INTERNATIONAL STANDARD

ISO 7682

First edition
1991-05-15

Acrylonitrile/butadiene/styrene (ABS) pipes and fittings for soil and waste discharge (low and high temperature) systems inside buildings — Specifications

Tubes et raccords en acrylonitrile/butadiène/styrène (ABS) 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 7682:1991(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 7682 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, H, J and K form an integral part of this International Standard. Annex L is for information only.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Acrylonitrile/butadiene/styrene (ABS) 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 acrylonitrile/butadiene/styrene (ABS) pipes and fittings, with nominal outside diameters of 32 mm to 160 mm, intended for domestic installations inside buildings for

a) soil and waste discharge pipe lines (including the ventilation of these pipes), and

b) internal rainwater pipes

for the transportation of domestic waste waters[1] (low and high temperature).

Two systems, type A and type B, are specified[2]. Both systems are suitable for this field of application. However, type B is recommended for applications where higher impact performance is required. This higher impact performance is normally associated with lower temperatures during handling and installation.

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 indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 179:1982, *Plastics — Determination of Charpy impact strength of rigid materials.*

ISO 2651:1988, *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 3606:1976, *Unplasticized polyvinyl chloride (PVC) pipes — Tolerances on outside diameters and wall thicknesses.*

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 7245:1984, *Pipes and fittings of acrylonitrile/butadiene/styrene (ABS) — General specification for moulding and extrusion materials.*

ISO 7246:1984, *Pipes and fittings of acrylonitrile/styrene/acrylester (ASA) — General specification for moulding and extrusion materials.*

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

2) Individual countries may select either type for their national standards.

ISO 8283-4:—[3], *Plastics pipes and fittings — Dimensions of sockets and spigots for discharge systems inside buildings — Part 4: Acrylonitrile/butadiene/styrene (ABS).*

3 Material

3.1 The material shall consist of acrylonitrile/butadiene/styrene (ABS) copolymer or terpolymer in accordance with ISO 7245, to which may be added acrylonitrile/styrene/acrylester (ASA) in accordance with ISO 7246 together with 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 International Standard is permissible. No other rework material shall be used.

3.3 Pipes and fittings shall be sufficiently stabilized against 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.

Table 1 — Nominal outside diameter

Dimensions in millimetres

32	40	50	63	75	90	110	125	160

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*

Tolerances on outside diameters shall be in accordance with ISO 3606.

3) To be published.

4.1.2 Wall thickness

The wall thickness shall be in accordance with table 2.

Tolerances on wall thicknesses shall be in accordance with ISO 3606.

Table 2 — Wall thickness

Dimensions in millimetres

Nominal outside diameter D	Minimum wall thickness e_{min}	
	Type A	Type B
32	1,8	2,2
40	1,8	2,2
50	1,8	2,2
63	1,8	2,2
75	1,8	2,5
90	1,8	2,8
110	2,2	3,2
125	2,5	3,7
160	3,2	4,7

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 as 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 and type 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 8283-4.

4.3.2 Wall thickness of sockets on pipes and fittings

The minimum wall thickness of sockets shall meet the requirements of table 3 (see figure 2 for an example).

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 3 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 of the fitting that do not come into contact with the liquid, i.e. beyond the designated ring seal point, thinner walls are permitted.

Retaining caps or rings may be made to other designs and from polymers other than ABS 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.

Table 3 — Minimum wall thickness of sockets on pipes and fittings

Dimensions in millimetres

Nominal outside diameter D	e_2 [1] min.		e_3 [2] min.	
	Type A	Type B	Type A	Type B
32	1,7	2	1	1,3
40	1,7	2	1	1,3
50	1,7	2	1	1,3
63	1,7	2	1	1,3
75	1,7	2,3	1	1,4
90	1,7	2,6	1	1,6
110	2	2,9	1,3	1,8
125	2,3	3,4	1,4	2,1
160	2,9	4,3	1,8	2,6

