

# Fibre cement pipes for drains and sewers —

## Part 2: Manholes and inspection chambers

The European Standard EN 588-2:2001 has the status of a  
British Standard

ICS 13.060.30; 93.030

**NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW**



## National foreword

This British Standard is the official English language version of EN 588-2:2001.

The UK participation in its preparation was entrusted to Technical Committee B/505, Waste water 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.

### Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

This British Standard, having been prepared under the direction of the Building and Civil Engineering Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 3 April 2002

### Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 35 and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

### Amendments issued since publication

Amd. No.	Date	Comments

© BSI 3 April 2002

ISBN 0 580 39454 9

---

EUROPEAN STANDARD

EN 588-2

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 2001

---

ICS 13.060.30; 93.030

English version

## Fibre cement pipes for drains and sewers - Part 2: Manholes and inspection chambers

Tuyaux en fibres-ciment pour réseaux d'assainissement et  
branchements - Partie 2: Regards et boîtes de  
branchements

Faserzementrohre für Abwasserkanäle und  
Abwasserleitungen - Teil 2: Einsteig- und Kontrollschächte

This European Standard was approved by CEN on 17 February 2001.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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

Management Centre: rue de Stassart, 36 B-1050 Brussels

---

© 2001 CEN All rights of exploitation in any form and by any means reserved  
worldwide for CEN national Members.

Ref. No. EN 588-2:2001 E

## Contents

	page
<b>1</b>	<b>Scope</b> ..... 5
<b>2</b>	<b>Normative references</b> ..... 5
<b>3</b>	<b>Terms and definitions</b> ..... 5
<b>4</b>	<b>Symbols and abbreviations</b> ..... 5
<b>5</b>	<b>Description and requirements for components</b> ..... 6
<b>5.1</b>	<b>Manholes with access for inspection by personnel</b> ..... 6
<b>5.2</b>	<b>Manholes with access for cleaning and inspection</b> ..... 6
<b>5.3</b>	<b>Inspection chambers</b> ..... 6
<b>5.4</b>	<b>Prefabricated elements</b> ..... 12
<b>5.4.1</b>	<b>Base element (see key 4)</b> ..... 12
<b>5.4.2</b>	<b>Saddle element (see key 7)</b> ..... 12
<b>5.4.3</b>	<b>Shaft (see key 6)</b> ..... 12
<b>5.4.4</b>	<b>Connecting ring (see key 8)</b> ..... 12
<b>5.4.5</b>	<b>Reducer-slab (see key 9)</b> ..... 12
<b>5.4.6</b>	<b>Capping structure (see key 12, 13, 14 and 15)</b> ..... 12
<b>5.4.7</b>	<b>Connection to sewer network (see key 5)</b> ..... 12
<b>5.5</b>	<b>Prefabricated complete manhole or inspection chamber (see Figures 1 and 2)</b> ..... 12
<b>6</b>	<b>Requirements</b> ..... 13
<b>6.1</b>	<b>General</b> ..... 13
<b>6.2</b>	<b>General composition</b> ..... 13
<b>6.3</b>	<b>General appearance and finish</b> ..... 13
<b>6.4</b>	<b>Geometrical characteristics</b> ..... 13
<b>6.4.1</b>	<b>Nominal diameter</b> ..... 13
<b>6.4.2</b>	<b>Wall thickness</b> ..... 14
<b>6.4.3</b>	<b>Height</b> ..... 14
<b>6.4.4</b>	<b>Angles between axes of connections to sewers</b> ..... 14
<b>6.4.5</b>	<b>Location for steps or fixed ladders</b> ..... 15
<b>6.4.6</b>	<b>Interchangeability</b> ..... 15
<b>6.4.7</b>	<b>Limit deviations</b> ..... 15
<b>6.5</b>	<b>Mechanical characteristics</b> ..... 17
<b>6.5.1</b>	<b>Crushing loads for pipes for base elements and shafts</b> ..... 17
<b>6.5.2</b>	<b>Stability of connections to sewer network</b> ..... 17
<b>6.5.3</b>	<b>Bonding stability</b> ..... 17
<b>6.5.4</b>	<b>Watertightness</b> ..... 17
<b>6.5.5</b>	<b>Access steps</b> ..... 18
<b>6.6</b>	<b>Hydraulic design</b> ..... 18
<b>6.7</b>	<b>Resistance to domestic sewage media</b> ..... 18
<b>6.8</b>	<b>Jointing of elements</b> ..... 18
<b>6.9</b>	<b>Assembly of prefabricated elements on-site</b> ..... 18
<b>6.10</b>	<b>Connections to sewers</b> ..... 18
<b>7</b>	<b>Test methods</b> ..... 19
<b>7.1</b>	<b>General</b> ..... 19
<b>7.1.1</b>	<b>Acceptance tests</b> ..... 19
<b>7.1.2</b>	<b>Type tests</b> ..... 19
<b>7.2</b>	<b>Geometrical characteristics of prefabricated elements</b> ..... 19
<b>7.2.1</b>	<b>Internal diameter</b> ..... 19
<b>7.2.2</b>	<b>Wall thickness</b> ..... 19
<b>7.2.3</b>	<b>Height</b> ..... 20
<b>7.2.4</b>	<b>Angles between the axis of connections</b> ..... 20
<b>7.2.5</b>	<b>Perpendicularity of end faces</b> ..... 20
<b>7.3</b>	<b>Mechanical characteristics</b> ..... 20

7.3.1	Crushing loads for pipes to be used for base elements and shafts .....	20
7.3.2	Stability of connections to sewer network.....	20
7.3.3	Watertightness test.....	21
8	Marking .....	21
9	Conformity Evaluation.....	22
9.1	General Requirements.....	22
9.2	Initial control of the products (type testing) .....	22
9.3	Factory production control (internal quality control) .....	22
9.3.1	Quality control system .....	22
9.3.2	Acceptance tests .....	22
9.3.3	Inspection of a consignment of finished products .....	22
9.4	Third party inspection .....	23
Annex A	(normative) Quality organization for factories not complying with EN ISO 9001 .....	24
A.1	General requirements.....	24
A.1.1	Personnel, resources and test equipment .....	24
A.1.2	Quality records.....	24
A.1.3	Statistical methods .....	24
A.2	Sampling procedures .....	24
A.3	Non-conforming products .....	25
Annex B	(normative) Acceptance test for products which are not subject to third party certification .....	26
Annex C	(informative) Third party inspection .....	27
C.1	General.....	27
C.2	Factories with certification and quality system according to EN ISO 9001 or equivalent .....	27
C.3	Factories without certification and quality system according to EN ISO 9001 or equivalent. ....	27
C.4	Test report by the third party.....	28
C.5	Retesting.....	29
Annex D	(informative) Design requirements .....	30
D.1	Stability .....	30
D.2	Connections to sewers.....	30
Annex ZA	(informative) Clauses of this European standard addressing the provisions of the EU Construction Products Directive.....	31
ZA.1	Scope and relevant characteristics .....	31
ZA.2	Procedure(s) for the attestation of conformity of manholes and inspection chambers .....	32
ZA.2.1	Systems of attestation of conformity .....	32
ZA.2.2	Certificate and Declaration of conformity .....	33
ZA.3	CE Marking .....	33
Bibliography	.....	35

## Foreword

This European Standard has been prepared by Technical Committee CEN /TC 165, "Wastewater engineering", the secretariat of which is held by DIN.

