British Standard

BRITISH STANDARD

BS EN
1917:2002

Concrete manholes and inspection chambers, unreinforced, steel fibre and reinforced

The European Standard EN 1917:2002 has the status of a British Standard

ICS 93.030

National foreword

This British Standard is the official English language version of EN 1917:2002.

EN 1917 is a candidate "harmonized" European Standard and fully takes into account the requirements of the European Commission mandate M118, *Wastewater engineering products*, given under the EU Construction Products Directive (89/106/EEC), and is intended to lead to CE marking. The date of applicability of EN 1917:2002 as a "harmonized" European Standard, i.e. the date after which this standard may be used for CE marking purposes, is subject to an announcement in the *Official Journal of the European Communities*.

BS EN 1917:2002 together with BS 5911-3:2002 supersedes BS 5911-200:1994.
BS EN 1917:2002 together with BS 5911-4:2002 supersedes BS 5911-2:1998.

The Commission in consultation with Member States have agreed a transition period for the co-existence of "harmonized" European Standards and their corresponding national standard(s). It is intended that this period will comprise a period, usually nine months after the date of availability of the European Standard, during which any required changes to national regulations are to be made, followed by a further fifteen-month period for the implementation of CE marking. At the end of this co-existence period, the national standard(s) will be withdrawn. In the UK, the corresponding national standards are:

— BS 5911-2:1982, *Precast concrete pipes, fittings and ancillary products — Specification for inspection chambers;*

— BS 5911-200:1994, *Precast concrete pipes, fittings and ancillary products — Specification for unreinforced and reinforced manholes and soakaways of circular cross-section;* (insofar as it specifies manholes with nominal sizes not exceeding DN 1250)*;*

and based on this nominal transition period of twenty-four months, BS 5911-2:1982 and BS 5911-200:1994 will be withdrawn in October 2004, the non-conflicting requirements having been revised.

NOTE This date is approximate. Users of this standard should contact BSI Customer Services for confirmation of withdrawal.

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 international/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.

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 18 November 2002

Amendments issued since publication

Amd. No.	Date	Comments

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

The foreword of EN 1917:2002 explains why, and under what circumstances, complementary requirements and associated test methods outside the scope of that standard will be needed at national level. BS EN 1917:2002 together with BS 5911-3:2002 supersedes BS 5911-200:1994, and BS EN 1917:2002 together with BS 5911-4:2002 supersedes BS 5911-2:1982. Therefore, BS 5911-3:2002 and BS 5911-4:2002 are for use in conjunction with BS EN 1917:2002 for manholes and inspection chambers respectively and all three come into effect simultaneously. In order not to create barriers to European trade, products under the scope of this British Standard should be specified as conforming to "BS EN 1917:2002 and BS 5911-3:2002 (or BS EN 5911-4:2002) or equivalent".

Cross-references

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 75 and a back cover.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1917

October 2002

ICS 93.030

English version

Concrete manholes and inspection chambers, unreinforced, steel fibre and reinforced

Regards de visite et boîtes de branchement en béton non armé, béton fibré acier et béton armé

Einsteig- und Kontrollschächte aus Beton, Stahlfaserbeton und Stahlbeton

This European Standard was approved by CEN on 18 August 2002.

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, Malta, 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

Ref. No. EN 1917:2002 E

Contents

Foreword

This document EN 1917:2002 has been prepared by Technical Committee CEN/TC 165 "Wastewater engineering", the secretariat of which is held by DIN.

It is a companion standard to EN 1916 “Concrete pipes and fittings, unreinforced, steel fibre and reinforced”.

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 April 2003, and conflicting national standards shall be withdrawn at the latest by October 2004.

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 includes ten normative annexes and one informative annex. Annexes A, B, C, D, E, F, G, H, I and J are normative, annex ZA is informative.

When the text of this European Standard was approved, complete agreement could not be achieved for all requirements in the existing national specifications of CEN members and so it includes only those requirements and associated test methods for which a consensus could be reached. Consensus was achieved on the requirements for quality control.

NOTE For the time being, for specification purposes, complementary (i.e. non-conflicting) requirements and associated test methods outside the scope of this European Standard (see Table 1) will be needed at national level. In order not to create any barrier to trade, any call for conformity to complementary requirements should always be qualified by incorporating the words 'or equivalent' after the reference to them.

