BRITISH STANDARD

BS EN
12763:2000

Fibre-cement pipes and fittings for discharge systems for buildings—Dimensions and technical terms of delivery

The European Standard EN 12763:2000 has the status of a British Standard

ICS 23.040.50; 91.140.80

National foreword

This British Standard is the official English language version of EN 12763:2000.

The UK participation in its preparation was entrusted to Technical Committee B/505, Wastewater engineering, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Summary of pages

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English version

Fibre-cement pipes and fittings for discharge systems for buildings - Dimensions and technical terms of delivery

Tuyaux et raccords en fibres-ciment pour systèmes d'évacuation pour bâtiments - Dimensions, conditions techniques de livraison

Faserzementrohre und -formstücke für Hausentwässerungssysteme - Maße und technische Lieferbedingungen

This European Standard was approved by CEN on 27 November 1999.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Contents Page

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 165, Waste water engineering, the Secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2001, and conflicting national standards shall be withdrawn at the latest by January 2001.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU Directive(s).

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This European Standard was prepared by working group 5 of CEN Technical Committee TC 165 on Waste water technology.

A distinction has been made between initial control of products (type tests) and internal quality control requirements (acceptance tests).

The performance of a water discharge system network constructed with these products depends not only on the properties of the product as required by this standard but also on the design and construction of the network as a whole in relation to the environment and conditions of use.

This standard is in accordance with EN 476:1996, General requirements for components used in discharge pipes, drains and sewers for gravity systems, established by TC 165 WG 1 and will be in accordance with other functional standards as soon as these are available.

Annexes A and B of this European Standard are normative; Annexes C, D and E are informative.

1 Scope

This European Standard applies to fibre-cement pipes, joints and fittings used for sewerage and rainwater discharge systems for buildings where pressure tight joints are required.

It defines general composition, classification, geometrical, mechanical and physical characteristics and quality control.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

ENV 197:1992 Cement - Composition, specifications and conformity criteria - Part 1: Common cements.

EN 476:1997 General requirements for components used in discharge pipes, drains and sewers for gravity systems.

EN 681-1:1996 Elastomeric seals - Materials requirements for pipe joint seals used in water and drainage applications - Part 1: Vulcanized rubber.

EN 10088-1:1995 Stainless steels - Part 1: List of stainless steels.

EN 10088-2:1995 Stainless steels - Part 2: Technical delivery conditions for sheet/plate and strip for general purposes.

EN ISO 9001 Quality systems - Model for quality assurance in design/development, production, installation and servicing (ISO 9001:1994).

EN ISO 9002 Quality systems - Model for quality assurance in production, installation and servicing (ISO 9002:1994).

ISO 390:1993 Products in fibre-reinforced cement - Sampling and inspection.

ISO 898-1 Mechanical properties of fasteners - Part 1: Bolts, screws and studs.

ISO 898-2 Mechanical properties of fasteners - Part 2: Nuts with specified proof load values - Coarse thread.

ISO 2602:1980 Statistical interpretation of test results - Estimation of the mean - Confidence interval.

ISO 2859-1:1989 Sampling procedures for inspection by attributes - Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot by lot inspection.

ISO 3951:1989 Sampling procedures and charts for inspection by variables for percent non-conforming.

ISO 4628 Paints and varnishes - Evaluation of degradation of paint coatings - Designation of intensity, quantity and size of common types of defect.

ISO 7253 Paints and varnishes - Determination of resistance to neutral salt spray (fog).

3 Terms and definitions

For the purpose of this standard the following terms and definitions apply.

3.1 nominal diameter (DN)

numerical denomination of size of a component, which is a convenient round number approximately equal to the manufacturing dimension in millimetres of the internal diameter

3.2 acceptance test

test to establish whether a batch of products conforms to a specification of the standard. The test is performed on samples drawn either from continuous production or from a consignment [ISO 390:1993]

NOTE: Test method, specifications and limit values are specified in this standard. Sampling levels and acceptance criteria are specified in ISO 390.

3.3 type test

test for approval of a new product and/or a fundamental change in formulation or method of manufacture, or both. The test is performed on the as delivered product

The type test is not to be taken as evidence of the conformity to specification of products subsequently produced in quantity [ISO 390:1993].

3.4 acceptable quality level (AQL)

when a continuous series of batches is considered, the quality level which for the purposes of sampling inspection is the limit of a satisfactory process average [ISO 2859-1:1989]

NOTE: A sampling scheme with an AQL of 4 % means that batches containing up to 4 % defective items have a high probability of acceptance.

4 Symbols and abbreviations

a	Length of machined ends
c	Length of axes
DN	Nominal diameter
d_1	Internal diameter
d_2	External diameter of the machined end
d_3	External diameter of the barrel of the pipe
e	Wall thickness
e_1	Nominal thickness of the machined end
f	Maximum deviation of straightness
l	Total length of pipe = building length
r	Minimum radius of bends
C_L	Crushing load

5 Requirements for pipes and fittings

5.1 General

Pipes and fittings shall comply with the requirements of this clause at the stage of delivery.

5.2 General composition

Products made of fibre-cement pipes according to this standard shall consist essentially of cement or a calcium silicate formed by chemical reaction of a siliceous and a calcareous material reinforced by fibres other than asbestos. The cement shall comply with relevant national standards of CEN members and/or ENV 197-1.

5.3 Pipe ends

Pipes and fittings shall have both ends plain.

NOTE: The pipes can have machined or unmachined ends.

5.4 General appearance and finish

The pipes shall be straight, uniform and regular. The shape of the finished end shall be fixed by the manufacturer to suit the type of joint used.

The end faces of pipes and fittings shall be free from breakouts and machining burrs and shall be perpendicular to the pipe axis.

NOTE: If necessary, the pipes may be impregnated and/or coated internally and/or externally to meet special working conditions as agreed between manufacturer and customer. The coating and finish should comply with the relevant national standards, if existing.

5.5 Smoothness of bore

The internal surface of the pipe shall be regular and smooth. Slight scratches, indentations or small protrusions that do not affect the intended use or efficiency shall be acceptable.

5.6 Geometrical characteristics

5.6.1 Diameters, wall thickness

Internal diameters d_1 and wall thickness *e* shall be as given in Table 1. For pipes, the symbols for dimensions to be measured are given in Figure 1. External diameters d_2 and d_3 and tolerances shall be stated by the manufacturer. External diameters d_3 shall be observed along the whole length of the pipe, for fittings along the free length a (see Figure 2 and annex E).

Table 1 — Diameters and wall thickness of pipes

Nominal diameter	Internal diameter		Wall thickness
DN	d_1 mm	Tolerances mm	e_{min} mm
50	50	±2	6
60	60	±2	6
70	70	±2	6
80	80	±2	6
100	100	±2,5	6
125	125	±3	7
150	150	±4	7
200	200	±5	7,5
250	250	±6	8,5
300	300	±7	9,5

5.6.2 Length of pipes

The nominal length *l* of a pipe is the complete length between the extremities (see Figure 1).

The nominal length of pipes shall be: 2,0 m; 2,5 m; 3,0 m; 4 m; 5 m.

The tolerance on the length is $^{+10}_{-20}$ mm.

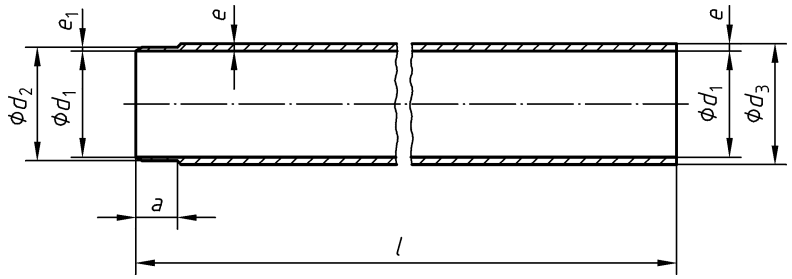


Figure 1 — Pipes, shape of the pipe end and dimensions

5.6.3 Straightness of pipes

When measured in accordance with 6.3 the maximum tolerance f on straightness shall not exceed the values given in Table 2.

Table 2 — Tolerance on straightness

DN	Maximum deviation f mm
50 to 80 100 to 150 200 to 300	4,5 l 3,0 l 2,5 l
l is the total length of the pipe in metres (see Figure 1).	

5.6.4 General design of fittings

5.6.4.1 Length of plain ends

For fittings the length of the plain ends shall be at least equal to the jointing length of the coupling.

5.6.4.2 Diameters and wall thickness

For fittings the internal diameters d_1 and the wall thickness shall be as given in Table 1. Outside diameters and tolerances of plain ends shall be compatible with pipes and shall be stated by the manufacturer.

5.6.4.3 Angles for branches and bends

Preferred angles for bends and branches are those shown in Table 3.

Table 3 — Angles for bends and branches

For bends	For branches
15° 20° to 22° 30' 30° 45° 87° to 90°	 45° 87° to 90°

5.6.4.4 Radius of bends

The minimum radius of bends is r = 0,5 DN except for bends of DN > 200 and angles > 70° where the minimum radius is r = 0,7 DN (see Figure 2).

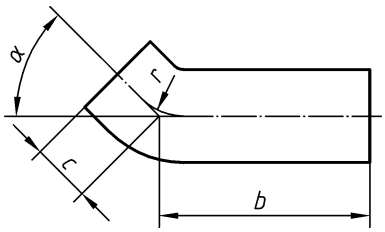


Figure 2 — Bend (example)

5.6.5 Examples of fittings

Examples of fittings and their applications are shown in annex E. The manufacturer shall state in his literature the dimensions for his range of products.

5.7 Mechanical characteristics

5.7.1 Crushing strength

The crushing test shall be carried out on pipe sizes of DN 100 up to 300 in accordance with 6.4.1. The minimum crushing loads shall not be lower than those stated in Table 4. The crushing strength is given by the crushing load C_L in kilonewtons per linear metre in accordance with 6.4.1.

Table 4 — Minimum values for crushing loads

Nominal diameter DN	Crushing load C_L kN/m
100	15
125	15
150	15
200	15
250	15
300	18
NOTE: For pipes of DN 200 to DN 300 a lower crushing load of not less than 11 kN/m can be agreed between manufacturer and customer.	

5.7.2 Longitudinal bending

The test shall be carried out on pipes with a nominal diameter of DN ≤ 150.

The minimum values for the longitudinal bending loads in accordance with 6.4.2 shall be as specified in Table 5.

Table 5 — Minimum values for longitudinal bending loads

Nominal diameter DN	Bending loads N min.
50	3 000
60	3 000
70	4 000
80	4 000
100	6 500
125	7 500
150	10 500

5.8 Physical characteristics

5.8.1 Watertightness

Pipes and fittings shall be watertight against an internal hydrostatic pressure of 50 kPa (0,5 bars).

When tested in accordance with 6.5.2, pipes and fittings shall exhibit no fissure, leakage or drops of water.