This document 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).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

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 June 2002, and conflicting national standards shall be withdrawn at the latest by September 2003.

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.

A distinction has been made between initial testing (type tests) and routine quality control requirements (acceptance tests).

Attention is drawn to the need for observance of EEC and/or EFTA and national legal requirements restricting the use of certain materials and to the related marking and labelling requirements.

The performance of a sewage 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.

## 1 Scope

This Standard gives specifications for asbestos free fibre-cement manholes and inspection chambers for use in buried drains and sewers with gravity flow at atmospheric pressure.

Products covered by this standard include prefabricated elements in as well as prefabricated complete manholes and inspection chambers.

It specifies definitions, descriptions, composition, general appearance and finish, geometrical characteristics, mechanical characteristics, acceptance tests, type tests and quality control requirements.

NOTE Complete manholes or prefabricated elements may also be used for other purposes such as pumping stations, items of drainage, items for sewage treatment or sewage disposal, when corresponding additional requirements according to the relevant European Standards are fulfilled.

## 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).

EN 124:1994 , *Gully tops and manhole tops for vehicular and pedestrian areas - Design requirements, type testing, marking, quality control.*

EN 197-1:2000, *Cement - Part 1: Composition, specifications and conformity criteria for common cements.*

EN 476:1997, *General Requirements for Components used in Discharge Pipes, Drains and Sewers for Gravity System.*

EN 588-1:1996, *Fibre-cement pipes for sewers and drains - Part 1: Pipes, joints and fittings for gravity systems.*

EN 681-1:1996, *Elastomeric seals – Material requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanized rubber (modified by 681-1/A1 of June 1998).*

prEN 1917:1995, *Concrete manholes and inspection chambers, unreinforced, steel fibre and reinforced.*

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

## 3 Terms and definitions

For the purposes of this European Standard, the definitions given in EN 588-1:1996 apply:

## 4 Symbols and abbreviations

DN	nominal diameter of shaft or base element
$d_1$	internal diameter of shaft or base element
$e$	wall thickness of base element or shaft
$h$	height, invert to ground level
$h_a$	effective height of reducer-slab

## EN 588-2:2001 (E)

$h_c$	effective height of connecting ring
$h_{co}$	effective height of cone section
$h_{cs}$	effective height of cover slab
$h_g$	height to channel
$h_{r1}$	height of base element
$h_{r2}, h_{r3}$ , etc.	height of shaft
$h_{up}$	height of saddle element
$\rho_{max}$	perpendicularity deviation

## 5 Description and requirements for components

### 5.1 Manholes with access for inspection by personnel

Manholes with access for personnel shall be suitable for all maintenance work on the system.

The nominal size shall be DN 1 000 or greater.

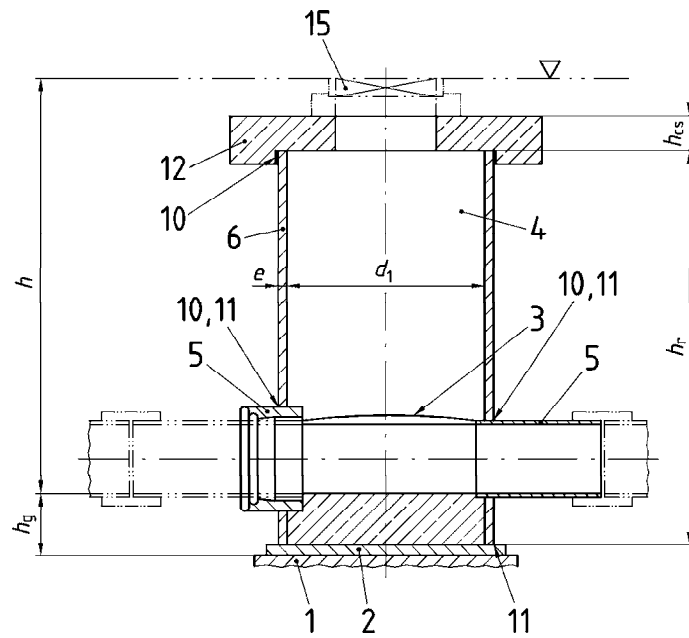
### 5.2 Manholes with access for cleaning and inspection

Manholes for the introduction of cleaning equipment, inspection and test equipment shall allow occasional access for a man equipped with a harness. The nominal size shall be DN 800 or DN 900.

### 5.3 Inspection chambers

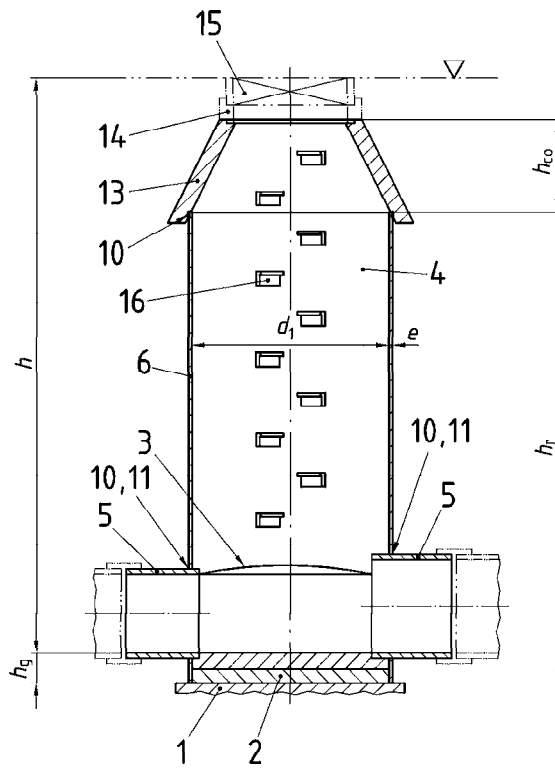
Inspection chambers having a nominal diameter less than DN 800 shall allow the introduction of cleaning, inspection and test equipment but do not provide access for personnel (see Figure 1 as example).