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies performance requirements as defined in Table 1 and describes test methods for precast concrete units for inspection chambers designed to be used for inverts not exceeding 2 metres deep and manholes, of circular, rectangular (with or without chamfered or rounded corners) or elliptical internal shape, unreinforced, steel fibre and reinforced, with nominal sizes and normal length not exceeding DN 1 250 (circular) or LN 1 250 (rectangular or elliptical). The intended use is to permit access to, and to allow aeration of, drain or sewer systems for the conveyance of sewage, rainwater and surface water under gravity or occasionally at low head of pressure, mainly installed in areas subjected to vehicular and/or pedestrian traffic. Requirements for joints (elastomeric, plastomeric or other sealing materials, either integrated in the unit or supplied separately) are also specified.

Provision is made for the evaluation of conformity of units to this European Standard.

Marking conditions are included.

Table 1 — Specified characteristics and exclusions

Characteristic	Exclusions
Materials	— Specifications where relevant European Standards have not yet been published; — any classification of double steps.
Concrete	Types and value(s) of minimum content of cement plus any pozzolanic or latent hydraulic addition, according to serviceability conditions.
Finish	Limitations on size of blemishes.
Geometrical characteristics	— Nominal sizes; — internal dimensions with tolerances; — shape and position of openings in slabs and adjusting units; —benchings; — tolerances on wall thickness of units, and on thickness of slabs and adjusting units; — tolerances on internal height; — deviation from straightness, from squareness of ends and from flatness of end faces.
Joints and joint seals	Provisions for interchangeability.
Crushing strength	Specific strength classes and corresponding minimum crushing loads.
Vertical strength	Vertical loading requirements for units to be installed in areas other than those for all types of road vehicles.
Watertightness	None.
Special requirements for steel fibre concrete units and reinforced concrete units	— Value(s) of minimum concrete cover for reinforced concrete units; — requirements for weld testing of reinforcement cages.
Marking	— Symbols or letters for identifying the material of a unit; — symbols or letters for identifying serviceability conditions other than normal conditions as stated in 4.3.9.
NOTE Provisions for the following are also outside the scope of this European Standard: - units with nominal sizes or nominal lengths greater than DN 1 250 or LN 1 250; - units for manholes and inspection chambers with a cross-section other than circular, rectangular or elliptical; - inspection chambers designed to be used for inverts other than those not exceeding 2 metres deep; - lifting facilities; - circumstances other than those stated; - any receiving inspection by, or on behalf of, the purchaser; - durability of joints between vertical units and connecting pipes or adaptors not conforming to EN 1916.	

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

EN 1916, *Concrete pipes and fittings, unreinforced, steel fibre and reinforced.*

EN 10002-1, *Metallic materials - Tensile testing - Part 1: Method of test at ambient temperature.*

ISO 4012, *Concrete - Determination of compressive strength of test specimens.*

ISO 10544, *Cold reduced steel wire for the reinforcement of concrete and the manufacture of welded fabric.*

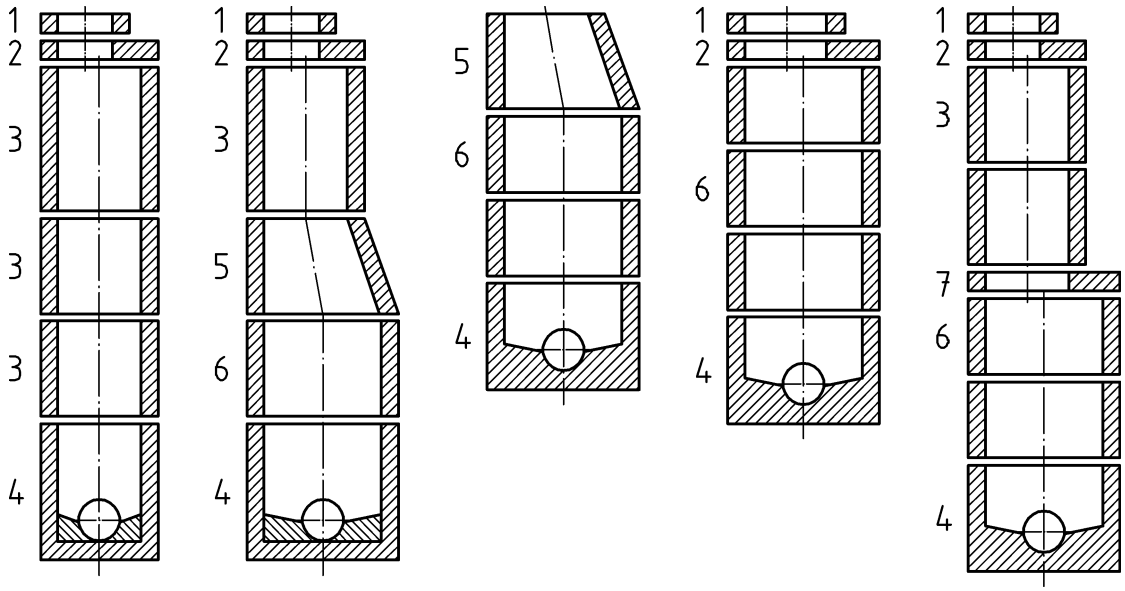
3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