5.8.2 Frost resistance

Pipes and fittings shall be resistant to frost. During the test in accordance with 6.5.3, no visible changes which may affect the performance in use of the test specimen shall be allowed.

5.8.3 Warm water test

When tested in accordance with 6.5.4, the lower confidence limit L calculated for the test specimens shall be not less than 0,75.

5.8.4 Thermal stability

Pipe systems shall be tested for thermal stability. Following the test in accordance with 6.5.5 all parts of the pipe system shall be watertight and no part of the pipe system shall show either cracks, damage, deformations or other defects which could affect the performance in use.

This test is not necessary for rainwater pipes marked as such.

5.8.5 Resistance to domestic sewage media

When tested in accordance with 6.5.6, pipes shall not show any visible changes which may affect their performance in use. In the comparison with the test specimens (see 6.5.8) the lower confidence limit L shall be not less than 0,75.

This test is not necessary for rainwater pipes marked as such.

5.8.6 Resistance to SO_2

When tested in accordance with 6.5.7, a comparison with the initial test specimens is to be made (see 6.5.8). The lower confidence limit L shall be not less than 0,75.

This test is not necessary for rainwater pipes marked as such.

5.9 Internal coating

When tested in accordance with 6.6, the coating shall not show any changes which may affect its performance in use.

5.10 Bonding stability of adhesive connections

When tested in accordance with 6.7, fittings with adhesive connections shall be watertight as specified in 5.8.1 and shall not exhibit any changes which may affect their performance in use.

6 Test methods for pipes and fittings

6.1 General

6.1.1 Acceptance tests

Acceptance tests shall be carried out at the manufacturers works on pipes and fittings as delivered whenever possible, or on test specimens cut from the pipes.

NOTE: The manufacturer can carry out the test as part of the routine quality control system at an earlier stage of maturity.

Acceptance tests consist of the following:

- visual inspection of finish and marking;
- geometrical characteristics;
- crushing strength;
- Longitudinal bending.

6.1.2 Type tests

The following type tests shall be carried out on pipes and fittings as delivered unless otherwise specified in the test method:

- frost test;
- warm water test - pipes only;
- thermal stability test;
- resistance to domestic sewage media - pipes only;
- resistance to SO_2 test - pipes only;
- watertightness test;
- test for internal coating;
- bonding stability test.

When type tests are carried out the product shall also be subjected to the acceptance tests to ensure it complies with the requirements of this standard.

6.2 Geometrical characteristics

6.2.1 General

Dimensions shall be subject to the tolerances as detailed in 5.6. Diameters and thickness of wall shall be measured with a minimum accuracy of 0,1 mm, other dimensions shall be measured with a minimum accuracy of 1 mm.

6.2.2 Internal diameter

The internal diameter d_1 shall be measured at all plain ends of pipes or fittings.

Two measurements at 90° to each other shall be carried out. The average of two measurements shall comply with the requirements of 5.6.

6.2.3 External diameter

The external diameter d_3 shall be measured at least at the plain ends of pipes and fittings and at the centre of the pipes. At each place two measurements shall be taken at 90° to each other. Each measurement shall comply with the requirements of 5.6.

6.2.4 Wall thickness

The minimum wall thickness shall be measured at approximately 20 mm from each end. Each measurement shall comply with the requirements of 5.6.1.

6.2.5 Length of pipe

Take the average of two diametrically opposed measurements of the pipe length with an accuracy of 1 mm.

6.3 Straightness of pipes

6.3.1 Test specimen

The test specimen shall be a complete pipe.

6.3.2 Apparatus

The apparatus shall consist of:

6.3.2.1 Two supports, the distance between the centres of which is equal to 2/3 of the total length of the pipe to be checked.

Each support shall be equipped with a roller system which makes it possible to rotate the pipe around its axis without longitudinal or lateral movement.

6.3.2.2 A dial gauge with semi-spherical shaped measuring faces or with rounded tips, accurate to 0,1 mm and fixed on a stable base.

6.3.3 Procedure

Lay the pipe horizontally on the two supports. Place the dial gauge at an equal distance, from the supports, in such a way that the sliding spindle of the gauge is in radial contact with the pipe. Turn the pipe at least one complete rotation. Note the maximum deviation f obtained, round to the nearest millimetre (see Figure 3).

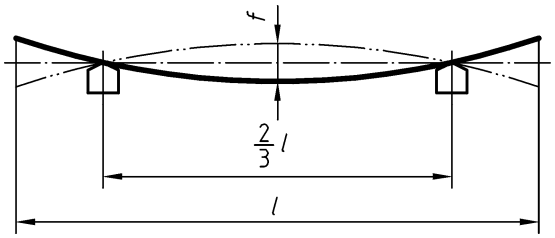


Figure 3 — Arrangement for the straightness test

6.3.4 Expression and interpretation of results

Record the maximum deviation f. The deviation shall not exceed the values of Table 2.

6.4 Mechanical characteristics

6.4.1 Crushing test

6.4.1.1 Test specimen

The test specimen shall be a piece of pipe with a uniform thickness of wall and a length of 200 mm ± 15 mm.

6.4.1.2 Apparatus

The apparatus shall consist of:

6.4.1.2.1 A press with a loading error of ±3 % maximum and a reproducibility error of ±2 % maximum.

6.4.1.2.2 A lower press block formed by a V-shaped support having an included angle of 170° made of metal or hard wood, and a flat upper press block made of the same material. The length of these blocks shall be equal to the length of the specimen (see Figure 4). The width of the upper press block shall be 50 mm.

6.4.1.2.3 Strips of rubber of suitable width and length shall be interposed between the press blocks and the test specimen[1)]. The rubber strips shall have a uniform thickness of 25 mm ± 5 mm and a hardness of 60 ± 5 IRHD.

6.4.1.3 Procedure

Immerse the test specimen in water for 24 h. Measure the length of the test specimen with an accuracy of 1 mm along two diametrically opposed generating lines. Record the average of the two measurements.

[1)] For the purpose of internal quality control the rubber strips may be omitted when the test is also used to determine pipe ring deflection.

Arrange the test specimen centred on the V-shaped support and put the upper press block in contact with it, apply the load uniformly so that the rupture occurs between 15 s and 30 s following application of the load (see Figure 4).

Record the value of ultimate crushing load F and the length l of the test specimen.

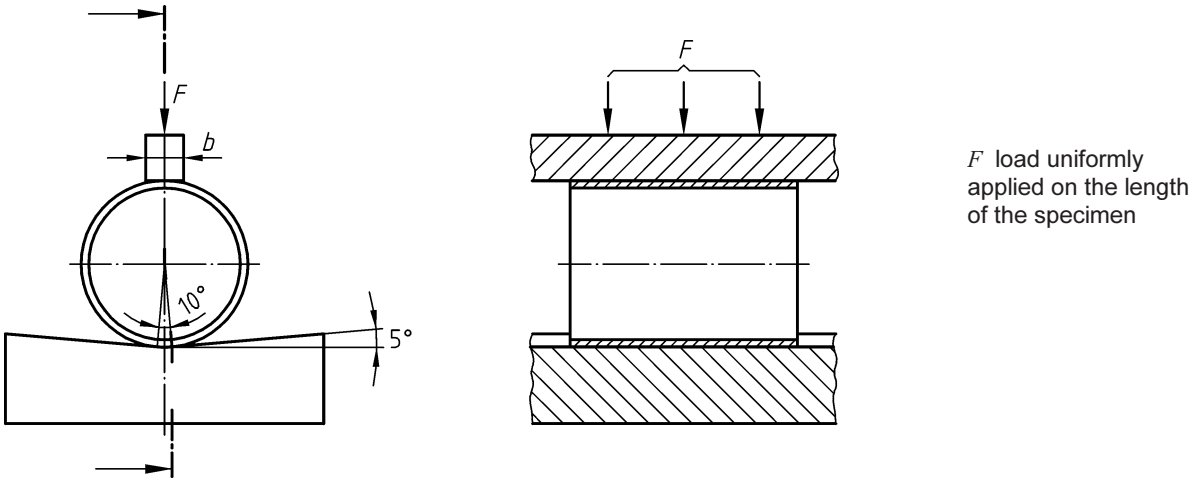


Figure 4 — Arrangement for the crushing test

6.4.1.4 Expression and interpretation of results

Calculate the quotient C_{L}, expressed in kilonewtons per metre:

$$C_{\mathrm{L}} = \frac{F}{l} \qquad (1)$$

where:

F is the ultimate crushing load, expressed in kilonewtons;
l is the effective length of the test specimen, expressed in metres.

The quotient C_{L} shall comply with the specification of 5.7.1.

6.4.2 Bending strength test

6.4.2.1 Test specimen

The test shall be carried out on a pipe or part of a pipe with a length of not more than 1,5 times the distance between the supports (see Figure 5).

6.4.2.2 Apparatus

The apparatus shall consist of:

6.4.2.2.1 A press with a loading error of ±3 % maximum, and a reproducibility error of ±2 % maximum.

6.4.2.2.2 Two metal V-shaped supports having an included angle of 120° presenting a face x, 50 mm to 100 mm wide to the pipe and free to move in the plane of bending on two horizontal axes (see Figure 5), the distance of which corresponds to Table 6.

6.4.2.3 Procedure

Immerse the test specimen in water for at least 24 h.

The load shall be applied vertically at an equal distance from the supports in the plan passing through the axis of the test specimen. It is transmitted by a metal pad having the same shape as the supports, but with a width in accordance with Table 6. Strips of rubber[2)] with a uniform thickness of 15 mm ± 5 mm and a hardness of (60± 5) IRHD shall be interposed between the supports and the test specimen, and between the test specimen and the metal pad.

With the test specimen centred in the testing apparatus, the bending load shall be applied regularly so that the rupture occurs between 15 s and no more than 30 s following the commencement of the application of the load.

Table 6 — Distance y between the supports and width b of the metal pad for the bending strength test

DN	y mm	b mm
50	300	25
60	360	25
70	420	25
80	480	25
100	600	50
125	750	75
150	900	75
NOTE: For longer pipes, the span y may be increased up to a maximum of 2 m. The values given in Table 5 shall be reduced proportionally to the span. In this case the width of the metal pad b can be increased to 100 mm.		

[2)] For the purpose of internal quality control the rubber strips can be omitted when the test is also used to determine pipe bending deflection.