**Key**

- |   |                      |    |                 |
|---|----------------------|----|-----------------|
| 1 | base slab            | 6  | shaft           |
| 2 | channel              | 10 | sealant         |
| 3 | benching and channel | 11 | joining element |
| 4 | base/chamber element | 12 | cover slab      |
| 5 | connection to sewer  | 15 | manhole cover   |

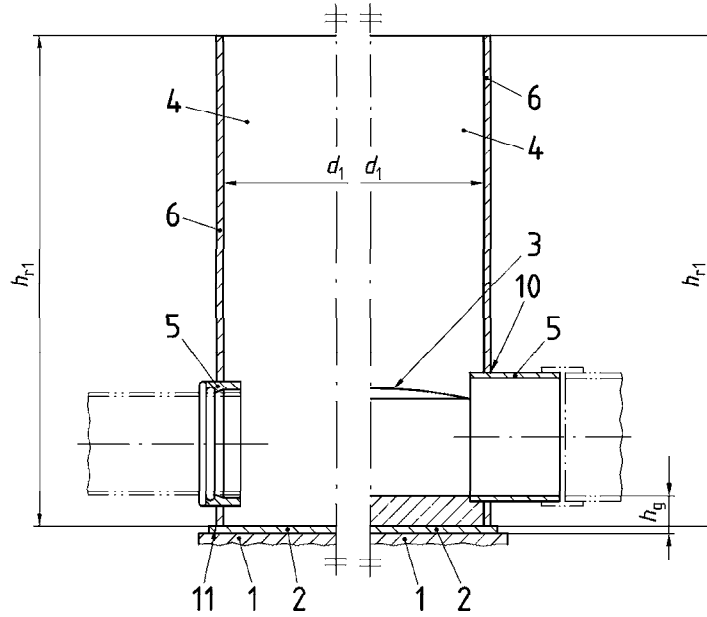
**Figure 1 — Inspection chambers**



**Key**

- |   |                      |    |                 |
|---|----------------------|----|-----------------|
| 1 | base slab            | 10 | sealant         |
| 2 | channel              | 11 | joining element |
| 3 | benching and channel | 13 | eccentric cone  |
| 4 | base/chamber element | 14 | levelling ring  |
| 5 | connection to sewer  | 15 | manhole cover   |
| 6 | shaft                | 16 | step            |

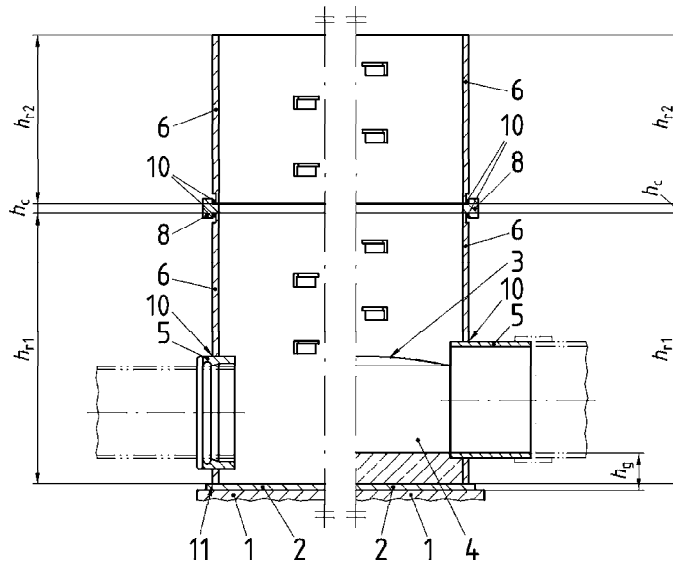
**Figure 2 — Prefabricated complete manhole**



**Key**

- |   |                      |    |                  |
|---|----------------------|----|------------------|
| 1 | base slab            | 6  | shaft            |
| 2 | channel              | 10 | sealant          |
| 4 | base/chamber element | 11 | jointing element |
| 5 | connection to sewer  |    |                  |

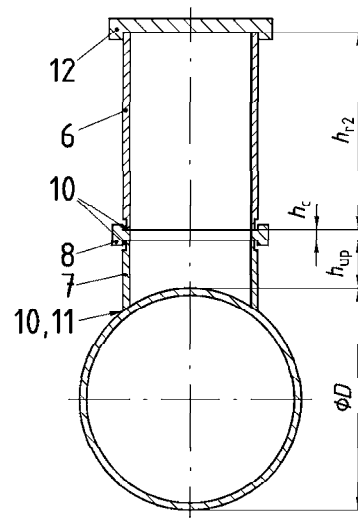
**Figure 3 — Prefabricated base element**



**Key**

- |   |                      |    |                  |
|---|----------------------|----|------------------|
| 1 | base slab            | 6  | shaft            |
| 2 | channel              | 8  | connecting ring  |
| 3 | benching and channel | 10 | sealant          |
| 4 | base/chamber element | 11 | jointing element |
| 5 | connection to sewer  |    |                  |

**Figure 4 — Prefabricated base element and shaft**



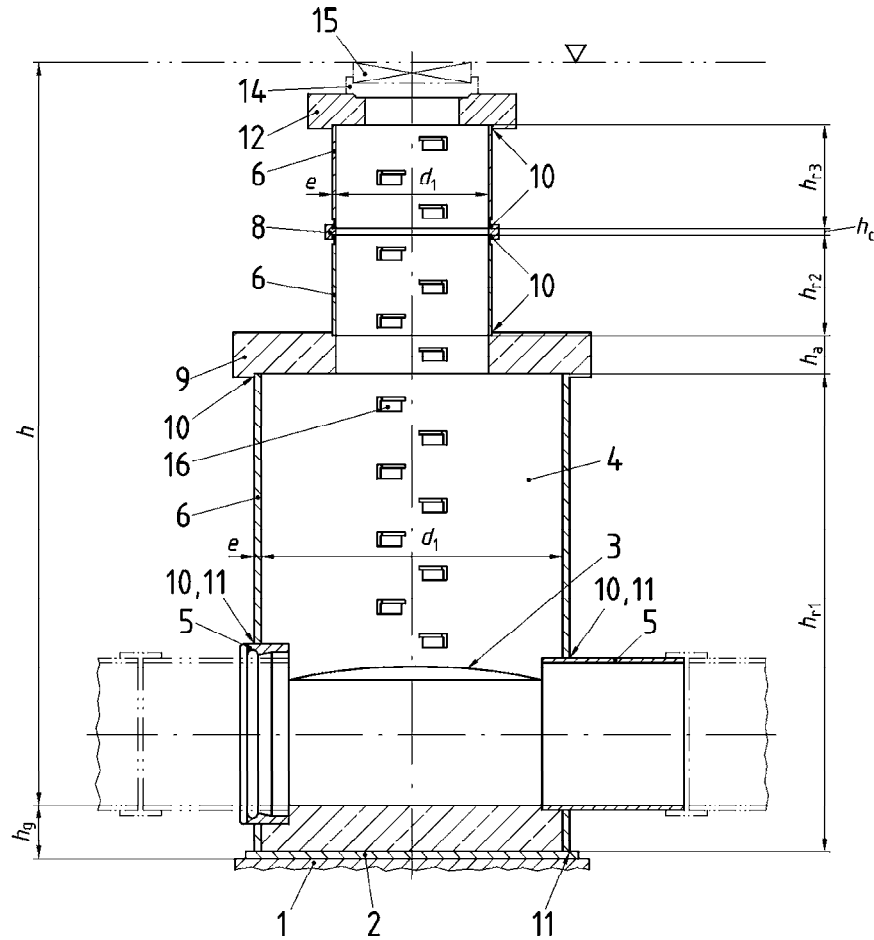
**Key**

- |   |                 |    |                  |
|---|-----------------|----|------------------|
| 6 | shaft           | 10 | sealant          |
| 7 | saddle element  | 11 | jointing element |
| 8 | connecting ring | 12 | corer slab       |