3.1.1
manhole
vertical watertight structure used to connect pipelines, to change direction and/or level, to permit access for personnel and/or equipment for inspection and maintenance and to allow aeration and ventilation

NOTE For the purposes of this European Standard a precast manhole or inspection chamber consists of units defined in this clause and as shown in Figure 1. Typical joint assemblies are shown in Figure 2.



Key

1 Adjusting unit
4 Base unit
2 Cover slab
6 Chamber unit
7 Reducing slab
3 Shaft unit
5 Taper

NOTE 1 Joint details have been omitted, for clarity.

NOTE 2 Precast base slabs of structures can be integral with the base unit or a separate slab incorporating construction joints.

Figure 1 — Typical structures

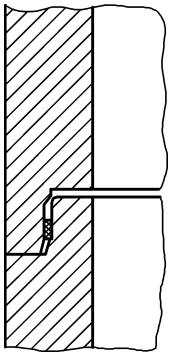


Figure 2.a - Elastomeric joint seal

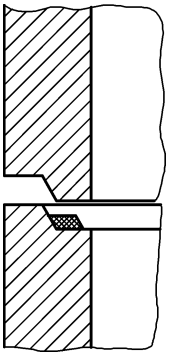


Figure 2.b - Elastomeric, plastomeric or other sealing material

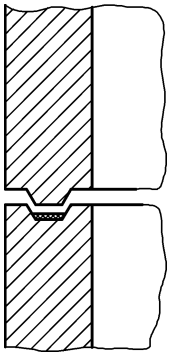


Figure 2.c - Elastomeric, plastomeric or other sealing material

Figure 2 — Typical joint assemblies

3.1.2
inspection chamber
structure as a manhole, but without access for personnel

3.1.3
base unit
vertical component with integral base, with or without benching, and with appropriate flexible joints to provide watertight connections with pipelines, with or without integral connecting pipe(s) or adaptor(s)

3.1.4
chamber or shaft unit
vertical hollow component of uniform cross-section except at the joint profile. Flexible joints to accommodate connecting pipelines may be provided as for a base unit

3.1.5
capping unit
integral shaft unit and shaft cover slab

3.1.6
vertical unit
base, capping, chamber or shaft unit

3.1.7
cover slab
unit forming the horizontal roof of a chamber or shaft and having an access opening, immediately above which an adjusting unit or frame and cover is designed to fit

3.1.8
reducing slab
reducing unit forming the horizontal roof of a chamber and having an opening to accommodate a shaft unit above it

3.1.9
taper
unit forming the sloping roof of a circular or elliptical chamber, thereby reducing the chamber to the size of the access opening

3.1.10
reducing unit
taper (either used as a top or intermediate unit), cover slab or reducing slab

3.1.11
adaptor
fitting that provides for connections to structures

3.1.12
connecting pipe
short pipe with plain, spigot or socket ends

3.1.13
adjusting unit
component without a joint or installed step, to adjust the total height of a structure and/or to accommodate an appropriate frame and cover

3.1.14
unit
precast concrete component of a manhole or inspection chamber structure

3.1.15
type
units of the same manufacturing process, shape or bore and material (unreinforced, steel fibre or reinforced concrete)

3.1.16
nominal size
numerical designation of the size of a component within a structure, which is a convenient integer approximately equal to the manufacturing dimension(s) in millimetres; for a circular unit it is the internal diameter (DN), for a unit having a rectangular or elliptical internal shape it is the internal length/width (LN/WN)

3.1.17
rectangular shape
shape of a rectangle (including a square), or one having chamfered or rounded corners

3.1.18
elliptical shape
shape approximating to an ellipse, but a compound curve formed by two opposing pairs of circular arcs, the radius of one pair being larger than that of the other pair

3.1.19
internal height
dimension of a unit relating to the jointing faces or invert as shown in Figure 3