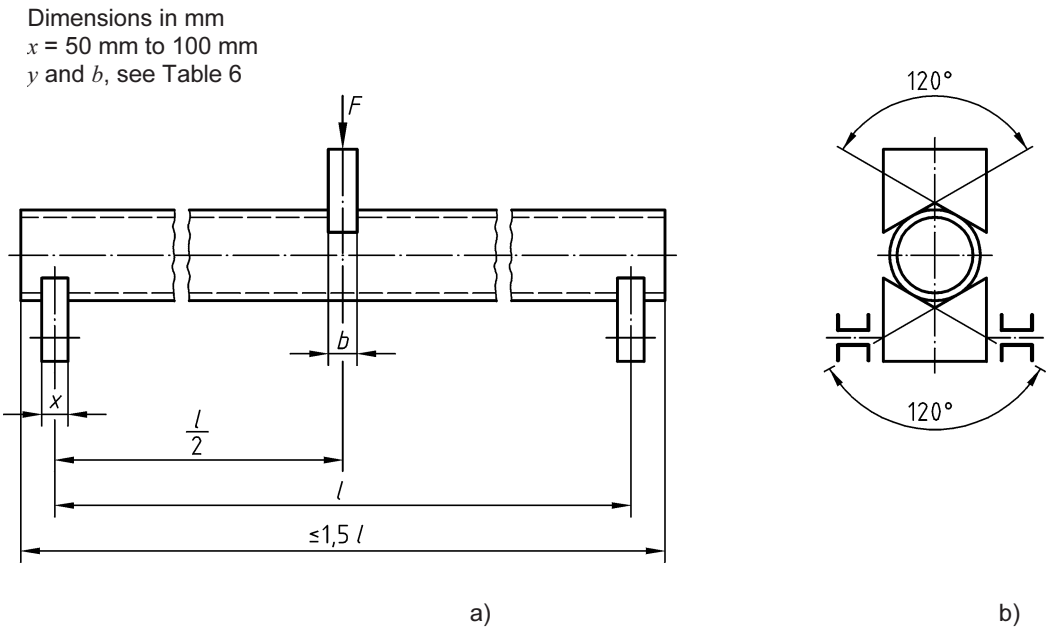


Figure 5 — Arrangement for the bending strength test

6.4.2.4 Expression and interpretation of results

Record the value of the load at rupture, in newtons. The load shall not be less than given in Table 5.

6.5 Physical characteristics

6.5.1 General

Tests for physical characteristics are carried out on pipes and fittings of DN 100 unless otherwise specified in the test methods.

6.5.2 Watertightness test

6.5.2.1 Test specimen

A pipe or a part of a pipe with a minimum length of 500 mm.

Fittings shall be tested completely.

6.5.2.2 Apparatus

The test specimen ends shall be closed with appropriate devices to contain the internal test pressure. The test apparatus shall be capable of applying and maintaining the test pressure over the specified period and restraining the test specimen and closures. No forces shall be induced by the restraints or closures that could affect the test result. The hydrostatic test pressure shall be measured by a pressure gauge calibrated to give a reading accurate to within ±5 kPa or stand pipe.

6.5.2.3 Test procedure

The test specimen shall be immersed in water for at least 24 h.

Put the test specimen in the test arrangement and close the ends.

Fill the test specimen with water and let the air escape.

Subject the test specimen without shock to a constant internal hydrostatic test pressure of 50 kPa (0,5 bar) (related to the highest part of the pipe) for 15 min.

6.5.2.4 Expression of results

Inspect the external surface of the test specimen and record any fissures, leakage or drops of water.

The result shall be compared with the requirements of 5.8.1.

6.5.3 Frost test

6.5.3.1 Preparation of test specimens

Cut five pipe specimens of about 300 mm length or sample five fittings.

Immerse the test specimens in tap water at ambient temperature for 48 h.

6.5.3.2 Apparatus

6.5.3.2.1 A freezer unit having forced air circulation with air temperature control of –20°C ± 2°C and capable of reaching this temperature within 1 h to 2 h with a full load of test specimens.

6.5.3.2.2 A bath filled with water and maintained at 20°C ± 2°C.

6.5.3.3 Test procedure

Subject these test specimens to 25 of the following freeze-thaw cycles:

- cool (freeze) in the freezer which shall reach a temperature of –20°C ± 2°C within 1 h to 2 h and hold at this temperature for a further 1 h;

- heat (thaw) in the water bath which shall reach a temperature of 20°C ± 2°C within 1 h to 2 h and hold at this temperature for a further 1 h.

During both the cooling and heating (freezing and thawing) cycles position the test specimens to enable free circulation of the conducting medium (air in the freezer or water in the bath) around them.

Each freeze/thaw cycle shall take between 4 h and 6 h but an interval of 72 h maximum can be taken between cycles during which the test specimens shall be stored in water at 20°C.

Control of the freeze/thaw cycles can be automatic or manual. Continuous automatic cycling is preferable. For manual control record the completion of each cycle.

6.5.3.4 Expression and interpretation of results

Changes seen by visual inspection shall be recorded and compared with the requirements of 5.8.2.

6.5.4 Warm water test

This test investigates the possible degradation of the products by keeping them in warm water for a protracted period. This test is a comparative one and is only carried out on uncoated pipes.

6.5.4.1 Preparation of specimens

Sample 10 paired test specimens in accordance with 6.5.9.

6.5.4.2 Apparatus

6.5.4.2.1 Water bath capable of temperature control at 60°C ± 2°C;

6.5.4.2.2 A crushing test apparatus as described in 6.4.1.2.

6.5.4.3 Test procedure

Divide the paired test specimens to form two lots of 10 test specimens each.

Submit the first lot of 10 specimens to the crushing test in accordance with 6.4.1.

Immerse the 10 test specimens of the second lot in water at 60°C ± 2°C for 56 days ± 2 days.

At the end of this period the test specimens shall be stored in normal ambient conditions for 7 days.

After this conditioning, carry out the crushing test in accordance with 6.4.1.

6.5.4.4 Expression and interpretation of results (see annex D)

Carry out the statistical comparison as specified in 6.5.8 and 6.5.9. The result shall comply with the specification of 5.8.3.

6.5.5 Thermal stability test

The test simulates stresses caused by flows of water with alternating temperatures and stresses caused by constant flows of hot water.

6.5.5.1 Test specimen

The test specimen shall be a pipe system in accordance with Figure 6.

6.5.5.2 Apparatus

6.5.5.2.1 A solid wall or a suitable rigid frame.

6.5.5.2.2 Equipment for heating and pumping warm water, including temperature and flow control.

6.5.5.3 Test procedure

Fix pipes and fittings to the solid wall or to the frame in accordance with Figure 6 by taking the installation instructions of the pipe manufacturer into account. Submit the system to 300 test cycles with not more than three interruptions.

The alternating test cycles are as follows:

- flow of water: 30 l/min ±1 l/min, 95°C ± 2°C for about 1 min;

- no flow for about 1 min;

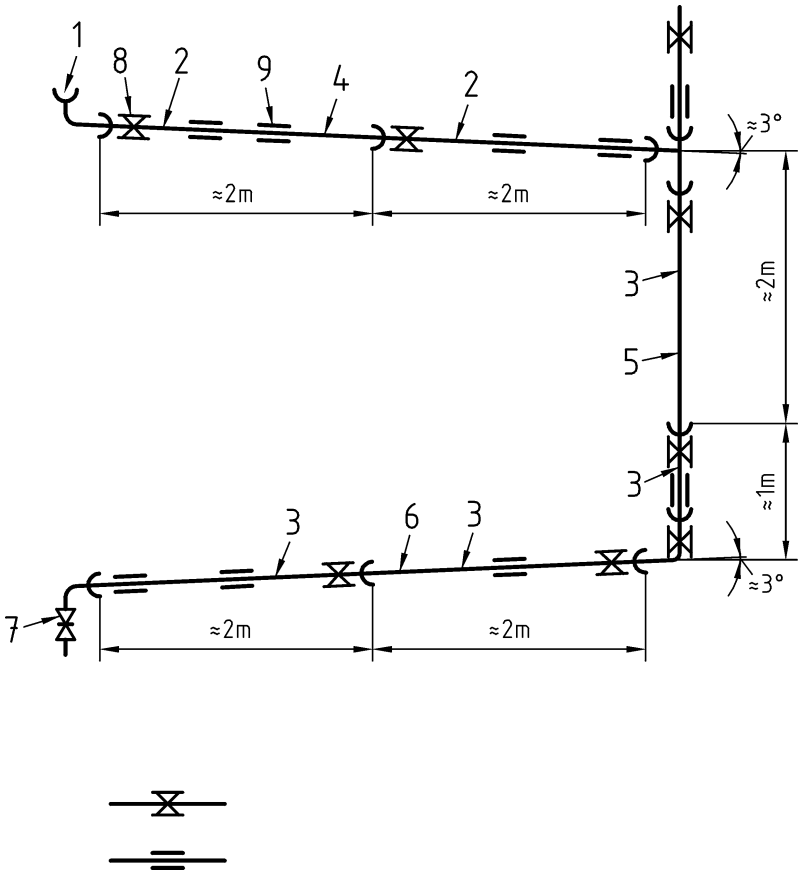
- flow of water: 30 l/min. ±1 l/min., 15°C ± 5°C for about 1 min;

- no flow for about 1 min.

Following the last cycle the test shall be continued with:

- a constant flow of water: 30 l/min ± 1 l/min, 90°C ± 2° C for about 20 h.

Before and after the test, the pipe system shall be filled with water at 10°C to 15°C (tap water). No leakage shall occur within 15 min.



1) Inlet
2) DN I = DN 50 or the smallest DN produced
3) DN II = DN 70 or DN 100
4) Connection pipe
5) Down pipe
6) Header pipe
7) Outlet valve
8) Flexible clamp (according to the installation instructions of the pipe manufacturer)
9) Fixing clamp (according to the installation instructions of the pipe manufacturer)

Figure 6 — Arrangement for the thermal stability test

6.5.5.4 Expression and interpretation of results

Changes seen by visual inspection of watertightness and alterations in the system that may affect the performance in use, shall be recorded and compared with the requirements of 5.8.4.

6.5.6 Resistance to domestic sewage media test

6.5.6.1 Test specimen

Ten paired test specimens of an uncoated pipe shall be sampled in accordance with 6.5.8.

6.5.6.2 Apparatus and reagent

6.5.6.2.1 A bath containing test media as described in Table 7, and maintained at a temperature between 18°C and 28°C.

Table 7 — Test media

Component	Concentration mg/l
Polysaccharide (starch)	50
Sodium stearate	32
Sodium acetate	56
Glycerine triacetate	15
Urea	13
Ammonium sulfate	70
Protein (albumin)	90
NOTE: Industrial purity of components is required.	

6.5.6.2.2 The crushing test apparatus shall be as described in 6.4.1.2.

6.5.6.3 Test procedure

Divide the paired test specimens to form two lots of 10 test specimens each.

Submit the first lot of 10 test specimens to the crushing test in accordance with 6.4.1. At the same time immerse the 10 test specimens of the second lot in the bath containing media as described in Table 7 in accordance with 6.5.6.2.1 at a temperature between 18°C and 28°C for 28 days.

At the end of this period store the test specimens in a normal laboratory ambient atmosphere for 7 days.

Carry out the crushing test in accordance with 6.4.1.

6.5.6.4 Expression and interpretation of results (see annex D)

Carry out the statistical comparison as specified in 6.5.8 and 6.5.9.

The result shall comply with the specifications of 5.8.5.