**Figure 5 — Prefabricated saddle element<sup>1)</sup>**

---

1) Figure 5 shows a centric saddle manhole, Eccentric access shafts are also possible

**Key**

- |                        |                     |
|------------------------|---------------------|
| 1 base slab            | 9 reducer-slab      |
| 2 channel              | 10 sealant          |
| 3 benching and channel | 11 jointing element |
| 4 base/chamber element | 12 cover slab       |
| 5 connection to sewer  | 14 levelling ring   |
| 6 shaft                | 15 manhole cover    |
| 8 connecting ring      |                     |

**Figure 6 — Manhole with reduced shaft diameter**

## 5.4 Prefabricated elements

### 5.4.1 Base element (see key 4)

A base element shall consist of a fibre-cement pipe fitted with a bottom blanking slab made of fibre-cement or concrete and/or a concrete benching plug, the pipe shall have one or more connections to the sewer network.

The base element can be connected to a shaft or directly to the capping structure.

The base element can be equipped with a channel and/or steps in the factory.

### 5.4.2 Saddle element (see key 7)

Fibre-cement pipe which is worked on in accordance with the outside diameter of fibre cement sewer and connects a fibre-cement sewer with a shaft or a covering slab (or a taper shaft ring).

### 5.4.3 Shaft (see key 6)

Fibre-cement pipe which shall ensure the connection of the base element to a covering slab or taper shaft ring or to another shaft.

The shaft can be equipped with connections to the sewer network and/or with access steps.

### 5.4.4 Connecting ring (see key 8)

The fibre-cement connecting ring joints the base element to shaft or shafts to each other and shall secure the connected elements against horizontal displacement.

### 5.4.5 Reducer-slab (see key 9)

The reducer slab made from reinforced concrete shall allow the connection of two shafts of different nominal sizes and shall secure the connected elements against horizontal displacement.

### 5.4.6 Capping structure (see key 12, 13, 14 and 15)

The capping structure shall be composed of:

- a manhole cover, conforming to EN 124:1994;
- a taper shaft ring or a covering slab in concrete conforming to prEN 1917:1995, compatible with the shaft and secured against horizontal displacement;
- concrete levelling rings, compatible with the cone or the covering slab and with the manhole cover and secured against horizontal displacement.

### 5.4.7 Connection to sewer network (see key 5)

Short length of pipe or joint, conforming to EN 588-1:1996, which is fixed into the base element or the shaft. The length of the short pipe shall be compatible with the length of the coupling and shall conform to the requirements of the stability test according to 7.3.2.

## 5.5 Prefabricated complete manhole or inspection chamber (see Figures 1 and 2)

Prefabricated manhole or inspection chambers shall be constructed with all required components to be ready for fitting into the sewage system. Jointing material shall be supplied by the manufacturer of prefabricated manholes or inspection chambers.

## 6 Requirements

### 6.1 General

Figures 1 to 4 show possible construction examples in which fibre-cement components could be included in manholes and inspection chambers.

Fibre-cement components according to this standard shall conform to the requirements of EN 588-1.

### 6.2 General composition

Fibre-cement components 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 specification of the cement shall be included in the manufacturer's production control documentation. The manufacturer shall specify the cement and have data on its suitability. This suitability may be demonstrated by using cement conforming to EN 197-1:2000 or at least other applicable specifications.

### 6.3 General appearance and finish

All components shall be free of visible defects that may adversely affect the performance in use.

The end faces of vertical parts of base elements and shafts shall be flat and even.

To meet special working conditions components may be suitably impregnated and/or coated internally and/or externally.

### 6.4 Geometrical characteristics

#### 6.4.1 Nominal diameter

The nominal diameter DN (see 3.1 of EN 588-1:1996) of a manhole or inspection chamber corresponds to the internal diameter  $d_1$  (see Figures 1 to 6), limit deviations excluded. The nominal diameter shall be:

- for manholes with access for inspection by personnel:  $DN \geq 1\ 000$  (see Table 1). For manholes of great depth the nominal diameter of the shaft may be smaller than that of the base element (see Figure 6 and EN 476:1997);
- for manholes with access for cleaning and inspection: DN 800 or DN 900 (see Table 1);
- for inspection chambers: DN 250 up to DN 600 (see Table 1).

**Table 1 — Nominal diameters for inspection chambers and manholes**

Inspection chambers	Manholes with access for	
	cleaning, inspection	inspection by personnel
250 300 400 450 500 600	800 900	1 000 1 100 1 200 1 300 1 400 1 500 1 600 1 800 2 000 2 200 2 400 2 500

#### 6.4.2 Wall thickness

The wall thickness of pipes for manholes and inspection chambers shall be stated in the factory documents and shall conform to 6.4.7.2.

#### 6.4.3 Height

The height  $h$  (see Figures 1 to 6) of a manhole or inspection chamber is project related and shall be stated by the purchaser.

The height of prefabricated elements  $h_g$ ,  $h_c$ ,  $h_{up}$ ,  $h_a$  (see Figures 1 to 6) shall be stated in the factory documents.

The height  $h_r$  of a base element (part 4 in Figures 1 to 4) or of shaft elements (part 6 in Figures 1 to 6) is project related and shall be specified by the purchaser.

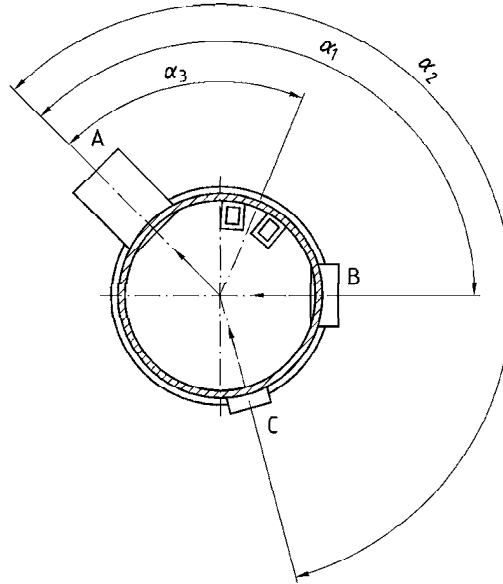
The minimum heights  $h_r$  of a shaft element (part 6, see Figures 1 to 4) shall be 250 mm, the maximum height  $h_r$  is the total length of a pipe according to Part 1 of this standard.