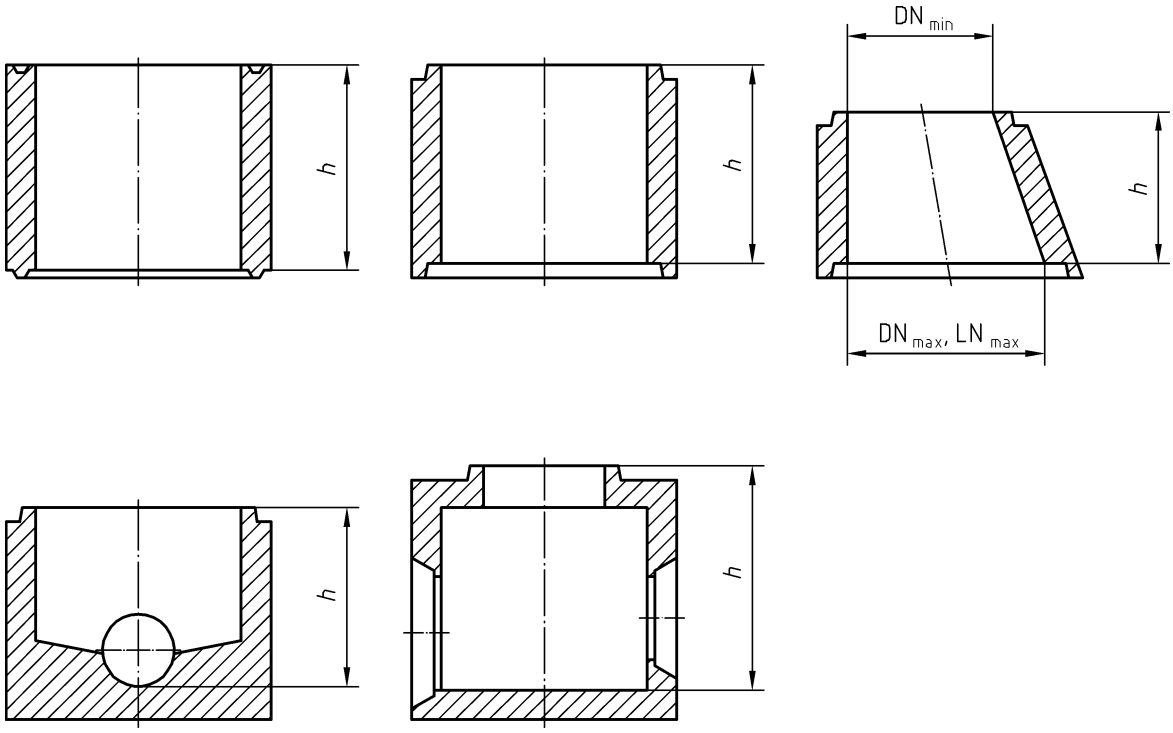


Figure 3 — Illustration of internal height of vertical units and tapers

3.1.20
integrated seal
seal incorporated into a unit during manufacture

3.1.21
strength class
minimum crushing load in kilonewtons per metre, divided by one thousandth of either a unit's nominal size (DN) or nominal length (LN)

3.1.22
minimum crushing load
load that a unit is required to withstand

3.1.23
ultimate (collapse) load
maximum load reached by the testing machine during a crushing or vertical strength test (i.e. when the load-recording facility does not show any further increase)

3.1.24
proof load
load that a steel fibre or reinforced concrete unit is required to withstand with a defined limit on cracking

3.1.25
concrete cover
actual thickness of concrete over any reinforcement

3.1.26
characteristic value
that value of a characteristic beyond which, with a 75 % confidence level, 5 % of the population of all possible measurements of the specified material may fall

NOTE A 75 % confidence level is recommended in ISO 12491.

3.1.27
inspection
process of measuring, examining, testing, gauging or otherwise comparing a unit with the applicable requirements

3.1.28
routine inspection
inspection by sampling at prescribed intervals in order to determine the acceptability of the items represented by the samples

3.1.29
continuous inspection
routine inspection according to a sampling plan which indicates the number of units from a specific process evaluated to have attained, and continue to be in, a state of control, and the associated acceptance criteria

3.1.30
sample
one or more units selected at random without regard to their quality

3.1.31
group
clearly identifiable collection of units, manufactured using the same process; units of different nominal size may be grouped together, provided that the ratio of largest to smallest nominal size is not greater than 2

3.1.32
specific process
manufacture of units of the same nominal size, strength and type, essentially under the same conditions over any period of time

3.1.33
state of statistical control
state in which the variations among the observed sampling results can be attributed to a system of chance causes that does not appear to change with time

3.1.34
switching rules
rules that govern the decision to increase or decrease the severity of inspection

3.2 Symbols

Table 2 gives the meanings of symbols, units and references used in this European Standard.