6.5.7 Resistance to SO_2 test

The resistance to SO_2 shall be proven in a test cycle by alternating storage in a warm SO_2 atmosphere and a laboratory atmosphere.

The SO_2-solution shall be a hydrous solution with 5 % to 6 % SO_2 (mass).

6.5.7.1 Test specimen

Cut 10 paired test specimens with a length of about 200 mm from pipes without any additional coating. The test pieces shall be immersed in water for at least 48 h, before starting the test.

6.5.7.2 Apparatus

A plastic container with SO_2-solution at 40°C and a sealed glass cover.

The container shall be of sufficient size to allow test specimens to be set vertically on end upon a grating clear of the SO_2-solution and enclosed completely.

6.5.7.3 Test procedure

Divide the paired test specimens to form two lots of 10 test specimens each.

Submit the first lot of 10 test specimens to the crushing test in accordance with 6.4.1.

Submit the second lot to five cycles as follows:

- storage for 8 h in a SO_2 atmosphere with a temperature of 40°C ± 2°C;

- storage for 16 h in a laboratory atmosphere.

Following the five cycles the test specimens shall be placed in a normal laboratory atmosphere for 7 days.

Carry out the crushing test in accordance with 6.4.1.

6.5.7.4 Expression and interpretation of results (see annex D)

Carry out the statistical comparison as specified in 6.5.8 and 6.5.9.

The result shall comply with the specification of 5.8.6.

6.5.8 Comparison of test specimens

Comparison of test specimens before and after type testing (applies to 6.5.4 warm water test, 6.5.6 resistance to domestic sewage, 6.5.7 resistance to SO_2).

The criterion for the comparison is the crushing strength. For the test method see 6.4.1.

6.5.9 Sampling of paired test specimens

Paired test specimens shall be adjoining test specimens cut off the same pipe, numbered with 1a/1b, 2a/2b, 3a/3b, and so on. In the example shown in Figure 7 the test specimens with the same number shall be paired test specimens. From each pair take the one with the letter “a” as the paired test specimen and the one with the

letter “b” as the test specimen for one of the tests in accordance with 6.5.4, 6.5.6 and 6.5.7. The required number of paired test specimens for a comparison shall be 10. The length of the test specimens shall be 200 mm.

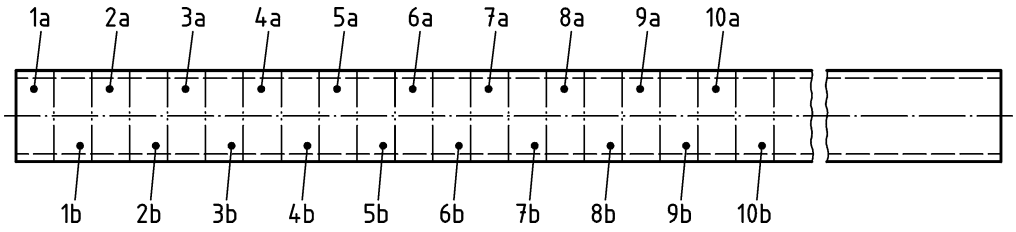


Figure 7 — Paired test specimens

Following the tests 6.5.4, 6.5.6 and 6.5.7 place the test specimens in a normal laboratory atmosphere for 7 days.

Carry out the crushing test in accordance with 6.4.1 including preliminary conditioning.

For each pair of test specimens (i = 1 to 10) calculate the individual ratio r_i:

$$r_i = \frac{t_i}{c_i} \qquad (2)$$

where:

t_i is the crushing strength of the test specimen after the test;
c_i is the crushing strength of the test specimen.

Calculate the average r_m and the standard deviation s of the individual ratio r_i.

Calculate the 95 % lower confidence limit L of the average ratio r_m as follows:

$$L = r_m - 0{,}58 \times s \qquad (3)$$

where:

L is the confidence limit;
r_m is the average ratio;
s is the standard deviation.

6.6 Test for internal coating

6.6.1 Test specimen

Test specimens shall be of a length of about 300 mm or fittings with internal coating, sealed at one end face.

6.6.2 Test procedure

Pipes or fittings shall be sealed at one end and filled with the acid solution (1n-hydrochloric acid and sodium acetate) with a pH-value of 4 ± 0,2.

The test solutions shall have a temperature of 18°C to 28°C.

After about 24 hours the solution shall be poured out and the test specimens shall be filled with water at 90°C ± 2° C for rinsing by constant stirring for about 1 min before emptying.

The test specimens shall be filled with a solution of sodium hydroxide with pH-value of 9,5 ± 0,2.

After about 24 h this solution shall be poured out and each test specimen filled again with water at 90°C ± 2°C for rinsing by constant stirring for about 1 min before emptying.

This cycle shall be repeated 10 times. Three interruptions of up to 72 h between the test cycles shall be allowed during which the test specimens shall be left in a normal laboratory atmosphere.

6.6.3 Expression and interpretation of results

A visual inspection of possible changes shall be made and recorded.

6.7 Bonding stability test of adhesive

6.7.1 Test specimen

The test shall be carried out on four fittings having adhesive connections.

6.7.2 Test procedure

The fittings shall first be stored for 7 days in a controlled atmosphere with an air temperature of 20°C ± 2°C and a relative humidity of 65 % ± 5 %, afterwards their tightness shall be proved in accordance with 6.5.2.

They shall be submitted to 10 cycles as follows:

- 15 h storing at 85 % ± 5 % relative atmospheric humidity and 70°C ± 2°C;

- 9 h storing at 30 % ± 5 % relative atmospheric humidity and 20°C ± 2°C.

Then they shall be subjected to 10 further cycles as follows:

- 15 h storing at 65 % ± 5 % relative atmospheric humidity and at 20°C ± 2°C;

- 9 h storing at –15°C ± 2°C.

Then the test specimens shall be subjected to the watertightness test in accordance with 6.5.2.

6.7.3 Expression of results

Inspect the external surface of the test specimens and record any fissures, leakage or drops of water and changes of the adhesive joint.

7 Joints

All jointing components shall be supplied by the manufacturer of pipes and fittings.

7.1 Requirements

7.1.1 Types of joints

Joints for fibre-cement pipes and fittings in accordance with this standard shall be sleeves or clamps made of stainless steel.

Clamps shall be designed in such a way that parts of their elastomer seals do not protrude into the pipe bore.

NOTE: Other materials can be used, provided the manufacturer specifies the material to be used and, where existing, the relevant European Standard or, in its absence, another appropriate specification, to which this material shall comply.

7.1.2 Materials

7.1.2.1 Sleeves made of fibre-cement

Sleeves made of fibre-cement shall comply with 5.2.

7.1.2.2 Stainless steel for clamps

Stainless steels shall be in accordance with EN 10088-1:1995 and EN 10088:1995 is used. In order to ensure good resistance to corrosion and to intergranular corrosion effects only the following types are permitted:

- austenitic steels: all types;
- ferritic and martensitic steels: X 8 CrTi 17 or
- X 8 CrNb 17

When using other materials, the following requirements shall be met:

– the materials shall comply with the relevant standards;

– the elements shall be suitably coated and withstand a salt spray test of at least 350 h in accordance with ISO 7253, class 3, size 3 and $R_1 \leq 2$ being accepted for possible blistering and rusting in accordance with ISO 4628; and

– the joints shall comply with all requirements given in 7.

7.1.2.3 Fasteners for clamps

Bolts, screws and nuts for clamps made of non-alloyed or low alloyed steel shall comply with the mechanical properties of ISO 898-1/2. Bolts and screws shall be at least of class 8.8 of ISO 898 Part 1, nuts at least of class 8 of ISO 898 Part 2.

Bolts, screws and nuts for clamps made of stainless steel shall comply with the relevant corresponding class of mechanical properties. The pipe manufacturer shall specify the mechanical class and the material of bolts, screws and nuts for clamps. Bolts, screws and nuts made of non-alloyed or low alloyed steel shall be protected against corrosion with a galvanic coating of at least 8 µm. The material of the galvanic coating and the thickness of the coating shall be specified by the pipe manufacturer.

7.1.2.4 Elastomeric seals

The material for elastomeric seals shall comply with EN 681-1:1995 Type WC, WD or WG in accordance with the service conditions.

7.1.3 General appearance and finish

Sleeves and sealing rings shall be free of surface faults that could affect the ease of installation and the watertightness.

7.1.4 Geometrical characteristics

The dimensions and the shape of all parts of the sleeves, clamps and elastomeric rings shall be determined by the manufacturer of the pipes (see figures in annex E).

The tolerance on all relevant dimensions of the sleeves shall be established by the manufacturer taking into account the tolerances on the elastomeric rings and on the external diameters of pipe ends.

Dimensions and tolerances shall allow assembly of the joint without damaging any component, or adversely affecting the efficiency of the joint even under the most unfavourable combination of tolerances.

The sealing rings of assembled joints shall not adversely effect the hydraulic flow by protruding into the pipe bore.

7.1.5 Watertightness

Joints shall be watertight against an internal hydrostatic pressure of 50 kPa.

When tested in accordance with 6.5.2, the joints shall not exhibit fissures, leakage or drops of water.

7.1.6 Air-tightness

To avoid the release of odours, the joints when tested according to 7.2.4 shall be air-tight at a positive internal air pressure of 0 to 10 mbar.

When tested in accordance with 7.2.4, the joints shall not show any leakage of air.

7.2 Tests

7.2.1 General

7.2.1.1 Acceptance tests

Acceptance tests shall be carried out at the manufacturers' works on joints as delivered.

NOTE: The manufacturer can carry out the test as part of the routine quality control system at an earlier stage of maturity.

Acceptance tests consist of the following:

- visual inspection of appearance, finish and marking;

- geometrical characteristics.

7.2.1.2 Type test

The test shall be carried out on joints as delivered. The type test concerns watertightness.

7.2.2 Geometrical characteristics

The internal diameters of sleeves and grooves and the external diameter of sleeves shall be measured in accordance with 6.2. Other dimensions of the cross section of the jointing system that are relevant to jointing integrity and installation shall be measured using an adequate measuring device to an accuracy of 0,1 mm.

Sealing rings, fasteners and clamps shall be measured in accordance with the relevant national standard transposing the European Standard, if existing.

7.2.3 Watertightness

7.2.3.1 General

This test certifies the watertightness of the jointing system when the most extreme combination of pipe, sleeve and sealing ring manufacturing tolerances and adverse site conditions result in the maximum decompression of the sealing rings.

All tests shall be carried out on one joint from each group of DN having the same transverse sealing cross-section and made of the same sealing material.

The tests shall be internal hydrostatic pressure tests.

NOTE: This test can be combined with the watertightness test for pipes (6.5.2).

7.2.3.2 Joint with pipes in straight alignment

7.2.3.2.1 Test specimen

The test specimen is one joint assembled to pipe(s) or piece(s) of pipe(s).

The dimensions of the joint components shall give the minimum sealing ring compression allowed by the manufacturer.