The manufacturer of prefabricated complete manholes or inspection chambers shall state the height  $h_{CS}$  of the cover slab (see Figure 1) and the height  $h_{CO}$  of the eccentric cone (see Figure 2).

#### 6.4.4 Angles between axes of connections to sewers

The angles between the axes of connections to sewers (see Figure 5) shall be specified by the purchaser.





### Key

- A Outlet
- B Connection 1
- C Connection 2

**Figure 7 — Denomination of angles**

#### 6.4.5 Location for steps or fixed ladders

The location for steps or fixed ladder (see Figure 5) shall be specified by the purchaser.

#### 6.4.6 Interchangeability

Prefabricated elements of a manhole or inspection chamber system produced by a manufacturer shall be designed to be compatible.

#### 6.4.7 Limit deviations

##### 6.4.7.1 Internal diameter

Limit deviations on individual measurements of internal diameters  $d_1$  (see Figures 1 to 4) expressed in millimetres shall be:

$$\text{for } d_1 \text{ 250 and 300: } \pm 0,03 d_1$$

$$\text{for } d_1 > 300: \pm 5,5 + 0,01 d_1$$

The manufacturer shall, as necessary, specify tighter limit deviations to achieve compatibility and the performance of the system.

##### 6.4.7.2 Wall thickness

The limit deviation on the wall thickness  $e$  (see Figures 1 to 6) shall be as shown in Table 2.

**Table 2 — Limit deviation on wall thickness  $e$** 

Dimensions in millimetres

Wall thickness $e$	Limit deviation	
	lower	upper
< 10	- 1,5	specified by the manufacturer
> 10 - 20	- 2,0	
> 20 - 30	- 2,5	
> 30 - 60	- 3,0	
> 60 - 90	- 3,5	
> 90	- 4,0	

**6.4.7.3 Height**

The limit deviation on manufacturer's stated heights of prefabricated elements shall be as stated in Table 3.

**Table 3 — Limit deviations on height**

Dimensions in millimetres

$h_r, h_{up}$	$h_c, h_g$	$h_a, h_{co}, h_{cs}$
-10 up to +20	$\pm 10$	0 up to +20

**6.4.7.4 Angles**

The limit deviation on angles between connections to sewers or for the location of steps or fixed ladders shall be not greater than  $3^\circ$  for all diameters.

**6.4.7.5 Perpendicularity of end faces**

When measured according to 7.2.5 the deviation from perpendicularity of end faces measured on pipes for shaft elements and base elements shall not exceed the values given in Table 4.

**Table 4 — Maximum deviation from perpendicularity**

Dimensions in millimetres

DN	$p_{max}$
250 to 400	5
500 to 700	6
800 to 900	8
1 000	9
1 200 to 1400	11
1 500 to 1900	15
2 000 to 2500	18

## 6.5 Mechanical characteristics

### 6.5.1 Crushing loads for pipes for base elements and shafts

When tested according to 7.3.1 pipes for base elements and shafts shall have a minimum crushing load as defined in Table 5:

**Table 5 — Minimum crushing load for base elements and shafts**

Nominal diameter DN	Crushing load kN/m
250	17
300	18
400	18
450	19
500	19
600	19
800	20
900	23
1000	25
1100	28
1200	30
1300	33
1400	35
1500	38
1600	40
1800	45
2000	50
2200	59
2500	67

### 6.5.2 Stability of connections to sewer network

Connections according to 5.4.7 shall be watertight according to 6.5.4 when tested according to 7.3.2.

### 6.5.3 Bonding stability

Evidence of the bonding stability shall be given by performing tests on fibre-cement fittings, assembled with the same adhesive as used for the assembly of elements of manholes and inspection chambers.

Requirements are given in 6.9 of EN 588-1:1996. The test method shall conform to 6.10.5 of EN 588-1:1996.

### 6.5.4 Watertightness

When tested according to 7.3.3 the elements shall not show any leakage, fissures or drops of water at the test pressure of 50 kPa (0,5 bar).

## EN 588-2:2001 (E)

For manholes and inspection chambers intended to be used for special working conditions a maximum test pressure up to 100 kPa (1 bar) can be specified where required.

### 6.5.5 Access steps

Access steps and ladders shall comply with the relevant European Standards and/or national safety regulations valid in the place of installation.

Steps in the elements shall be aligned in each element so as to form a continuous ladder with steps equally spaced vertically in the assembled manhole. The distance between two steps shall be regular and shall be of  $250 \text{ mm} \pm 10 \text{ mm}$  or  $333 \text{ mm} \pm 10 \text{ mm}$ .

Steps installed by the manufacturer with a manhole or shaft shall conform to the following requirements:

- resist a vertical load of 2 kN (see Figure 8), with the deformation under this load of  $\leq 10 \text{ mm}$ , and the remaining deformation after relief of  $\leq 2 \text{ mm}$ ;
- withstand a horizontal pull-out load of 3,5 kN (see Figure 8).

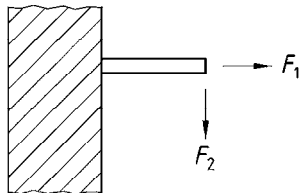


Figure 8 — Step loading

### 6.6 Hydraulic design

Benchings shall be designed according to the hydraulic design requirements. In particular the benching connecting inlets to the main shall be designed in such a way that the hydraulic flow is not obstructed. National safety regulations in the place of installation shall be taken into account for inverts

### 6.7 Resistance to domestic sewage media

Manholes and inspection chambers made of fibre-cement pipes according to this standard do not require protection against domestic waste water or surface water.

### 6.8 Jointing of elements

Jointing of fibre-cement shaft elements shall be by means of connecting rings and adhesives according to 6.5.3 or with pipe connections complying with 6.9 of EN 588-1:1996. Sockets or sleeves with elastomeric seals in conformity with EN 681-1:1996 or with adhesive materials complying with 6.9 of EN 588-1. Capping structures and adaptor slabs shall have watertight joints to the shaft.

All the necessary approved sealing materials shall be supplied by the manufacturer of the manholes, inspection chambers or of the components.

### 6.9 Assembly of prefabricated elements on-site

Assembly of prefabricated elements shall be carried out according to the manufacturer's instructions.

### 6.10 Connections to sewers

All connections shall be watertight according to 6.5.4. All necessary sealing materials and jointing elements according to this standard shall be supplied by the manufacturer of the manholes and inspection chambers. Sealing devices for connections to other pipe materials shall comply with EN 681-1:1996 (design see Annex D).

## 7 Test methods

### 7.1 General

#### 7.1.1 Acceptance tests

The specifications of acceptance tests apply to the elements as delivered, whenever possible, or on test specimens cut off the elements, the maturity of which shall have been guaranteed by the manufacturer.

Acceptance tests shall be:

- visual inspection of appearance and finish and of marking;
- geometrical characteristics.