Table 2 — Symbols

Symbol	Meaning	Unit	Reference
A_w	absorption of water by immersion	per cent	D.5
a_s	distance between additional shear load and centre of joint seal	metres	C.7.3
F_a	effective crushing test result	kilonewtons per metre	A.5, H.3.2, H.4.1,
F_c	proof load	kilonewtons per metre	5.2.3, A.1, A.4.3, H.3.2, H.4.1
F_d	vertical load on step	kilonewtons	4.3.7.1, 4.3.7.2, E.2.1
F_l	horizontal pull-out force on step	kilonewtons	4.3.7.1, 4.3.7.2, E.2.2
F_n	minimum crushing load	kilonewtons per metre	4.3.5, 5.1.2, 5.2.3, A.1, A.4.3, H.1.1, H.3.2, H.4.1, H.4.2, J
F_p	vertical proof load	kilonewtons	5.2.4, B.4.2, H.3.2, H.3.4
F_s	shear load	kilonewtons	C.7.3, C.7.4
F_u	ultimate (collapse) load	kilonewtons per metre	5.1.2, A.1, A.4.3, B.4.1, B.4.2, H.1.1, H.3.2, H.3.4, H.4.1, H.4.2, J
F_v	minimum vertical crushing load	kilonewtons	4.3.6, B.4.1, H.4.1, H.4.2
f_{bt}	bending tensile stress in concrete	megapascals	J
f_{ch}	characteristic bending tensile stress in concrete	megapascals	J
f_{ck}	characteristic concrete compressive strength	megapascals	4.2.2
f_{des}	design bending tensile stress in concrete	megapascals	J
G	test per group	-	G
h	internal height	metres	3.1, A.4.1, A.4.2, A.5, B.4.1
J	test per 500 produced per group, with a minimum of one per month	-	G
k	acceptability constant	-	H.4.1, H.4.2, J
l_l	distance between centres of adjacent joint seals	metres	C.7.3
m_1	constant mass of immersed sample	kilograms	D.4.1, D.5
m_2	constant mass of dry sample	kilograms	D.4.2, D.5
N	test per nominal size	-	G
n	number of consecutive samples	-	H.4.1, H.4.2, J
P	measured crushing load	kilonewtons	A.4.1, A.4.2, A.5
P^*	effective self-weight of load bearers	kilonewtons	A.5
Q	quality statistic	-	H.4.2, J
R	routine inspection test	-	6.1, A.1

Table 2 *(continued)*

Symbol	Meaning	Unit	Reference
R_s	additional shear load	kilonewtons	C.7.3
r_m	mean radius of unit	millimetres	J
S	test per type, nominal size and strength class	-	G
s	estimated standard deviation	-	H.4.1, H.4.2, J
T	initial type test	-	6.1, A.1
t	design wall thickness	millimetres	H.3.2
t_{act}	mean measured wall thickness of unit at the point of contact with the single bearer	millimetres	J
t_{min}	minimum permissible wall thickness of unit at the point of contact with the single bearer	millimetres	J
W	test per type, nominal size and same wall thickness	-	G
W_w	weight of connecting pipe filled with water	kilonewtons	C.7.3
x	measured value	-	H.4.2, J
$\bar{x}$	arithmetic sample mean	-	H.4.1, H.4.2, J
Y	test per type, size and strength produced, per 1 000, with a minimum of one per type and year	-	G
Z	test per type of step and method of installation	-	G
ß	included testing angle	degrees	A.4.1
σ	known standard deviation	-	H.4.1, H.4.2

4 General requirements

4.1 Materials

4.1.1 General

Materials under the scope of this European Standard shall be as listed in Table 3.

NOTE Where relevant European Standards have not yet been published, complementary requirements for the reference specifications of materials will be needed. These should take the form of national standards or, in the absence of these, to regulations or provisions valid in the place of use of the units.

