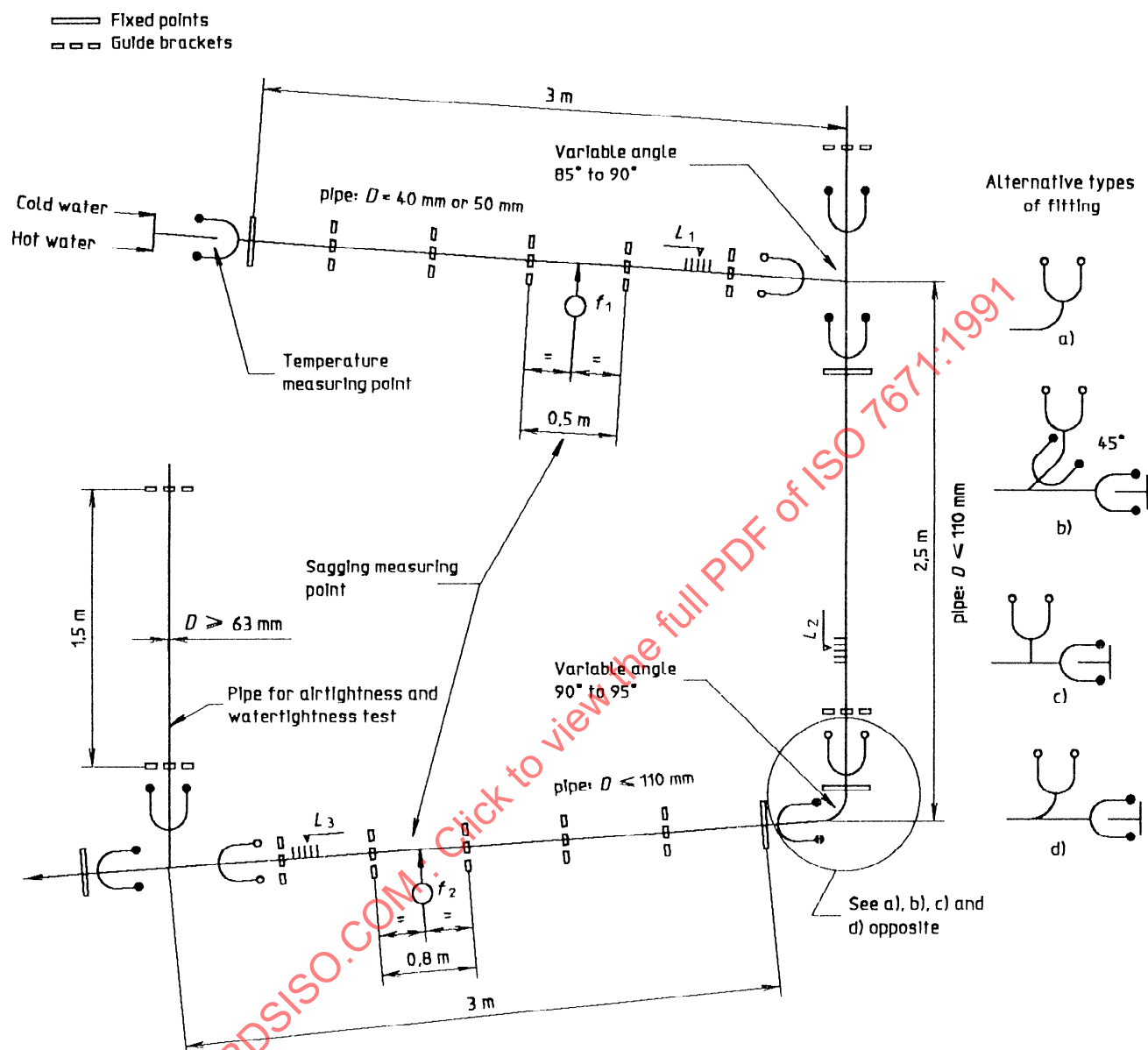


Figure G.1 — Test assembly for elevated-temperature cycling test (5 cycles)

Annex H

(normative)

Cycling tests — General information for both 1 500-cycle and 5-cycle tests

H.1 Test report

The test report shall include the following information:

- a) a statement indicating the cycling test carried out (i.e. 1 500-cycle or 5-cycle test);
- b) the types and dimensions of the components used in the test assembly;
- c) all test parameters;
- d) results of leakproofness tests before the cycling test;
- e) observations during the cycling test;
- f) results of leakproofness tests after the cycling test;
- g) any sagging noted;
- h) results of final inspection of the test assembly;
- i) all details not provided for in this International Standard, as well as any incidents which might have had an influence on the results.

H.2 Key to symbols

The symbols used to specify or report on a test assembly shall comply with ISO/TR 7024.