Pipes and joints shall be of the same finish as delivered to the customer.

7.2.3.2.2 Apparatus

For internal pressure test:

7.2.3.2.2.1 An installation capable of receiving the test specimen and withstanding the forces due to internal pressure.

7.2.3.2.2.2 Devices for the evacuation of air and for filling the test specimen with water.

7.2.3.2.2.3 A pressure gauge calibrated to give an accurate reading within 0,01 MPa (0,1 bar).

7.2.3.2.2.4 Pump or similar device to raise the pressure.

7.2.3.2.2.5 A chronometer.

7.2.3.2.3 Procedure

For internal pressure test:

Fill the test specimen with water and expel all air without producing internal overpressure. Apply the following water pressure in test sequences in accordance with Table 8.

Table 8 — Internal pressure test

Test pressure		Duration of test min
kPa	bar	
0 20 50	0,0 0,2 0,5	5 10 15

7.2.3.2.4 Expression and interpretation of results

Inspect the surface of the test specimen.

The joints shall not exhibit any leakage or drops of water.

7.2.3.3 Joint with deflected straight pipe

7.2.3.3.1 Test specimen

In accordance with 7.2.3.2.1.

7.2.3.3.2 Apparatus

In accordance with 7.2.3.2.2.

7.2.3.3.3 Procedure

Deflect one pipe of the joint by moving the free end angularly to the pipe axis for a distance of 30 mm/m.

Carry out the internal pressure tests in accordance with 7.2.3.2.

7.2.3.4 Seals

Elastomeric sealing rings shall be tested in accordance with EN 681-1:1995.

7.2.4 Air tightness

The finished joint shall be exposed to an internal air pressure raising at a pace of 1 mbar up to the final pressure of 10 mbar. The pressure shall be kept in constant way at each pressure step during 1 min. The test is carried out by using a suitable foaming agent, e.g. soap water to detect leakages.

8 Marking

Pipes, joints and fittings complying with the requirements of this standard shall be marked legibly and durably with at least the following information:

a) EN 12763;

b) nominal diameter (DN) (for all);

c) manufacturer's identification (for all);

d) date of manufacture (at least month and year for pipes, at least the year for fittings and joints);

e) marking for rainwater pipes (see 5.8.4, 5.8.5, 5.8.6), where applicable;

f) third party certification, where applicable (see annex C).

9 Quality control

9.1 General

Products manufactured and delivered in accordance with this standard shall be subjected to the following procedures for quality control:

a) the initial control of the products (type testing) (see 9.2);

b) the internal quality control, to be carried out by the manufacturer (see 9.3).

A third party control can be carried out as recommended by annex C (informative).

9.2 Initial control of the products (type testing)

The initial control in accordance with 6 and 7.2 of this standard shall be carried out at the manufacturer's laboratory or by another competent laboratory and may be supervised by an independent testing institute recognized by EU or EFTA. Full reports of these tests shall be recorded and filed. They shall be made available to the third party for examination.

One single type test with positive results will be sufficient, provided no substantial change in the formulation and/or the manufacturing process, the effects of which cannot be predicted on the basis of previous experience, has been made. Otherwise the test shall be repeated.

9.3 Internal quality control carried out by the manufacturer

9.3.1 Quality system

The manufacturer shall establish and maintain an effective documented quality control system so as to achieve compliance with this standard.

The quality control system of the manufacturer shall comply with the transposed national standard for EN ISO 9001 or EN ISO 9002 within 6 years of the publication of this standard.

For factories not yet complying with EN ISO 9001 or EN ISO 9002 the quality organization shall conform at least to the requirements of annex A.

9.3.2 Acceptance tests

Each limit of specification will be subject to an AQL of 4 %. The sampling schemes provided in ISO 390, with an AQL of 4 % and an inspection level S_3, ensures that for large batches approximately 95 % of the items fulfill the requirements.

Once the type test on the joints has been fulfilled (7.2.1.2) conformity of the joint to this standard shall be verified by checking the relevant dimensions of the components of the joints and the conformity of the sealing rings with EN 681-1:1995.

9.3.3 Inspection of a consignment of finished products

Inspection of a consignment of finished products is not a requirement of this standard.

NOTE: If in special cases inspection is still required by the customer it can be carried out in accordance with annex B and ISO 390.

9.4 Third party inspection

If a third party inspection is required, it can be carried out in accordance with annex C (informative).

10 Denomination of products covered by this standard

The denomination of pipes and fittings shall include at least:

- reference to this standard;
- nominal diameter;
- length of pipes in metres;
- type of joint;
- diameters and angles for bends and branches.

11 Requirements for design and installation

The manufacturer has to give instructions for transport, storage, laying and workability on-site.

During design and construction of networks, the national regulations applicable on site regarding fire resistance and noise emissions shall be taken into account. The manufacturer shall give information on possibly required protection measures in his installation instructions.

Annex A (normative)

Quality organization for factories not yet complying with EN ISO 9001 or EN ISO 9002

A.1 General requirements

A.1.1 Personnel, resources and test equipment

The responsibility, authority and the interrelation of all personnel engaged in the inspection and/or tests shall be defined by the manufacturer.

The manufacturer shall provide adequate resources and assign trained personnel for verification activities.

The manufacturer shall control, calibrate and maintain measuring and testing equipment.

A.1.2 Quality records

The manufacturer shall establish and maintain procedures for identification, collection, indexing, filing, storage, maintenance and disposition of quality records.

Quality records shall be maintained to demonstrate achievement of the required quality and the effective operation of the quality system. Relevant sub-contractor quality records shall be an element of this information.

Retention times of quality records shall be at least 5 years.

Quality records shall be presented to the third party inspection on demand.

A.1.3 Statistical methods

The manufacturer shall establish procedures for identifying adequate statistical methods required for verifying the results of the factory quality control (see ISO 2602:1980).

A.2 Quality assurance

A.2.1 General

The manufacturer shall establish and maintain a documented quality system for each production plant as means of ensuring that products conform to requirements specified in this standard.

The quality system consists of an internal quality control and a third party certification.

A.2.2 Internal quality control

For each production plant, the manufacturer shall verify that pipes, joints and fittings conform to the specifications of this standard. The internal quality control includes the control of incoming raw materials, control of production process, control of product characteristics during production and final inspection and testing of finished products.

The requirements for internal quality control and corresponding test methods are given in the three following Tables A.1, A.2 and A.3. The minimum sampling schemes shall be calculated in accordance with ISO 2859-1 for inspection by attribute (double sampling) with an AQL of 4 % and an inspection level S_1 or ISO 3951:1989 for inspection by variable (method σ or s) with an AQL of 4 % and an inspection level S_3. These sampling schemes are given in Table A.4.

Table A.1 — Internal quality control for pipes — Requirements and test methods

	Requirement	Test method
General appearance and finish	5.4	visual inspection
Smoothness of bore	5.5	visual inspection
Wall thicknesses, diameters	5.6.1	6.2.2/6.2.3/6.2.4
Length	5.6.3	6.2.5
Straightness	5.6.4	6.3
Crushing strength	5.7.1	6.4.1
Longitudinal bending strength	5.7.2	6.4.2
Sealing rings	7.2.3.4	—
Marking	8	visual inspection

Table A.2 — Internal quality control for fittings — Requirements and test methods

	Requirement	Test method
General appearance and finish	5.4	visual inspection
Smoothness of bore	5.5	visual inspection
External diameter	5.6.1	6.2.3
Internal diameter*	5.6.1	6.2.2
Thickness of wall	5.6.1	6.2.4
Crushing strength*	5.7.1	6.4.1
Marking	8	visual inspection
*Shall not be tested if the fittings are made of pipes in accordance with this standard.		

Table A.3 — Internal quality control for joints — Requirements and test methods

	Requirement	Test method
General appearance, finish of sleeves	5.1.3	visual inspection
Sealing rings	EN 681-1:1995	EN 681-1:1995
Shape and dimensions of sleeves	7.1.4	7.2.2
Shape and dimensions of sealing rings*	EN 681-1:1995	EN 681-1:1995
Hardness of sealing rings*	7.1.2.4	EN 681-1:1995
Marking of sleeves	8	visual inspection
Marking of sealing rings	EN 681-1:1995	EN 681-1:1995
*Need not be tested if the value has been provided by the supplier of the sealing ring.		

Table A.4— Internal quality control for pipes, joints and fittings — Minimum sampling schemes

Size of batch	ISO 2859-1 Normal inspection Inspection by attribute (AQL 4-Level S_1)				ISO 3951 Normal inspection (AQL 4-Level S_1)	
	Sample size	Initial		Initial + second		Sample size	k
		Ac n_1	Re n_1	Ac n_1	Re n_1		
< 280	2	0	1	NA*	NA	2	0,936
281/500	2	0	1	NA	NA	2	0,936
501/1200	3	0	1	NA	NA	3	1,01
1201/3200	3	0	1	NA	NA	4	1,11
3201/10000	3	0	1	NA	NA	5	1,20
The size of a control batch will be chosen by the manufacturer up to a maximum of a production of one week. * NA = Not applicable							

A.3 Non-conforming products

All non-conforming products shall be segregated and excluded from dispatch, and instructions shall be given for further handling and administration (storage, marking).

If during internal quality control non-conforming products are detected the manufacturer's department for quality assurance shall remedy the failure(s).

Only after investigation, proper correction of the failure(s) and final inspection the quality control department of the manufacturer may agree upon dispatch of production.

Annex B (normative)

Acceptance test[3)] for orders

B.1 When tenders and/or orders specify it, the acceptance test shall be carried out in lot(s) of the consignment in accordance with the test programme of this product standard, unless there is a special agreement. Therefore, the test programme necessarily covers the acceptance tests.

Details related to the application of the sampling clause shall be established in agreement between the manufacturer and the purchaser.

B.2 After agreement on the sampling procedure, sampling shall be carried out, in the presence of both parties, from lot(s) which are to be delivered to the purchaser. If the inspection lot(s) are not yet formed, the manufacturer should present to the purchaser the stock(s) from which the inspection lot(s) can be selected and marked.

B.3 The tests shall be carried out by the laboratory of the manufacturer or by an independent laboratory selected by mutual agreement between the manufacturer and the purchaser. In case of dispute, the tests shall be carried out in the presence of both parties.

B.4 When non-destructive tests are carried out and the result of the sampling inspection do not meet the acceptance test requirements of the product standard, the tests shall be required on each item of the consignment. The units of the consignment which do not meet the requirements when tested one by one can be refused and disposed of, unless otherwise agreed between the manufacturer and purchaser.

3) See ISO 390.

Annex C (informative)

Third party inspection

C.1 General

For each production plant, the manufacturer may establish and maintain a third party inspection, based on a contract between manufacturer and an inspection body.

The third party inspection shall be carried out by an independent certification body, recognized by EU or EFTA.

The purpose of the third party inspection is to carry out an independent quality control on products and to confirm the ability of the manufacturer to produce products which continuously meet the requirements of this standard.