When the pipes are cut in the factory with tools that automatically guarantee flat and even surfaces within the limit deviations, the control of perpendicularity of end faces is considered as a type test. Otherwise it shall be an acceptance test.

#### 7.1.2 Type tests

Type tests shall be carried out on products as delivered, whenever possible, or on prefabricated elements or on test specimens cut off the elements or off products of the prefabricated elements, the maturity of which shall have been guaranteed by the manufacturer.

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

Type tests shall be:

- crushing test;
- test on stability of connections to sewer network;
- bonding stability test;
- watertightness test;
- perpendicularity of end faces.

When the pipes are cut in the factory with tools that automatically guarantee flat and even surfaces within the limit deviations, the test of the perpendicularity of end faces is considered as a type test. Otherwise it shall be an acceptance test.

## 7.2 Geometrical characteristics of prefabricated elements

### 7.2.1 Internal diameter

The internal diameter shall be measured according to the method specified in 4.10.2.1 of EN 588-1:1996. The values obtained shall comply with the specifications of 6.4.7.1.

### 7.2.2 Wall thickness

The wall thickness shall be measured according to the method specified in 4.10.2.3 of EN 588-1: 1996. The values obtained shall comply with the specifications of 6.4.7.2.

### 7.2.3 Height

The height shall be measured according to the method specified in 4.10.2.4 of EN 588-1: 1996. The values obtained shall comply with the specifications of 6.4.7.3.

### 7.2.4 Angles between the axis of connections

Angles between the axes of connections shall be measured before drilling at the centre of the drilling-holes in accordance with Figure 7. The values obtained shall comply with the specifications of 6.4.7.4.

### 7.2.5 Perpendicularity of end faces

Lay the pipe horizontally on roller supports as shown in Figure 9. Set a dial gauge at each end of the pipe with the sliding spindle of the dial gauge parallel with the axis of the pipe and touching the pipe ends. Turn the pipe one complete revolution and note the maximum deviation of both ends to the nearest millimetre. Other similar devices that allow the pipe to rotate around its axis may also be used. The values obtained shall comply with the specifications of 6.4.7.5.

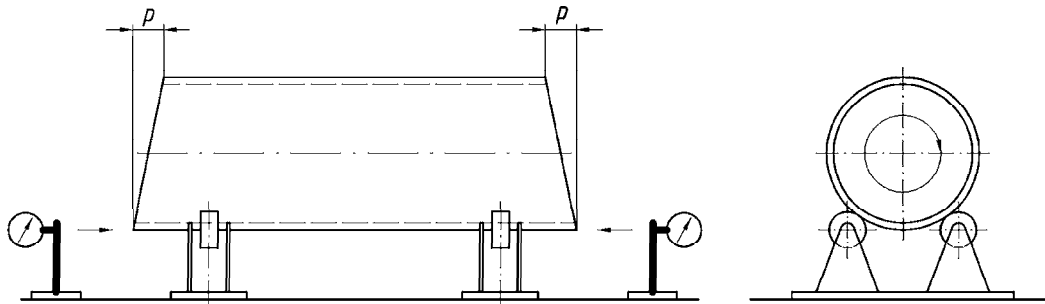


Figure 9 — Test arrangement for perpendicularity

## 7.3 Mechanical characteristics

### 7.3.1 Crushing loads for pipes to be used for base elements and shafts

Crushing loads are to be tested according to 4.10.3.1 of EN 588-1:1996. The values obtained shall comply with the specifications of 6.5.1.

### 7.3.2 Stability of connections to sewer network

Stability of connections shall be tested on a base element with a height of 1,00 m and of a representative nominal size from the middle range of all diameters produced under the same conditions. Connections to the sewer network shall be of the minimum and maximum applicable nominal size for the base element.

The test load of  $10 \times \text{DN}$  in Newton (DN is the nominal size of connections) shall be applied constantly and without any shock at the end of the connections (see Figure 10) for a period of 30 minutes. The point of loading shall be no more than 50 mm from the end of the plain end of the connecting pipe.

Following this test the watertightness test according to 7.3.3 shall be carried out.

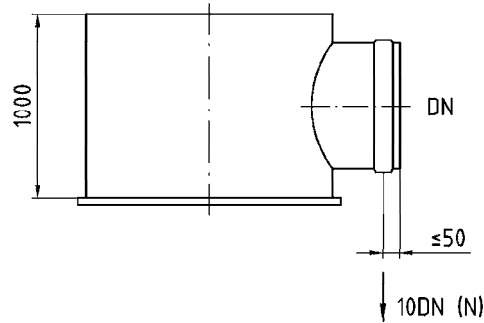


Figure 10 — Applying of test load for the stability test of connections

### 7.3.3 Watertightness test

#### 7.3.3.1 Test samples

##### 7.3.3.1.1 Complete manholes:

- For manholes of a total height of more than 5 m, the hydrostatic test pressure of 50 kPa (0,5 bar) on the lowest connection shall be obtained by filling the manhole with water.
- For shorter manholes an appropriate device shall be used which allows the application of a hydrostatic pressure up to 50 kPa (0,5 bar).

##### 7.3.3.1.2 Prefabricated elements:

- The test shall be carried out on the base element, completed with at least one shaft and using at least one connecting ring, so as to form a manhole with a total height such that a hydrostatic pressure of 50 kPa (0,5 bar) of the lowest connection is obtained.

#### 7.3.3.2 Test procedure

Close the connections with a cap or plug and fill the manhole with water.

Axial forces on the connections caused by the internal pressure may be transmitted into a rigid framework made of steel or into any other suitable construction.

Apply any additional pressure, necessary to obtain a hydrostatic pressure of 50 kPa (0,5 bar).

Maintain the test pressure for a period of 30 min and observe for leakage or sweating.

#### 7.3.3.3 Interpretation of results

The test piece shall not exhibit any fissure, leakage or drops of water.

## 8 Marking

Manholes and inspection chambers shall be marked legibly with at least the following information:

- EN 588-2;
- nominal diameter;
- manufacturer's identification (manufacturer of the supplied product);
- date of manufacture (at least month and year);

## EN 588-2:2001 (E)

- identification of the product related to the project;
- third party certifier, where applicable;

NOTE Where Z.3 requires the same information as this clause 8, the requirements of this clause are met.

## 9 Conformity Evaluation

### 9.1 General Requirements

To demonstrate conformity with this standard products manufactured shall be subjected to the following evaluation procedures:

- the initial control of the products (type testing) (see 9.2);
- the internal factory production control, to be carried out by the manufacturer (internal quality control) (see 9.3).

A third party control may be carried out as recommended in Annex C (third party inspection).

### 9.2 Initial control of the products (type testing)

Initial type testing shall be performed on first application of this standard. Tests previously performed on first application of this standard (same product, same characteristic, test method, sampling procedure, system of attestation of conformity, etc.) may be taken into account.