1) Type A and B: $e_2 = 0{,}9e$

2) Type A and B: $e_3 = 0{,}55e$

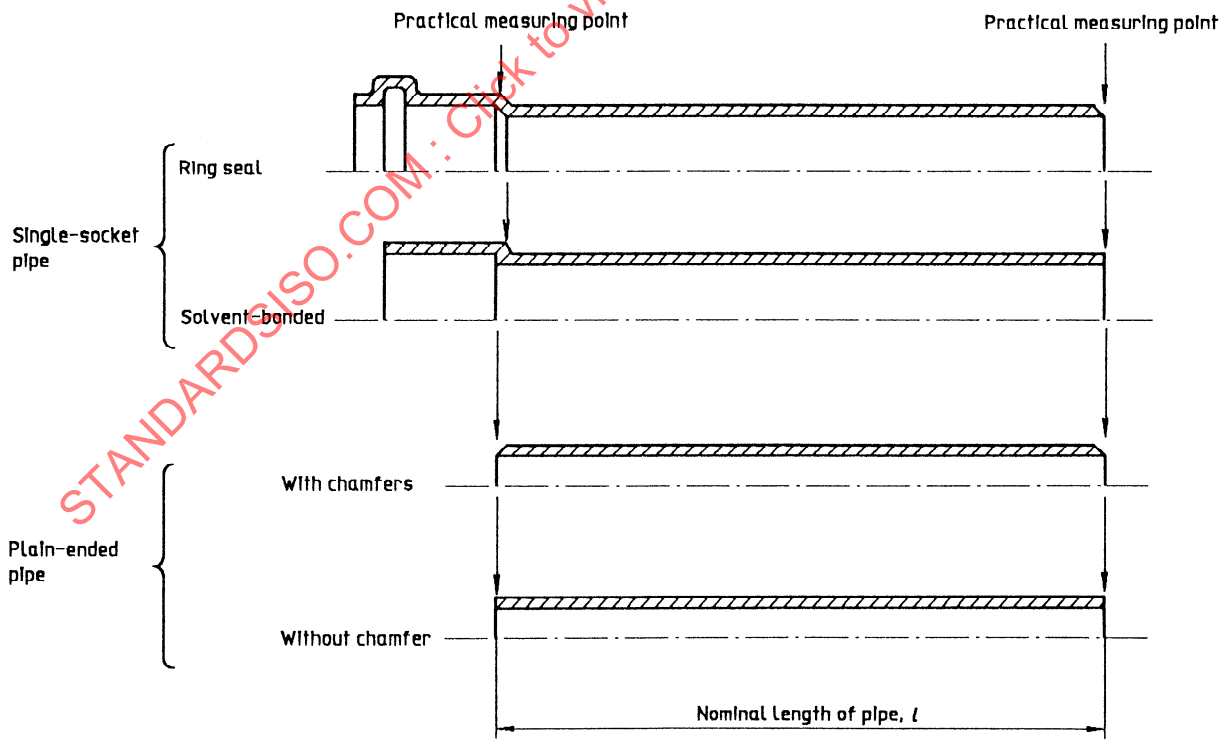


Figure 1 — Nominal pipe length and definitions

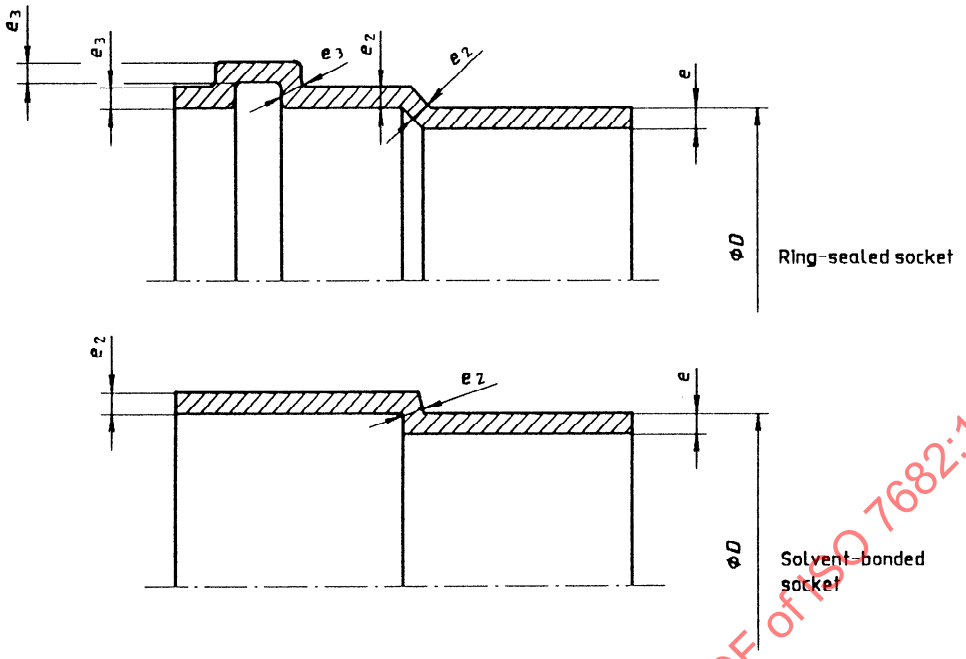


Figure 2 — Socket details

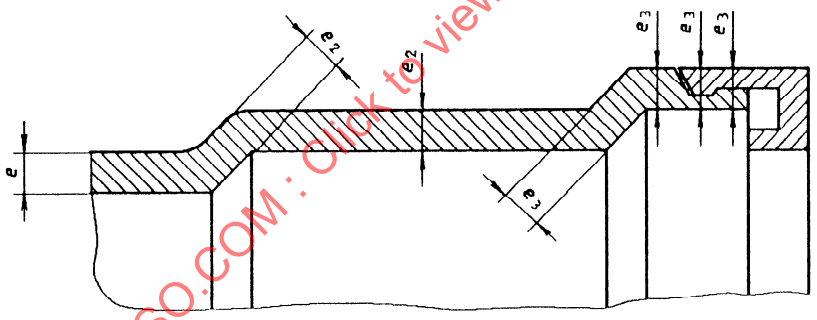


Figure 3 — Example of a seal retaining cap

5 Mechanical test requirements

5.1 Pipes

5.1.1 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.

5.1.2 Resistance to high-temperature ageing

The true impact rate (TIR) shall not exceed 5 % when tested using the method specified in annex C.

5.2 Fittings

5.2.1 Impact strength

Five fittings of each diameter and type shall be conditioned for at least 30 min at a temperature of 0 °C ± 1 °C. 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 $D \leqslant 75$ mm, drop from $(2\ ^{+0,1}_{0})$ m;

— for $D > 75$ mm, drop from $(1\ ^{+0,1}_{0})$ 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.

5.2.2 Resistance to high-temperature ageing

After exposure in accordance with annex C, the Charpy impact strength shall be determined according to annex D. If all values exceed 30 kJ/m^2, the requirements of this test are met. If some values are lower, then the fittings are only acceptable if the mean minus one standard deviation exceeds 30 kJ/m^2.

To obtain the correct size of test piece, samples shall be taken where possible from couplings of diameter greater than 50 mm.

6 Physical test requirements

6.1 Pipes

6.1.1 Vicat softening temperature

6.1.1.1 The dry Vicat softening temperature shall be not less than 90 °C.

6.1.1.2 The Vicat softening temperature after conditioning for 16 h in water at 90 °C shall be not less than 80 °C.

6.1.1.3 A test method to determine the Vicat softening temperature of ABS materials will form the subject of a future International Standard.

6.1.2 Water absorption

The water absorption shall be less than 3 % (m/m). A test method to determine the water absorption will form the subject of a future International Standard.

6.1.3 Longitudinal reversion

The longitudinal reversion shall not exceed 5 %. A test method to determine the longitudinal reversion of ABS materials will form the subject of a future International Standard.

6.1.4 Axial shrinkage

The axial shrinkage shall not exceed 1,5 % when determined in accordance with annex E.