Table 3 — Materials under the scope of this European Standard

Material	Supplementary requirements to the reference specification
Cements	None.
Aggregates	Aggregates shall not contain harmful constituents in such quantities as may be detrimental to the setting, hardening, strength, watertightness or durability of the concrete, nor cause corrosion of any steel. It is permissible for the manufacturer to modify standard gradings to suit the manufacturing process.
Mixing water	Mixing water shall not contain harmful constituents in such quantities as may be detrimental to the setting, hardening, strength, watertightness or durability of the concrete, nor cause corrosion of any steel.[a]
Admixtures	Admixtures, when used, shall not impair the durability of the concrete, nor cause corrosion of any steel.
Additions	Additions, when used, shall not contain harmful constituents in such quantities as may be detrimental to the setting, hardening, strength, watertightness or durability of the concrete, nor cause corrosion of any steel.
Steel fibres	Steel fibres shall: - be manufactured from hard drawn steel wire and having a characteristic tensile strength of not less than 1 000 Mpa (N/mm^2) when determined in accordance with EN 10002-1; - have a shape and/or surface texture that ensures their mechanical anchorage in the concrete.
Reinforcing steel	Reinforcing steel shall be weldable where welding is to be carried out. It is permissible for reinforcing steel to be plain, indented, profiled or ribbed. The same materials shall be used in the manufacture of any welded fabric. ISO 10544 shall be used in the absence of another reference specification for reinforcing steel.
Joint seals	See 4.1.2.
Steps	None.

[a] Drinking water from public supply is generally suitable for the manufacture of concrete.

4.1.2 Joint seals

Joint seals for connections between vertical units and pipelines shall conform to EN 681-1 and shall be supplied by the manufacturer of the units either integrated or supplied separately.

It is permissible for other sealing materials and methods to be used for joints between vertical components, as stated in the factory documents. The manufacturer shall make available information on the source of such materials and the methods used by him to meet the requirements of 6.6.

4.2 Concrete

4.2.1 Concrete materials

Only materials as described in 4.1.1 shall be used.

4.2.2 Concrete strength

4.2.2.1 General

Where conformity of units with structural requirements is not specified in this European Standard to be verified by routine performance testing of their strength, the characteristic compressive strength of the concrete f_{ck} shall be verified on the basis of testing in accordance with 6.8. The verified value shall be not less than the manufacturer's declared design strength as stated in the factory documents.

4.2.2.2 Strength requirement

The design strength declared by the manufacturer in the factory documents for the purposes of 4.2.2.1 shall be not less than 40 MPa (N/mm²).

4.2.3 Concrete quality

The concrete in any unit shall be dense, homogeneous and conform to the requirements of 4.2.4, 4.2.5 and 4.2.7.

4.2.4 Water content of concrete

4.2.4.1 General

Concrete shall have such a composition that the ratio of water to cement plus any pozzolanic or latent hydraulic addition in the fully compacted state is consistent with the serviceability conditions in 4.3.9.

4.2.4.2 Requirement for water/cement ratio

The ratio of water to cement plus any pozzolanic or latent hydraulic addition in the fully compacted state shall not be greater than 0,45.

4.2.5 Cement content of concrete

Concrete shall have such a composition that the minimum content of cement plus any pozzolanic or latent addition in the fully compacted state is consistent with the serviceability conditions in 4.3.9.

4.2.6 Chloride content of concrete

4.2.6.1 General

The maximum amount of chloride ion in the concrete shall be evaluated by calculation.

4.2.6.2 Requirement for chloride content

The calculated chloride ion content of the concrete shall not exceed the relevant value given in Table 4.

Table 4 — Maximum chloride content of concrete

Type of concrete	Cl^- by mass of cement
Unreinforced	1,0 %
Steel fibre	0,4 %
Reinforced	0,4 %

4.2.7 Water absorption of concrete

4.2.7.1 General

The water absorption of the concrete shall be tested in accordance with 6.7.

4.2.7.2 Absorption requirement

The water absorption of the concrete shall not exceed 6 % by mass.

4.3 Units

4.3.1 General

Units shall conform to the following requirements at the time of delivery.

4.3.2 Finish

Functional surfaces of joint profiles shall be free from irregularities that would preclude a durable watertight assembly.

Crazing within the cement-rich layer, shrinkage or temperature hairline cracks with a surface width not exceeding 0,15 mm and, for reinforced units, residual cracks caused by testing and having the same limiting surface width, are permissible. At the manufacturer's discretion it is permissible to soak a unit for a maximum of 28 hours before measuring any crack widths.

Units with cracks other than those described above do not conform to this European Standard.

After any final treatment, a unit shall conform to all relevant requirements of this European Standard.

4.3.3 Geometrical characteristics

4.3.3.1 Internal height

The internal height of vertical units and tapers shall conform to that stated in the factory documents.