Conformity with the requirements according to class 6. shall be tested according to clause 7 of this standard either at the manufacturer's laboratory or at another competent laboratory and may be supervised by an independent approved testing institute. Full reports of these tests shall be recorded and filled. They shall be made available to the third party for examination, if relevant.

Whenever a change occurs in the design, the raw material, components, supplier of the components or the production process, which would change significantly one or more of the stated characteristics and the effects of which cannot be predicted on the basis of previous experience, the type tests shall be repeated for the appropriate characteristic(s).

### 9.3 Factory production control (internal quality control)

#### 9.3.1 Quality control system

The manufacturer shall establish document and maintain a FPC system to ensure that the products, placed on the market, conform with the stated performance characteristics. The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of results to control raw and other incoming materials or components, the production process and the product.

A quality control system complying with EN ISO 9001 or equivalent, and taking account of the needs of this standard (at least Table A.1), will satisfy the above requirement.

For factories not complying with EN ISO 9001 or equivalent 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 390:1993, with an AQL of 4% and an inspection level  $S_3$ , ensures that for large batches approximately 95% of the items fulfil the requirements.

#### 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 may be carried out according to Annex B and ISO 390:1993.

#### **9.4 Third party inspection**

If a third party inspection is required, it may be carried out according to Annex C (informative).

## **Annex A** (normative)

### **Quality organization for factories not complying with EN ISO 9001**

#### **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, updating and surveillance 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.

Complete test reports shall be kept by the manufacturer for at least 5 years. In case of third party control the reports shall be made available to the third party body approved for performing the inspections.

##### **A.1.3 Statistical methods**

The manufacturer shall establish procedures for identifying adequate statistical methods required for verifying the results of the factory production control.

#### **A.2 Sampling procedures**

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

The requirements for internal factory production control and corresponding test methods are given in Table A.1.

**Table A.1 — Factory production control for manholes and inspection chambers  
Requirements and test methods**

	Requirement	Test	Frequency
General appearance and finish	6.3	visual inspection	all elements
Internal diameter	6.4.1	7.2.1	all elements
Thickness of wall	6.4.2	7.2.2	all elements
Height	6.4.3	7.2.3	all elements
Angles between axes of connections	6.4.4	7.2.4	all elements
Perpendicularity of end faces <sup>a</sup>	6.4.7.5	7.2.5	all elements
Crushing strength	6.5.1	7.3.1	see part 1, Table A.4
Watertightness	6.5.4	7.3.3	min. 2 elements/year
Marking	8	visual inspection	all elements
<sup>a</sup> provided the type test does not comply with 7.1.2			

### 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 factory production 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 shall the quality control department of the manufacturer agree upon dispatch of production.

**Annex B**  
(normative)

**Acceptance test for products which are not subject to third party certification**

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

Details related to the application of the sampling clause shall be established by 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 may be refused and disposed of, unless otherwise agreed between the manufacturer and purchaser.

## Annex C (informative)

### Third party inspection

#### C.1 General

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

The third party inspection is carried out by an independent approved certification body.

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 manholes and inspection chambers; specifications and tests**

Test item	Attribute	Requirement	Test method
Manholes and inspection chambers	General appearance and finish	6.3	visual inspection
	Marking	8	visual inspection
	Dimensions	6.4	7.2
	Crushing strength	6.5.1	7.3.1
	Stability of connections to the network	6.5.2	7.3.2
	Bonding stability	6.5.3	6.5.3
	Watertightness	6.5.4	7.3.3

#### C.2 Factories with certification and quality system according to EN ISO 9001 or equivalent

The inspection by the third party is made without previous announcement at least once a year at regular intervals.

The procedure for third party inspection consists of:

- controlling the validity of the certification of conformity granted to the manufacturer in accordance with EN ISO 9001 or equivalent for his quality system;
- verifying that the results of the internal quality control are according to the requirements of this standard;
- independent routine testing of finished products according to Table C.1.

#### C.3 Factories without certification and quality system according to EN ISO 9001 or equivalent.

The inspection by the third party is made without previous announcement at least four times a year at regular intervals.

The procedure of third party inspection consists 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 according to the requirements of this standard;
- verifying that the results of the internal quality control are according to the requirements of this standard;
- independent routine testing of finished products according to Table C.1.

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

- the manufacturer's internal factory production control system is adequate;
- the inspections have been continuously carried out in a proper and effective way for 2 years;
- the results are according to the requirements of this standard.

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

The third party ensures that the manufacturer's inspections and tests have been carried out according to 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 is drawn up by the third party inspector. The test report contains at least 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 further contains:

- a) for manufacturers with certification according to EN ISO 9001,
- b) EN ISO 9001 or equivalent statements regarding:
  - the validity of the certificate covering the internal quality control system;
  - the conformity of the products.
- c) for factories not complying with EN ISO 9001 or equivalent statements regarding:

- whether the requirements of annex A are fulfilled;
- 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 is carried out on the characteristics which have failed; if this reinforced inspection fails, the production related to the failure(s) is excluded from shipment pending the outcome of further investigations.

The problem will be identified and corrective actions are taken by the manufacturer in order to eliminate the nonconformity. On request the third party will be informed of these measures.

## **Annex D** (informative)

### **Design requirements**

#### **D.1 Stability**

Stability against buoyancy is checked in all cases. Resistance against other external loads (earth loads, traffic loads, etc.) need not to be checked for manholes and inspection chambers according to Figures 1, 2, 3, 4 and 6) up to a height of 5 m.

#### **D.2 Connections to sewers**

When designing the connections of sewers to manholes the pipeline designer should consider the possible occurrence of differential settlement between the sewer and manhole and the need to use a flexible connection such as a short length hinge pipe or take other similar precaution. All connections shall be watertight according to 6.5.4. All necessary sealing materials and jointing elements according to EN 588-1:1996 and to this standard shall be supplied by the manufacturer of the manhole or inspection chamber.



**Annex ZA**  
(informative)  
**Clauses of this European standard addressing the provisions of the EU  
Construction Products Directive**

**ZA.1 Scope and relevant characteristics**

Clause 1 of this Standard is applicable for the scope of this Annex.

This European standard has been prepared under the Mandate given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European standard shown in the below Table meet the requirements of the Mandate M/118 given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the construction products covered by this annex for their intended uses indicated herein.

**WARNING:** Other requirements and other EU Directives, not affecting the fitness for intended use may be applicable to the construction products falling within the scope of this standard.

Note In addition to any specific clauses relating to dangerous substances contained in this Standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply. *An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (CREATE, accessed through <http://europa.eu.int>).*

This Annex establishes the conditions for the CE marking of manholes and inspection chambers for drains and sewers given in Table ZA.1 and the relevant clauses.