6.2 Fittings

6.2.1 Vicat softening temperature

6.2.1.1 The dry Vicat softening temperature shall be not less than 90 °C.

6.2.1.2 The Vicat softening temperature after conditioning for 16 h in water at 90 °C shall be not less than 80 °C.

6.2.1.3 A test method to determine the Vicat softening temperature of ABS materials will form the subject of a future International Standard.

6.2.2 Water absorption

The water absorption shall be less than 3 % (m/m). A test method to determine the water absorption will form the subject of a future International Standard.

6.2.3 Oven test

Moulded fittings shall meet the requirements of ISO 580.

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 F.

7.2 Airtightness

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

7.3 Elevated-temperature cycling test

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

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

8 Elastomeric sealing elements and adhesives

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

The sealing elements and adhesive 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

9.1 Appearance

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.

9.2 Colour

Colours shall be as specified in national standards or regulations, or as agreed between manufacturer and user.

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 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)

ABS

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 0 °C ± 1 °C.

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 D mm	Mass of falling weight g $^{+10}_{0}$	Fall height mm $^{+20}_{0}$
32	500	1 500
40	500	1 800
50	500	2 000
63	500	2 000
75	1 000	2 000
90	2 000	2 000
110	2 000	2 000
125	2 700	2 000
160	3 750	2 000

Annex C
(normative)

Resistance to high-temperature ageing

C.1 Exposure conditions

Test specimens shall be exposed in a standing position (if necessary in layers) for a period of 500 h at 90 °C ± 2 °C and a relative humidity of at least 80 %.

C.2 Test method and apparatus

See ISO 3127.

C.3 Test conditions

The test temperature shall be 0 °C ± 1 °C.

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

Table C.1 — Mass and fall height

Nominal outside diameter D mm	Mass of falling weight g $^{+10}_{0}$	Fall height mm $^{+20}_{0}$
32	250	2 000
40	250	2 000
50	250	2 000
63	250	2 000
75	500	2 000
90	1 000	2 000
110	1 000	2 000
125	1 500	2 000
160	1 750	2 000

Annex D
(normative)

Charpy impact strength of fittings

D.1 Apparatus

See ISO 179, with the exception that the distance between the supports shall be 22 mm.

D.2 Test pieces

Ten test pieces shall be taken at random from one or more injection-moulded straight couplings, avoiding weld lines and injection areas, of the same type and batch, with the dimensions shown in figure D.1.

D.3 Conditioning

The test pieces shall be kept for at least 16 h at 23 °C ± 2 °C and a relative humidity of (50 ± 5) %.

D.4 Procedure

For every test piece, determine the width measured across the chord at the mid-length and the thickness with an accuracy of 0,05 mm.

For every test piece, determine the impact energy, A, and calculate the Charpy impact strength using the equation

$$a = \frac{A}{b \times e}$$

where

a is the Charpy impact strength, in kilojoules per square metre;

A is the impact energy, in kilojoules, absorbed by the test piece;

b is the width of the test piece, in metres;

e is the thickness of the test piece, in metres.

Average the ten values and calculate the standard deviation using the equation

$$s = \sqrt{\frac{\sum (a_i - a_m)^2}{n - 1}}$$

where

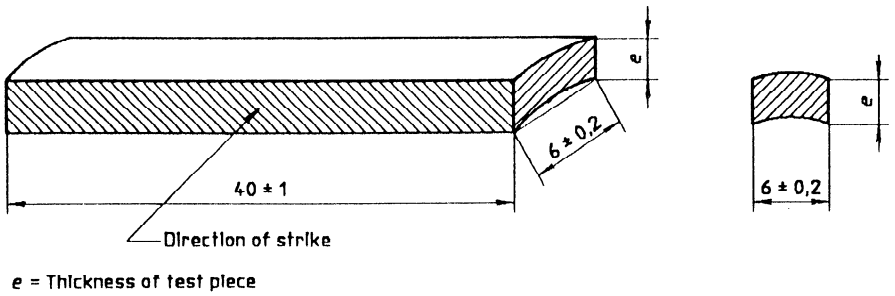
s is the standard deviation, in kilojoules per square metre;

a_i is the Charpy impact strength, in kilojoules per square metre, of the ith test piece;

a_m is the mean Charpy impact strength, in kilojoules per square metre;

n is the total number of test pieces.