Table C.1 — Third party inspection of pipes, joints and fittings

Test specimen	Attribute	Requirement	Test method
Pipes	Appearance, finish Marking Geometrical characteristics Crushing strength Bending load	5.4 8 5.6 5.7.1 5.7.2	visual inspection visual inspection 6.2 6.4.1 6.4.2
Fittings	Appearance, finish Marking Geometrical characteristics	5.4 8 5.6	visual inspection visual inspection 6.2
Sleeves	Appearance, finish Marking Geometrical characteristics	7.1.3 8 7.1.4	visual inspection visual inspection 7.2.2

C.2 Factories with certification and quality system in accordance with EN ISO 9001 or EN ISO 9002

The inspection by the third party shall be made without previous announcements at least once a year at regular intervals.

The procedure for third party inspection shall consist of:

- controlling the validity of the certification of conformity granted to the manufacturer in accordance with EN ISO 9001 or EN ISO 9002 for his quality system;

- verifying that the results of the internal quality control are in accordance with the requirements of this standard;

- independent routine testing of finished products in accordance with Table C-2.

C.3 Factories without certification and quality system in accordance with EN ISO 9001 or EN ISO 9002

The inspection by the third party shall be made without previous announcements at least four times a year at regular intervals.

The procedure of third party inspection shall consist of:

- assessing the adequacy of staff and equipment for continuous and orderly manufacture;

- verifying that the department responsible for internal quality control is independent of the production department;

- verifying that the type tests have been satisfactorily carried out in accordance with the requirements of this standard;

- verifying that the results of the internal quality control are in accordance with the requirements of this standard;

- independent routine testing of finished products in accordance with Table C.1.

The inspection by the third party may be reduced to two times a year provided that the third party is satisfied that:

- the manufacturer’s internal quality control system is adequate;

- the inspections have been continuously carried out in a proper and effective way for 2 years; and

- the results are in accordance with the requirements of this standard.

This reduced frequency of inspection may remain valid for as long as no defective product is detected.

The third party shall ensure that the manufacturer’s inspections and tests have been carried out in accordance with this standard, and that the results obtained meet the requirements.

C.4 Test report by the third party

After completion of the inspection a test report shall be drawn up by the third party inspector.

The test report shall at least contain the following information:

- name and location of the third party body;
- name and/or identification of manufacturer;
- name and location of plant;
- number and title of this standard;
- description of products tested;
- test results and their evaluation;
- location and date of the test report;
- signature of third party inspector.

It shall further contain:

a) for manufacturers with certification in accordance with EN ISO 9001 or EN ISO 9002 statements regarding:

- the validity of the certificate covering the internal quality control system;
- the conformity of the products;

b) for factories not yet complying with EN ISO 9001 or EN ISO 9002 statements regarding:

- whether the requirements of annex A are fulfilled; and
- the conformity of the products.

C.5 Retesting

If, during the third party inspection, a sample fails, a reinforced inspection in agreement with the third party shall be carried out on the characteristics which have failed; if this reinforced inspection fails, the production related to the failure(s) shall be excluded from shipment pending the outcome of further investigations.

The problem shall be identified and corrective actions shall be taken by the manufacturer in order to eliminate the non-conformity. On request the third party shall be informed of these measures.

Annex D (informative)

Note on statistical method used in some type tests

Warm water test (6.5.4) - Resistance to domestic sewage test (6.5.6).

These tests are carried out on 10 paired specimens. The main cause of difference between the two items of the same pair is the test itself (immersion in warm water, corrosion treatment).

The results of the crushing strength test on the two specimens of the same pair are compared by their ratio. The expression of L stated in the expression of results gives the lower value of the one sided confidence interval of the mean of this ratio (see ISO 2602).

Annex E (informative)