4.3.3.2 Wall thickness of tapers and base units

The wall thickness of tapers and base units shall be stated in the factory documents and be not less than 95 % of that of the connecting chamber or shaft unit corresponding to the required crushing strength.

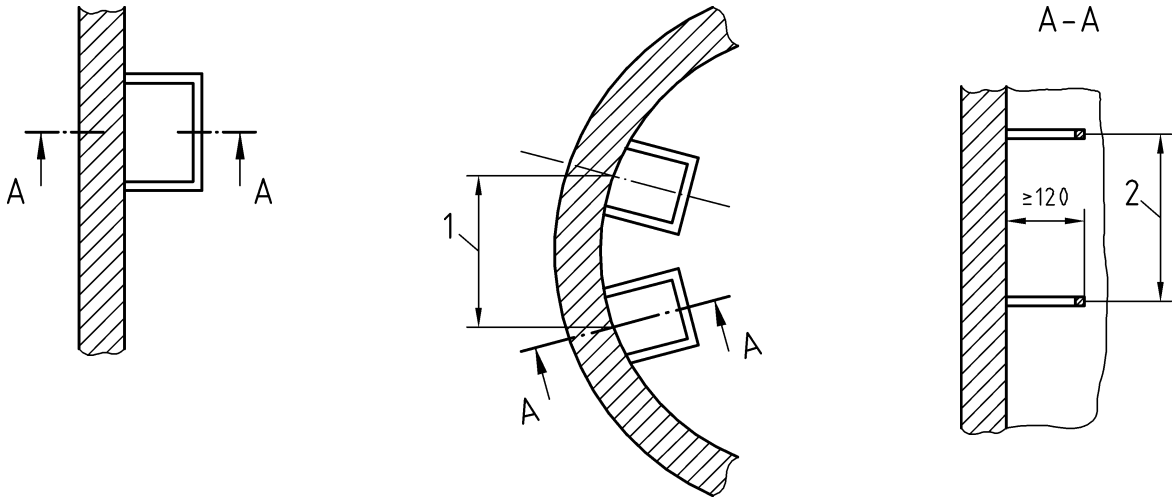
4.3.3.3 Length of connections

The maximum internal barrel length of a socketed pipe cast into a base unit shall be equal to the wall thickness of the base unit plus half the nominal size of the pipe expressed in millimetres, with a maximum of 500 mm. For a cast-in spigotted pipe, it is permissible for this length to be increased by the length of the spigot.

4.3.3.4 Location of steps

If a unit contains steps, these shall have a minimum projection of 120 mm from the concrete face. Vertical spacing within a finished structure shall relate to the internal height of the units (see Figure 4) and shall be within the range 250 mm to 350 mm, as stated in the factory documents. Single steps shall be fixed, with a tolerance of ± 10 mm, alternately at centres in vertical plan within the range 270 mm and 300 mm, as stated in the factory documents; double steps shall be fixed vertically above each other.

Dimensions in millimetres



4.1 - Plan: Double step in rectangular unit

4.2 - Plan: Single steps in circular or elliptical unit

4.3 - Elevation A-A

Key

1 Range 270 mm to 300 mm.

2 Range 250 mm to 350 mm.

NOTE Single or double steps can be used.

Figure 4 — Steps

4.3.3.5 Clear openings for man entry

Openings designed for man entry shall conform to the safety regulations or other provisions valid in the place of use of the units.

NOTE Safety requirements generally demand at least 600 mm diameter.

4.3.3.6 Tolerances on joint profiles

The profile of a joint shall conform to the corresponding design dimensions and tolerances stated in the factory documents. The effect of any other dimensional tolerances that affect the functioning of the joint shall be taken into account, as appropriate.

4.3.3.7 Pipe connections

The angular tolerances on prescribed locations of connections to vertical units shall be ± 3° horizontally; the tolerances on the levels of such connections shall be ± 15 mm, with no backfall between any inlet and outlet.

The minimum distance between the outer surface of two connecting pipes shall be equal to the wall thickness of the unit to which they are connected or 100 mm, whichever is the smaller.

4.3.4 Durability of joints between vertical units and connecting pipes or adaptors

The joint between a vertical unit and a connecting pipe or adaptor conforming to the requirements of EN 1916 shall also conform to the durability requirements of that standard.