Dimensions in millimetres



e = Thickness of test piece

Figure D.1 — Test piece

Annex E
(normative)

Determination of axial shrinkage of pipes

E.1 Scope

Determination of the permanent axial shrinkage at 90 °C of ABS pipes to be used for waste discharge systems inside buildings.

E.2 Apparatus

E.2.1 Thermostatically controlled water-bath, capable of being maintained at 90 °C ± 2 °C.

The volume and performance of the bath shall be such that there is virtually no variation in temperature when the test pieces are immersed.

The water in the bath shall not contain substances which can alter the product investigated.

Adequate stirring shall be provided so that the temperature limits are complied with at all points in the bath water.

E.2.2 Mounting device for the test pieces.

E.2.3 Thermometer, graduated in divisions of 0,5 °C.

E.3 Test pieces

Select three pipes 300 mm ± 20 mm in length. Mark each pipe, for example by means of a scriber, around the circumference with two circular marks, 200 mm apart, such that one of them is approximately 10 mm from one of the ends.

E.4 Conditioning

Condition the test pieces for at least 2 h at 23 °C ± 2 °C.

E.5 Procedure

With the test pieces at a temperature of 23 °C ± 2 °C, measure the distance between the marks to the nearest 0,25 mm. Regulate the temperature of the heating water to 90 °C ± 2 °C. Suspend the test pieces vertically in the heating water by the ends furthest from the marks, such that the whole test piece is immersed in the water and the upper end is at least 50 mm below the surface of the water.

The test pieces shall be placed in such a position that they touch neither the walls nor the bottom of the bath.

Leave the test pieces immersed for 16 h.

Remove the test pieces from the bath and, after complete cooling to 23 °C ± 2 °C, measure, under the same conditions as before, the distance between the marks along two lines running parallel to the longitudinal axis of the pipe and diametrically opposite each other on the pipe.

E.6 Expression of results

Calculate the percentage change in distance between the marks on the test piece using the equation

$$T = \frac{|\Delta L|}{L_0} \times 100$$

where

T is the percentage change in length, or shrinkage;

$\Delta L = L_0 - L$;

L_0 is the distance, in millimetres, between the marks before the test;

L is the distance, in millimetres, between the marks after the test.

Select the value of L which gives the greatest value of ΔL.

For the value of axial shrinkage of the pipe, take the arithmetic mean of the values obtained for each of the three test pieces.

Annex F
(normative)

Watertightness test

F.1 Apparatus

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

F.1.2 Precision pressure gauge.

F.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.

F.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 F.2) to the precision pressure gauge (F.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.

F.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 G
(normative)

Airtightness test

G.1 Apparatus

G.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 G.1.

G.1.2 Precision pressure gauge or **manometer.**

G.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.

G.3 Procedure

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

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

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

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

G.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.

G.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 G.1), maintaining it for 1 min in each of these directions.

G.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 shall be fulfilled for all types of test assembly, including those combining minimum spigot ends and maximum sockets.