Joints

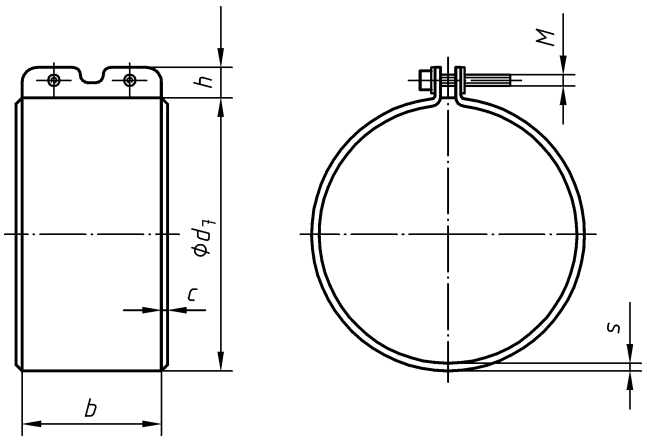


Figure E.1 — Clamp

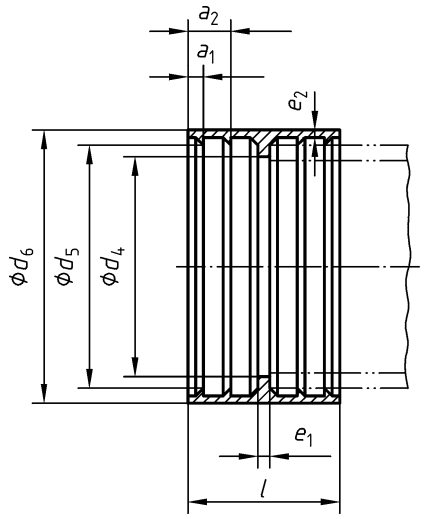


Figure E.2 — Elastomer sealing

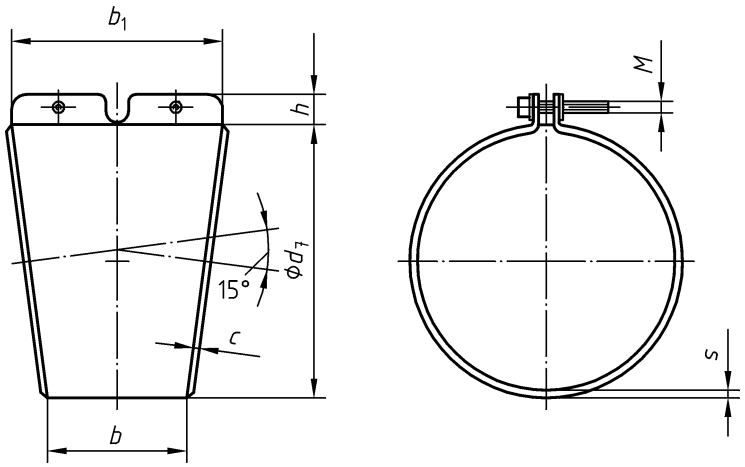


Figure E.3 — Clamp 15°

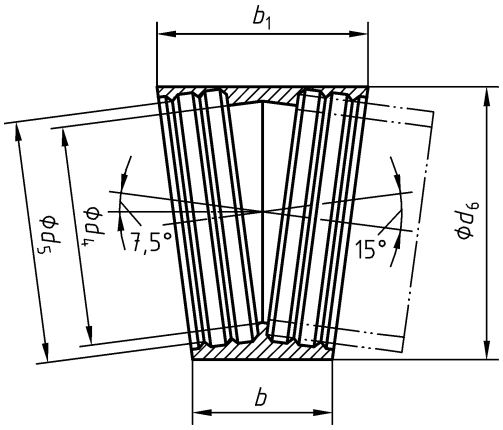


Figure E.4 — Elastomer sealing 15°

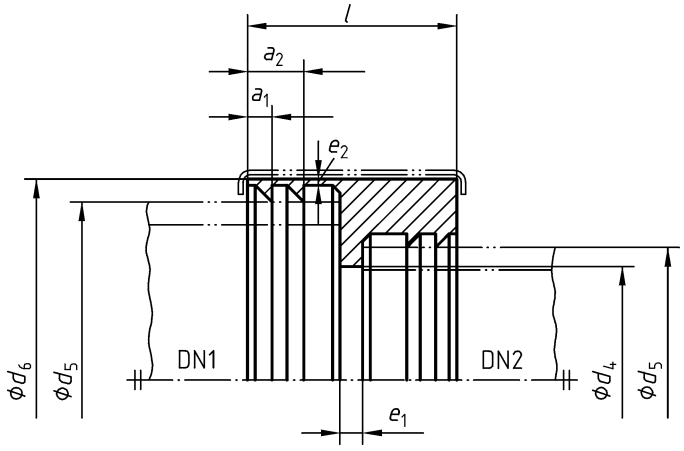


Figure E.5 — Reducing coupling

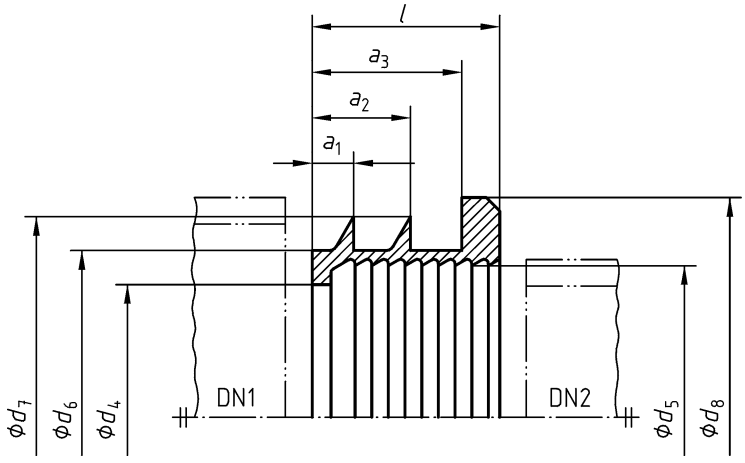


Figure E.6 — Reducing sealing

Bends

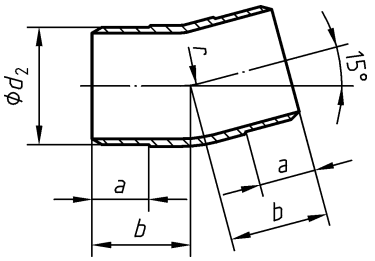


Figure E.7 — Bend 15°

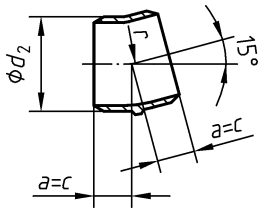


Figure E.8 — Bend 15°, short leg length

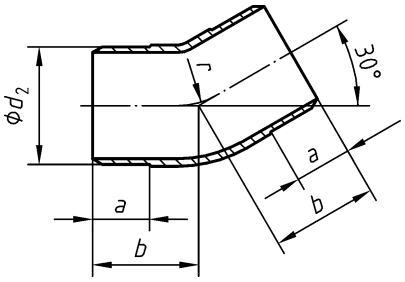


Figure E.9 — Bend 30°

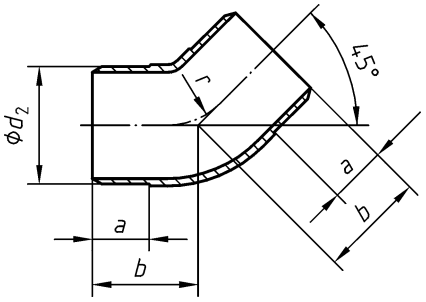


Figure E.10 — Bend 45°

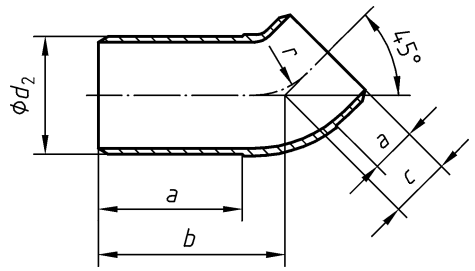


Figure E.11 — Bend 45° with one longer free end

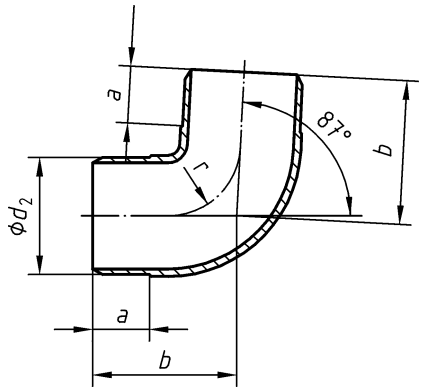


Figure E.12 — Bend 87°

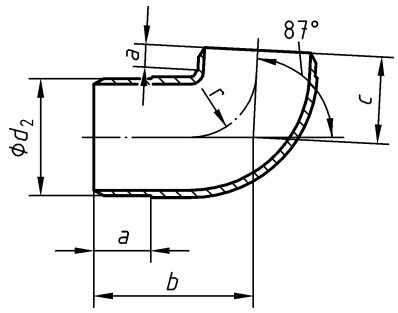


Figure E.13 — Bend 87° with one longer free end

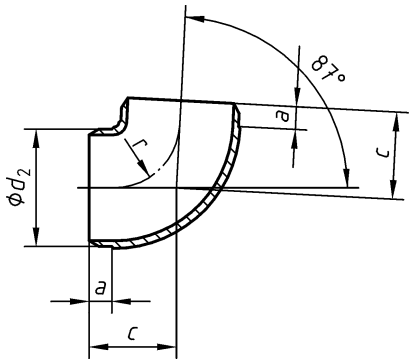


Figure E.14 — Bend 87°, short leg lengths

By-pass bends

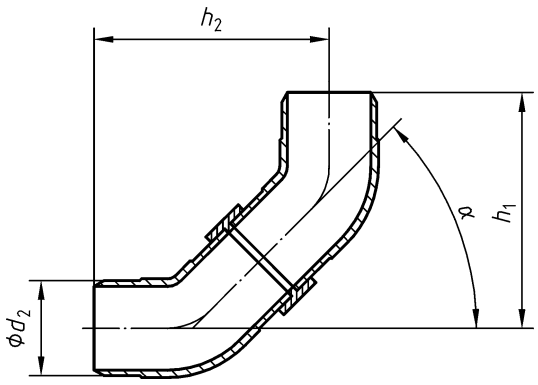


Figure E.15 — By-pass made of bends

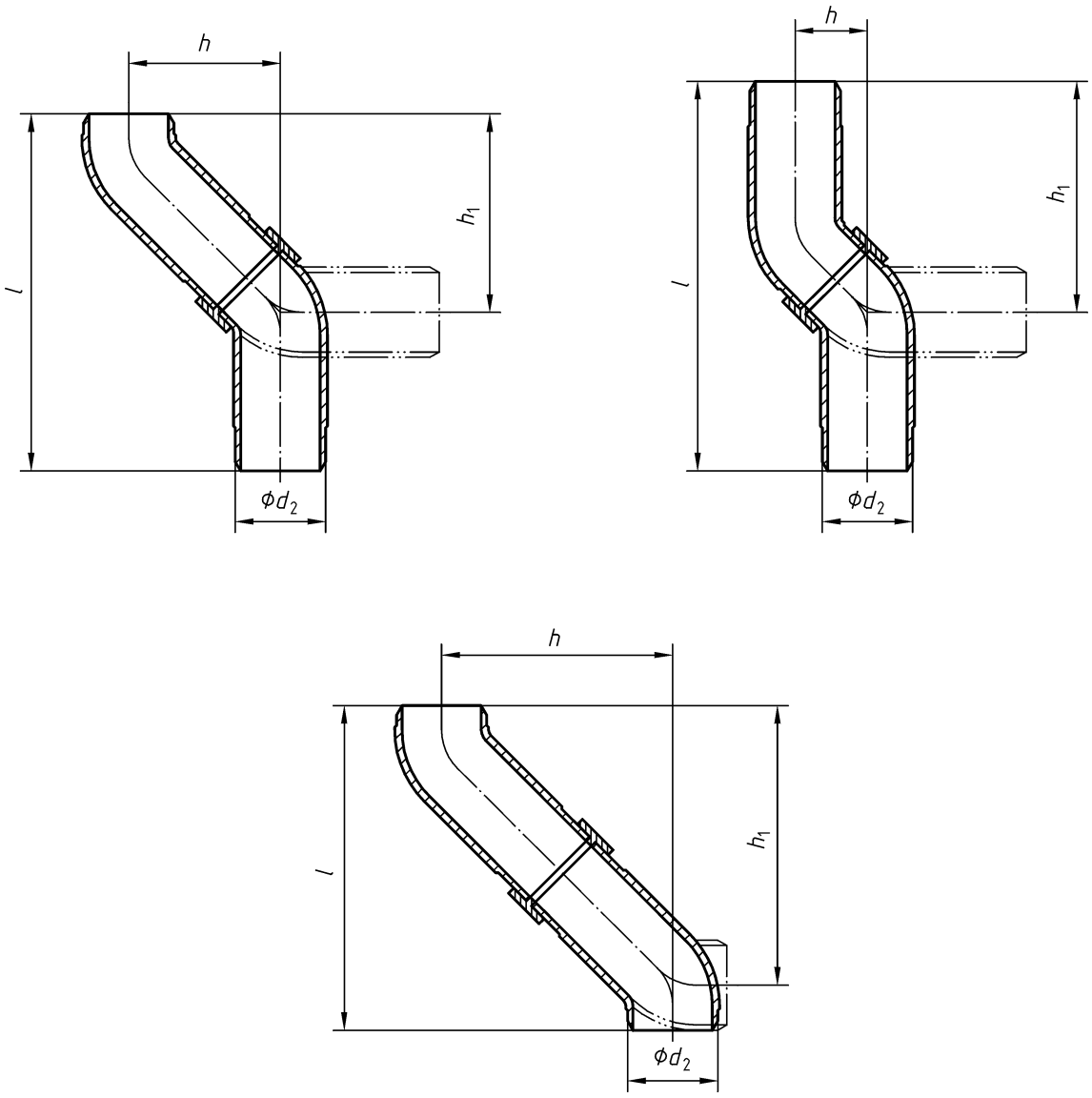


Figure E.16 — By-pass made up of bends

Branches

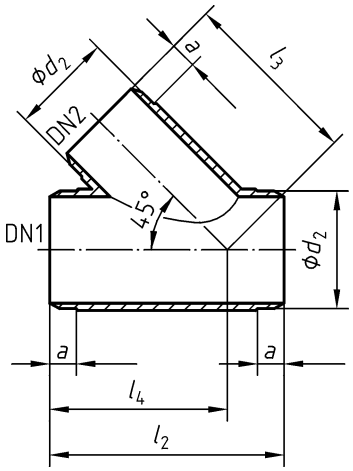


Figure E.17 — Branch 45°

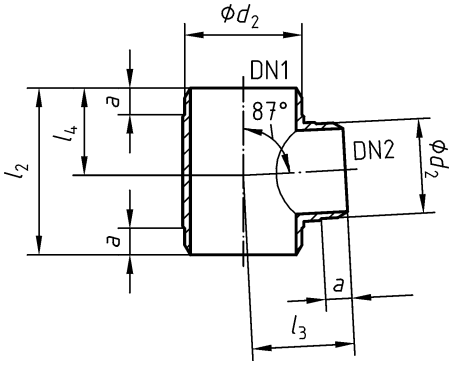


Figure E.18 — Tee 87°

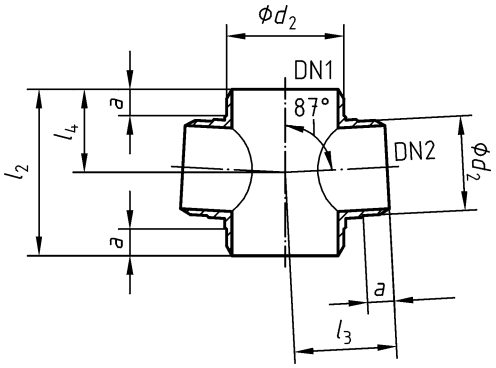


Figure E.19 — Double tee 87°

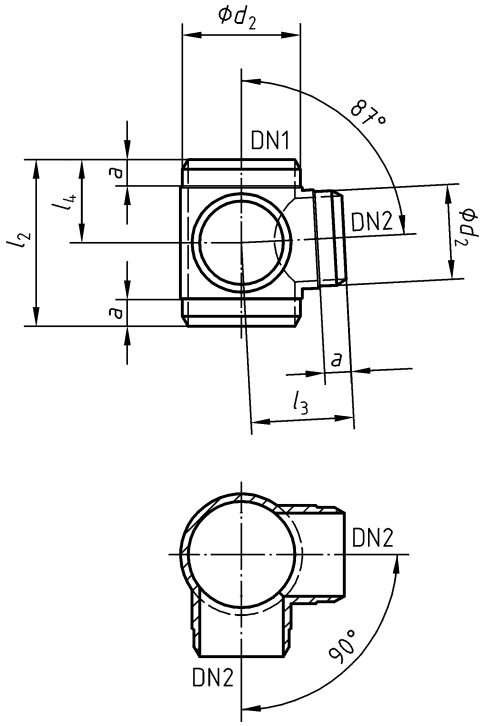


Figure E.20 — Corner tee 87°

Fittings

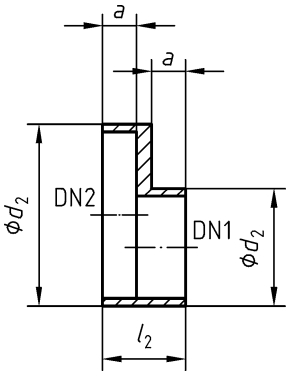


