

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

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ICS 23.040.50; 91.140.80

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 55 and a back cover.

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This British Standard, having been prepared under the direction of the Sector Committee for Building and Civil Engineering, was published under the authority of the Standards Committee and comes into effect on 15 November 2000

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ISBN 0 580 36707 X

Amendments issued since publication

Amd. No.	Date	Comments

ICS

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

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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of an identical text or by endorsement, at the latest by January 2001, and conflicting national standards shall be withdrawn at the latest by January 2001.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	$\pm 2,5$	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.

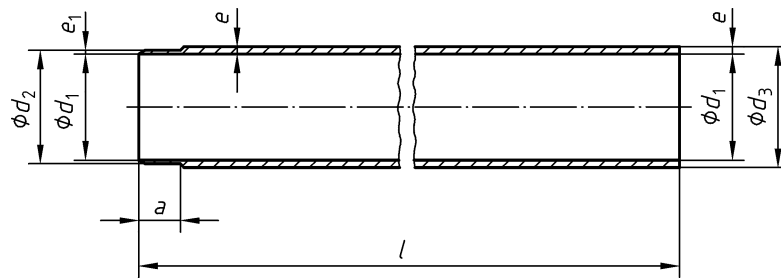


Figure 1 — Pipes, shape of the pipe end and dimensions

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	4,5 l
100 to 150	3,0 l
200 to 300	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 $r = 0,5 \text{ DN}$ except for bends of $\text{DN} > 200$ and angles $> 70^\circ$ where the minimum radius is $r = 0,7 \text{ DN}$ (see Figure 2).

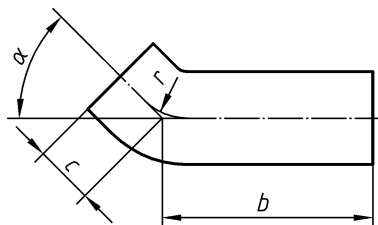


Figure 2 — Bend (example)

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 $DN \leq 150$.

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 SO₂

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 SO₂ 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).

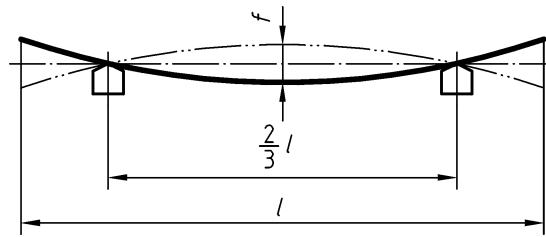


Figure 3 — Arrangement for the straightness test

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 $200 \text{ mm} \pm 15 \text{ mm}$.

6.4.1.2 Apparatus

The apparatus shall consist of:

6.4.1.2.1 A press with a loading error of $\pm 3 \%$ maximum and a reproducibility error of $\pm 2 \%$ 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 specimen¹⁾. The rubber strips shall have a uniform thickness of $25 \text{ mm} \pm 5 \text{ mm}$ and a hardness of $60 \pm 5 \text{ IRHD}$.

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.

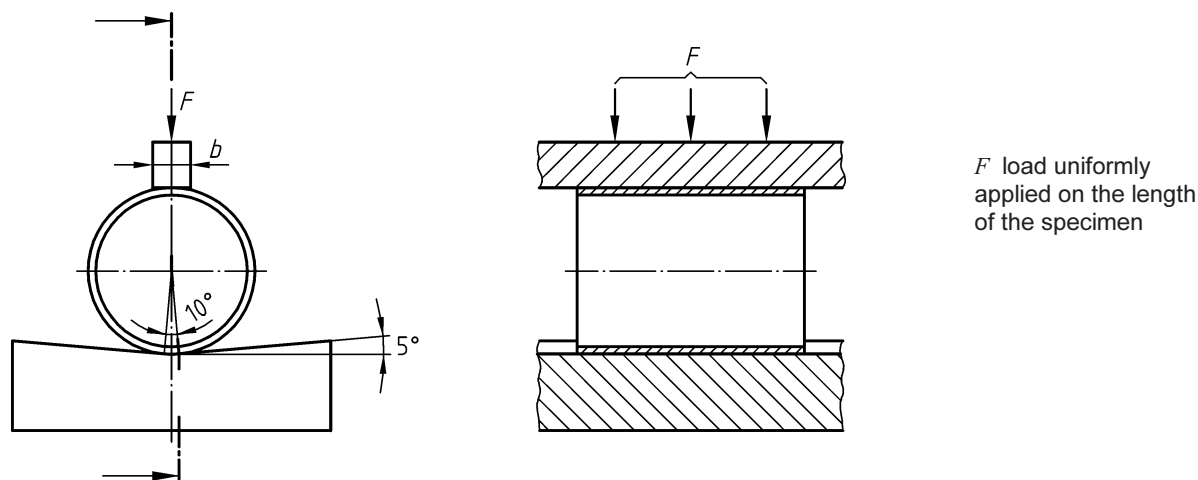


Figure 4 — Arrangement for the crushing test

6.4.1.4 Expression and interpretation of results

Calculate the quotient C_L , expressed in kilonewtons per metre:

$$C_L = \frac{F}{l} \quad (1)$$

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 rubber²⁾ with a uniform thickness of $15 \text{ mm} \pm 5 \text{ mm}$ 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.