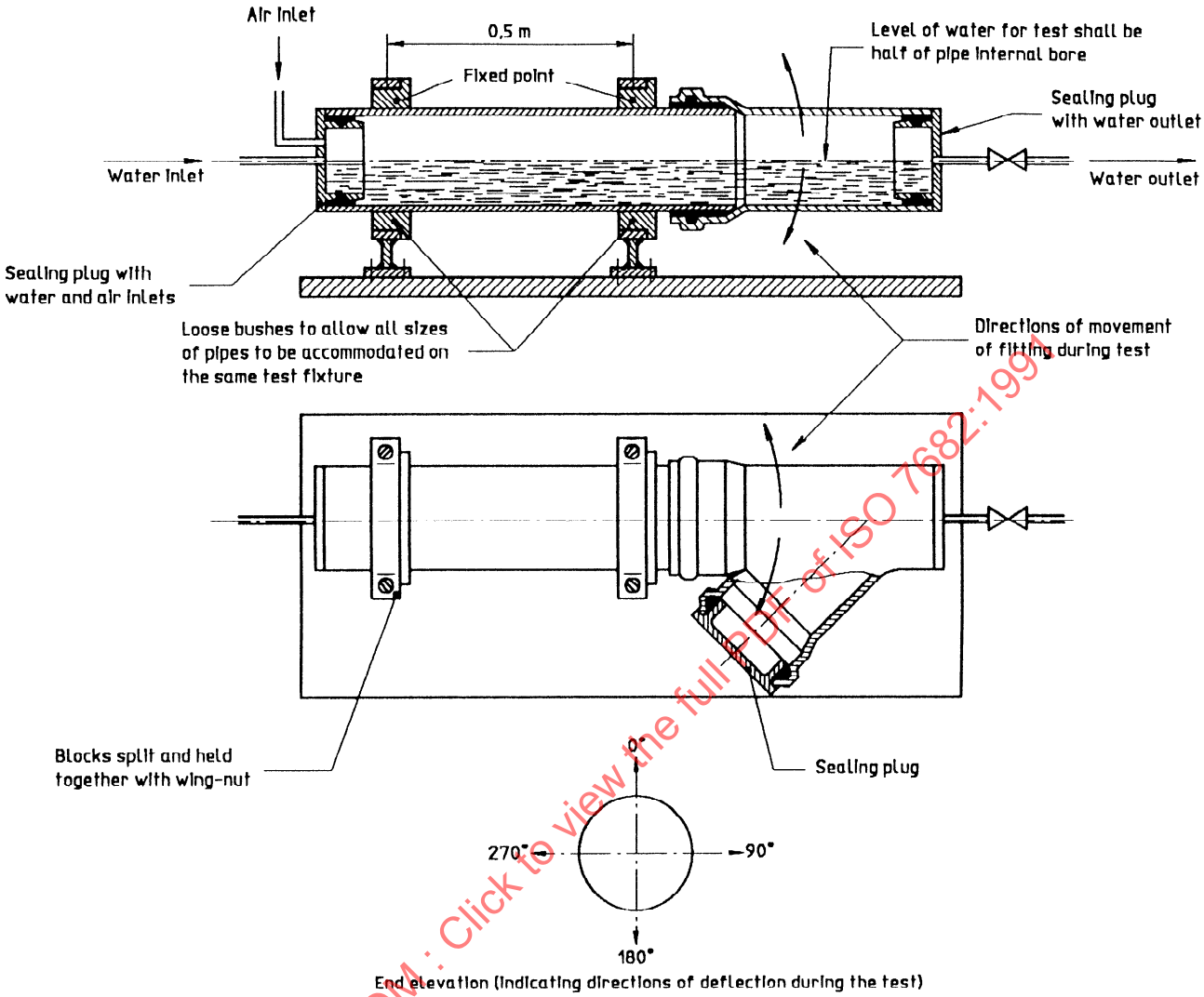


Figure G.1 — Test assembly for airtightness test

Annex H
(normative)

Elevated-temperature cycling test — 1 500-cycle test

H.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 H.1.

Where the test assembly is constructed using solvent cement, the solvent cement recommended by the fittings manufacturer shall be used.

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 10D 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.

H.2 Procedure

H.2.1 Carry out a watertightness test on the test assembly under the conditions described in J.3.1.

H.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 °C ± 2 °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 °C ± 5 °C (measured at the point of entry) over a period of 1 min (30 l/min);

d) rest and drain period of 1 min.