Figure E.21 — Eccentrical reducer

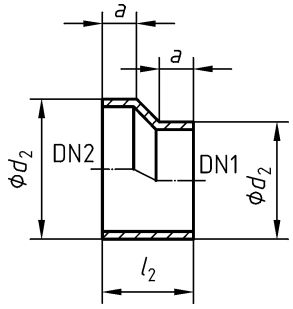


Figure E.22 — Eccentrical reducer

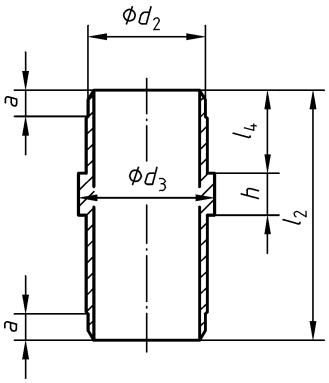


Figure E.23 — Support for down pipes

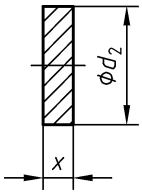


Figure E.24 — Lock piece

Fittings for ventilation ducts

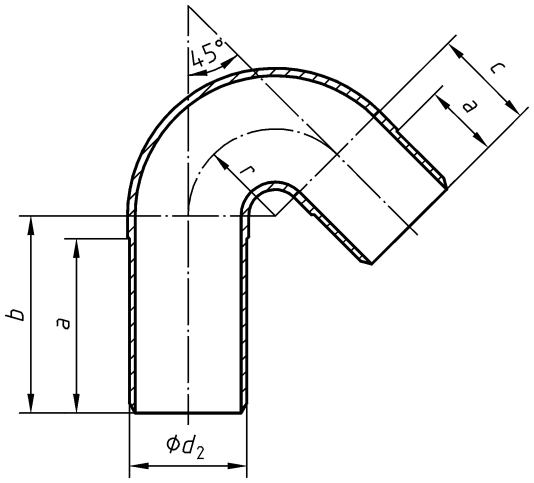


Figure E.25 — By-pass bend

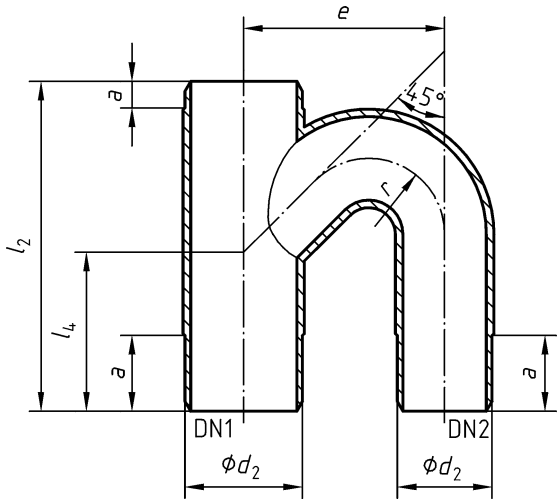


Figure E.26 — By-pass branch

Fittings for connection to WC

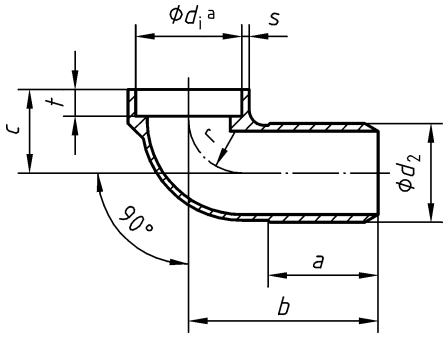


Figure E.27 — Connection bend

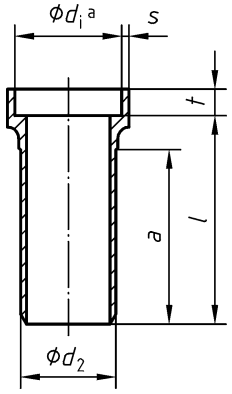


Figure E.28 — Connection pipe

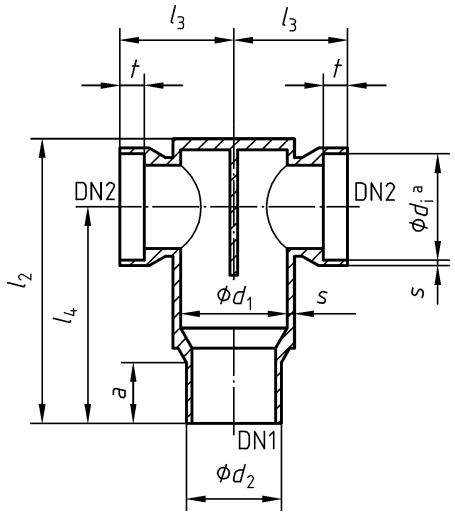


Figure E.29 — Double connection piece

Connections to other pipe materials (cast iron, steel, plastic)

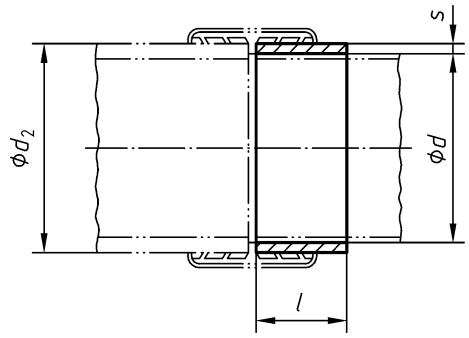


Figure E.30 — Transition sleeve

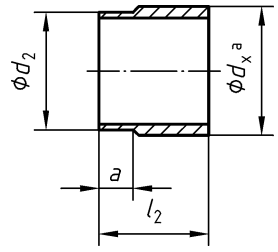


Figure E.31 — Transition pipe for clay socket

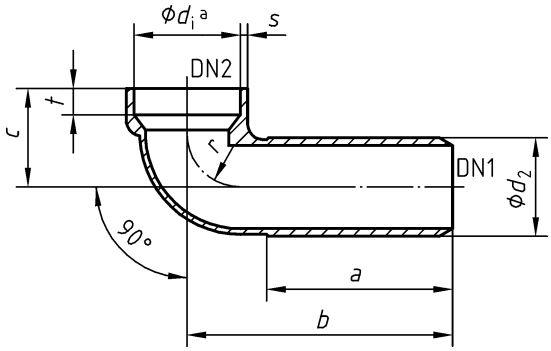


Figure E.32 — Connection bend

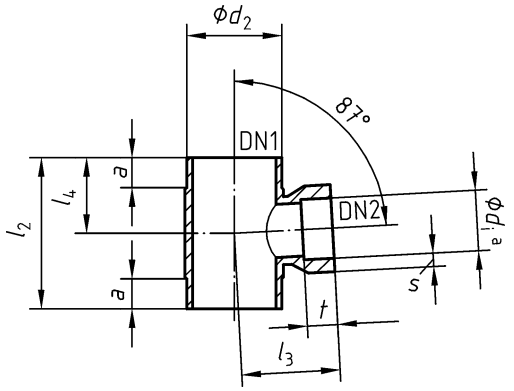


Figure E.33 — Transition branch

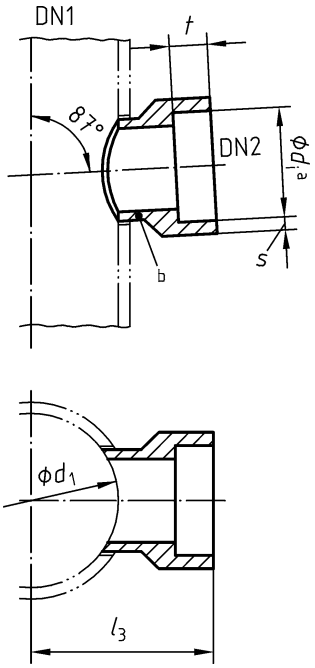


Figure E.34 — Connecting piece for established FC-pipe

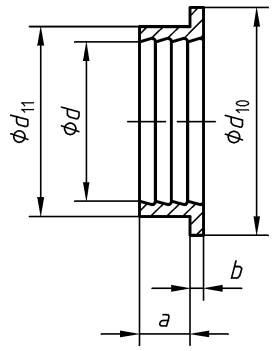


Figure E.35 — Transition gasket

Cleaning pieces

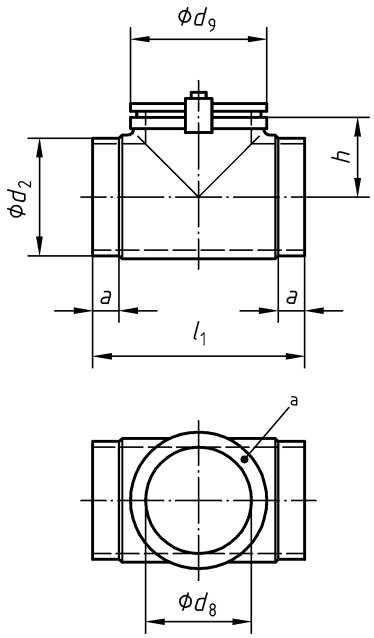


Figure E.36 — Cleaning piece, round opening

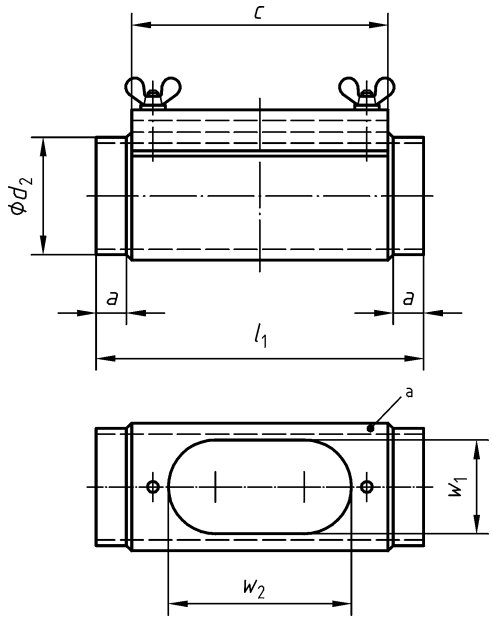


Figure E.37 — Cleaning piece, oval opening

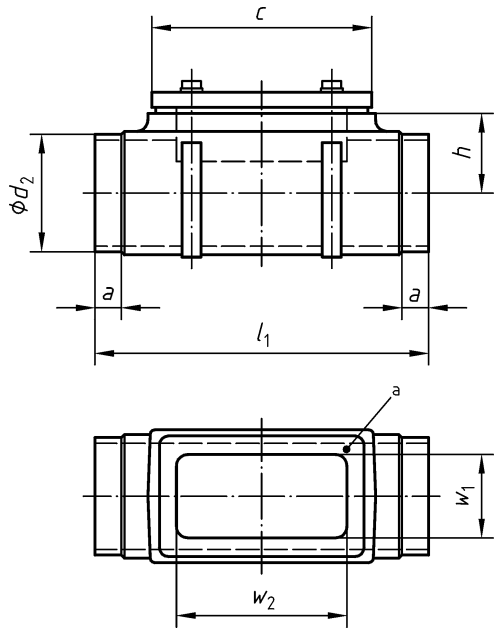


Figure E.38 — Cleaning piece, rectangular opening

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