**Table ZA.1 - Relevant Clauses for manholes and inspection chambers for drains and sewers**

<b>Product:</b> Fibre-cement manholes and inspection chambers for drains and sewers, components and prefabricated complete manholes and inspection chambers			
<b>Intended use:</b> Access for cleaning and inspection of drains and sewers for personnel and/or access for cleaning and inspection for the introduction of cleaning equipment			
Essential characteristics	Requirement clauses in this (or another) EN	Levels and/or classes	Notes
Water tightness	6.5.4	None	Test according to 7.3.3
Mechanical resistance	6.5.1, 6.5.2, 6.5.3	None	Test according to 7.3.1, 7.3.2 and 6.10.5 of EN 588-1:1996
Opening size	5	None	Mechanical measurement
Durability	6.2, 6.4.2, 6.4.7.2, 6.4.7.5, 6.5, 6.7, 6.8	None	Test according to clause 7

## ZA.2 Procedure(s) for the attestation of conformity of manholes and inspection chambers

### ZA.2.1 Systems of attestation of conformity

The system of attestation of conformity of fibre-cement elements indicated in Table ZA.1, which is given in Annex III of the mandate "Wastewater Engineering Products" (M 118) is shown in Table ZA.2 for the intended uses and relevant level(s) and classes.

**Table ZA.2 – Attestation of conformity systems**

Product	Intended use	Level(s) or class(es)	Attestation of conformity system(s)
Components for fibre-cement manholes and inspection chambers and prefabricated complete manholes and inspection chambers	Access for cleaning and inspection of drains and sewers for personal and/or introduction of cleaning equipment	None	4
System 4: See Directive 89/106/EEC (CPD) Annex III.2.(ii), Third possibility			

The attestation of conformity of fibre-cement elements in Table ZA.1 shall be according to the evaluation of conformity procedures indicated in Table ZA.3 resulting from the application of the clauses of this European standard indicated therein.

**Table ZA.3 — Assignment of evaluation of conformity tasks for fibre-cement elements for drains and sewers under system 4**

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (F.P.C)	Parameters related to all characteristics of Table ZA.1	Table ZA.1
	Initial type testing	All characteristics of Table ZA.1	Table ZA.1

### ZA.2.2 Certificate and Declaration of conformity

When compliance with this Annex is achieved, the manufacturer or his agent established in the EEA, shall prepare and retain a declaration of conformity, which authorises the affixing of the CE marking. This declaration shall include:

- name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;
- description of the product (type, identification, use, ...), and a copy of the information accompanying the CE marking;
- provisions to which the product conforms (e.g. Annex ZA of this EN);
- particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc);
- name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

The above mentioned declaration and certificate shall be presented in the official language or languages of the Member State in which the product is to be used.

### ZA.3 CE Marking

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol shall be in accordance with Directive 93/68/EEC.

The following information and characteristics shall be shown on the products:

- a) CE marking symbol
- b) name or identifying mark of the manufacturer
- c) last two digits of the year of affixing the CE marking

The following information shall be stated on the accompanying commercial documents:

- d) CE symbol
- e) name or identifying mark of the manufacturer
- f) last two digits of the year of affixing the CE marking
- g) EN 588-2
- h) intended use and description of the unit
- i) nominal size (DN)

## EN 588-2:2001 (E)

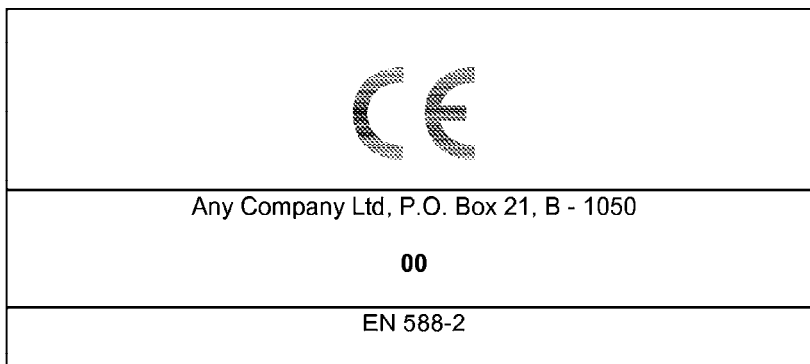
### j) crushing strength

The NPD option shall not be used where the characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements.

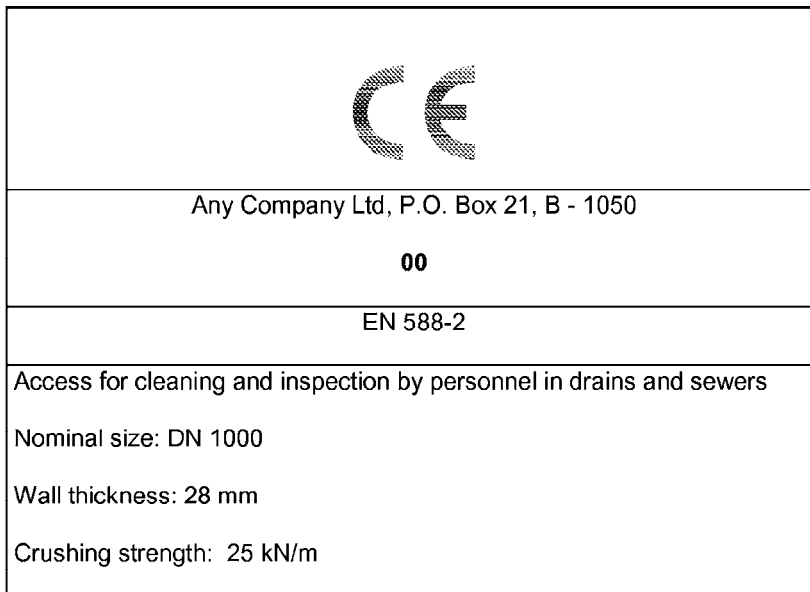
In addition to any specific information relating to dangerous substances shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

Note European legislation without national derogations need not be mentioned.

### Example of CE marking on the product



### Example of CE marking on the accompanying commercial documents



## Bibliography

EN ISO 9001, *Quality management systems - Requirements (ISO 9001:2000)*

---

## BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

### Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover.  
Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

### Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001.  
Fax: +44 (0)20 8996 7001. Email: [orders@bsi-global.com](mailto:orders@bsi-global.com). Standards are also available from the BSI website at <http://www.bsi-global.com>.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

### Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre.  
Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: [info@bsi-global.com](mailto:info@bsi-global.com).

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.  
Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001.  
Email: [membership@bsi-global.com](mailto:membership@bsi-global.com).

Information regarding online access to British Standards via British Standards Online can be found at <http://www.bsi-global.com/bsonline>.

Further information about BSI is available on the BSI website at <http://www.bsi-global.com>.

### Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

Details and advice can be obtained from the Copyright & Licensing Manager.  
Tel: +44 (0)20 8996 7070. Fax: +44 (0)20 8996 7553.  
Email: [copyright@bsi-global.com](mailto:copyright@bsi-global.com).

BSI  
389 Chiswick High Road  
London  
W4 4AL