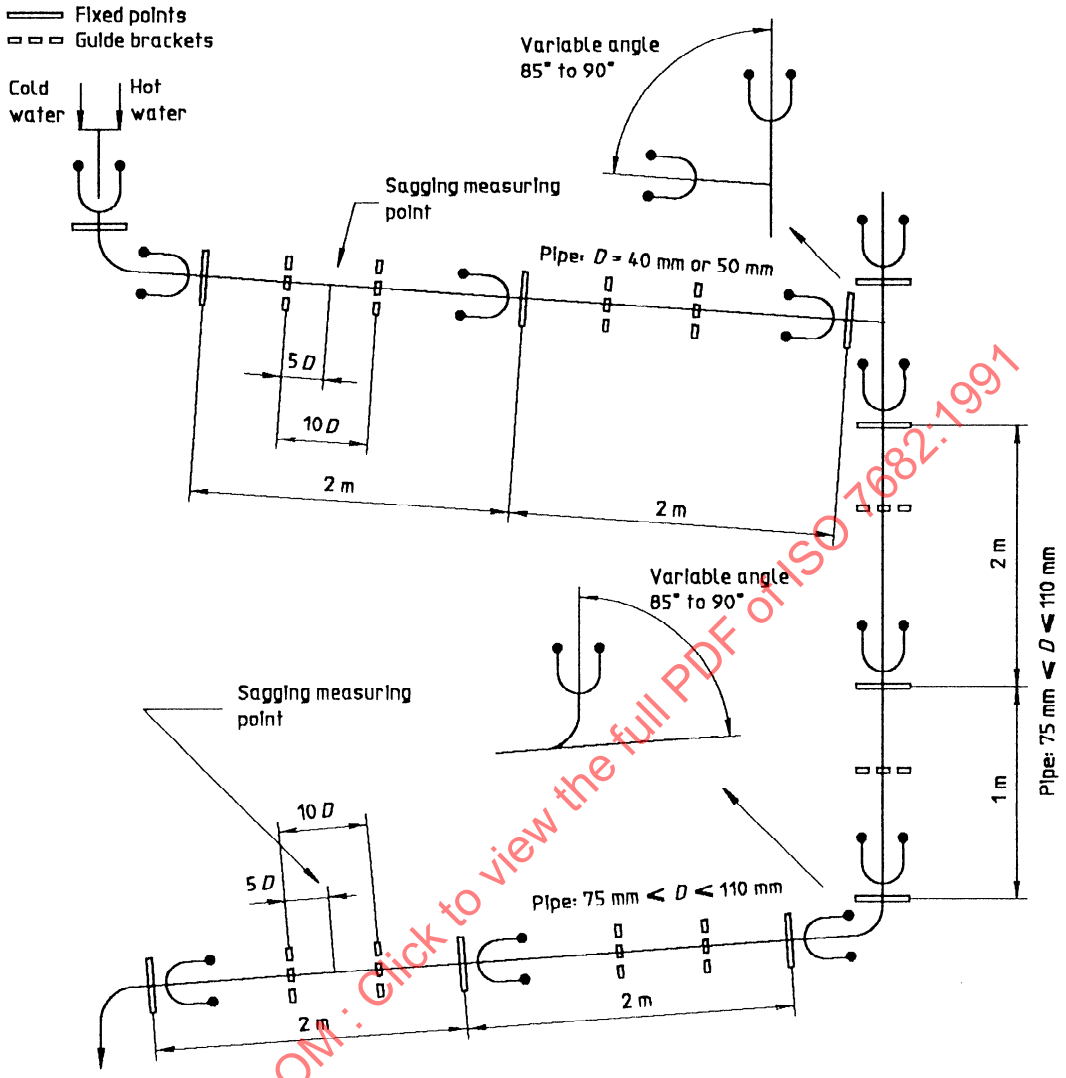
H.3 Test requirements

H.3.1 On completion of the test, fill the test assembly with water, at a temperature not exceeding 20 °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.

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

H.4 General information

See annex K.



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

Annex J
(normative)

Elevated-temperature cycling test — 5-cycle test

J.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 J.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 J.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 J.1).

Devices shall be provided, and positioned as indicated in figure J.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.

J.2 Procedure

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

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

a) circulation of water at 93 °C ± 2 °C for 15 min, at a flow-rate of 0,3 l/s (18 l/min);

b) circulation of water at 15 °C ± 5 °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.

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

J.3 Tightness test procedures

J.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.

J.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.

J.4 Test requirements

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

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

J.5 General information

See annex K.

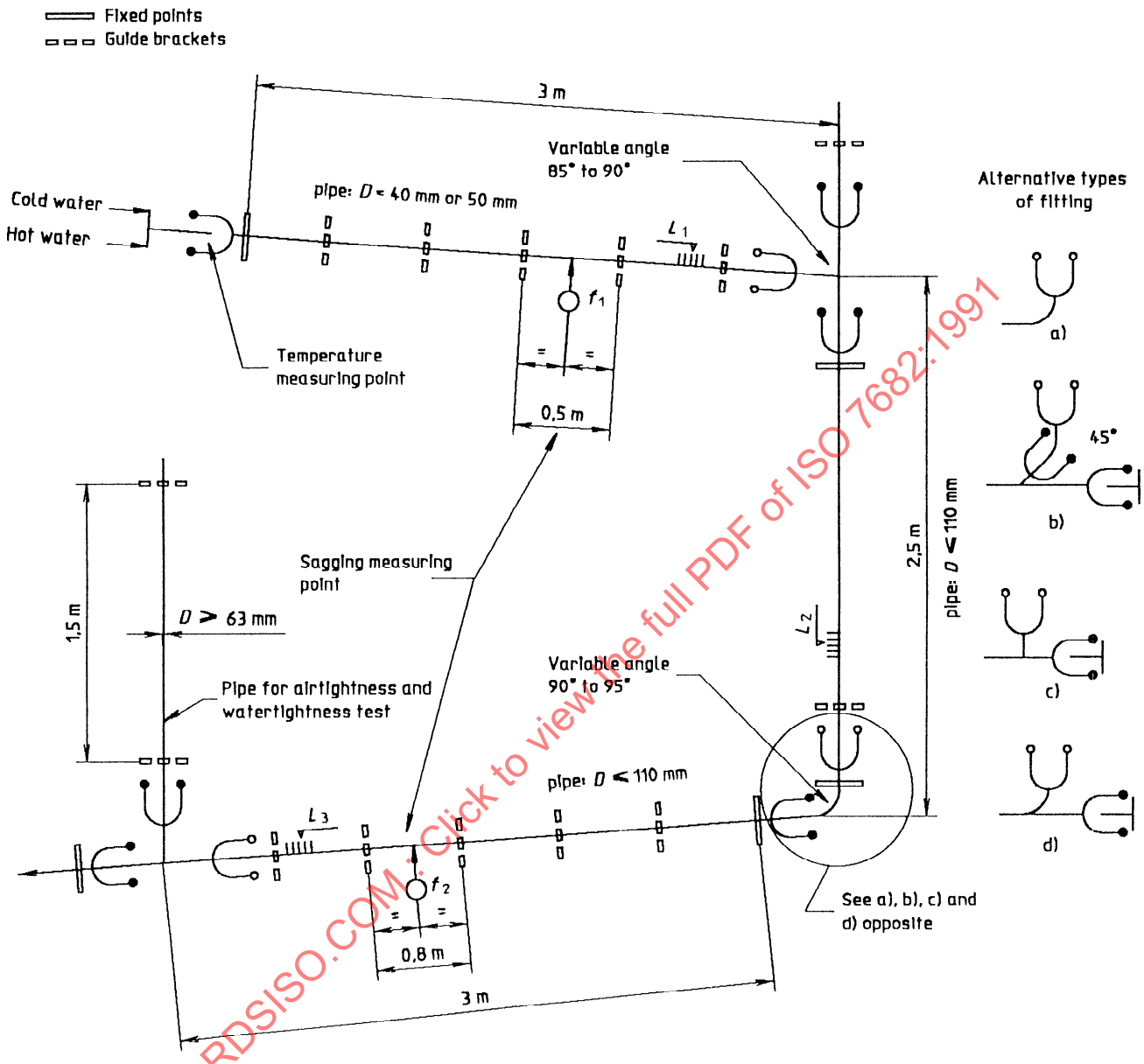


Figure J.1 — Test assembly for elevated-temperature cycling test (5 cycles)