4.3.5 Crushing strength of chamber and shaft units

A chamber or shaft unit shall withstand the minimum crushing load F_n corresponding to its nominal size and strength class when tested in accordance with 6.4 and in a vertical arrangement as described in A.4.2. At the manufacturer's discretion it is permissible for units to be tested in a horizontal arrangement as provided in A.4.1, in which case the specified minimum crushing load F_n shall be decreased by 20 % of the weight of the unit. For steel fibre and reinforced concrete units, see also 5.1.2 and 5.2.3 respectively.

4.3.6 Vertical strength of reducing units and capping units

4.3.6.1 General

Cover slabs, reducing slabs and capping units shall withstand a minimum vertical crushing load F_v when tested in accordance with 6.5. This requirement shall also apply to tapers with a vertical height of the sloping face less than (DN_{max} - DN_{min}) mm or (LN_{max} - DN_{min}) mm depending on whether the chamber has a circular or an elliptical shape, where (see Figure 3):

— DN_{max} or LN_{max} is the maximum opening of the taper;

— DN_{min} is the minimum opening of the taper.

For reinforced concrete slabs and reinforced capping units, see also 5.2.4.1.

4.3.6.2 Loading requirement

The minimum vertical crushing load F_v for units as described in 4.3.6.1 and to be installed in areas for all types of road vehicles shall be 300 kN.

For reinforced concrete slabs and reinforced concrete capping units, see also 5.2.4.2.

4.3.7 Installed steps

4.3.7.1 General

Steps installed by the manufacturer within a unit shall support a vertical load F_d and withstand a horizontal pull-out force F_I when tested in accordance with 6.9.

4.3.7.2 Loading requirements

When subjected to a vertical load F_d of 2 kN, the deflection under it shall be not greater than 5 mm for single steps and 10 mm for double steps, with a permanent deflection not greater than 1 mm for single steps and 2 mm for double steps.

Steps shall withstand a horizontal pull-out force F_l of 5 kN.

4.3.8 Watertightness

When tested in accordance with 6.6, and whether or not it contains steps, an individual vertical unit or a joint assembly shall not show any leakage or other visible defects during the test period; moisture adhering to the surface shall not constitute leakage. Vertical units having a design wall thickness greater than 125 mm shall not be subjected to the hydrostatic test.

4.3.9 Serviceability

Units conforming to this European Standard are at least suitable for use in humid conditions and a slightly aggressive chemical environment (i.e. normal conditions for domestic sewage and treated industrial effluent and for most soils and groundwaters). Special attention needs to be paid if more severe conditions are expected, primarily to the cement plus any pozzolanic or latent hydraulic addition in the concrete.

NOTE Definitions of "slightly aggressive" and more severe chemical environments can be found in national standards for concrete.

4.3.10 Durability

The durability of installed units and their joints is specifically ensured by the following requirements:

— a minimum strength of concrete where routine performance testing of the strength of units is not specified (see 4.2.2);

— a maximum water/cement ratio of the concrete (see 4.2.4);

— a maximum chloride content of the concrete (see 4.2.6);

— a maximum water absorption of the concrete (see 4.2.7);

— conformity to the criteria for demonstrating the durability of joints between vertical units and connecting pipes or adaptors (see 4.3.4);

— a minimum concrete cover in reinforced units (see 5.2.2).

5 Special requirements

Units shall conform to the following special requirements at the time of delivery.

5.1 Steel fibre concrete units

5.1.1 Steel fibre content

The amount of steel fibres introduced into the concrete shall be not less than that stated in the factory documents.

5.1.2 Crushing strength of chamber and shaft units

A steel fibre concrete chamber or shaft unit shall conform to the following sequence of test requirements:

— it shall withstand a proof load of 0,67 F_n appropriate to its nominal size and strength for one minute without showing any crack;

— the load shall be taken to ultimate (collapse) load F_u which shall be greater than F_n;

— after the sustained load has fallen to 0,95 % or less of the ultimate (collapse) load it shall be released, then reapplied to 0,67 F_n and supported for one minute.

5.2 Reinforced concrete units

5.2.1 Reinforcement

The reinforcement shall conform to 4.1.1 and the factory documents.

It is permissible for reinforcement to be used either helically wound or as concentric hoops, or an appropriate arrangement for slabs or for rectangular or elliptical units, or fabricated from steel fabric, securely connected.

Reinforcement shall be assembled by welding or splicing to control spacing and the shape of the reinforcement cage or matrix. The reinforcement cage(s) shall be maintained in the designed shape.

5.2.2 Concrete cover

The minimum concrete cover shall be consistent with the serviceability conditions described in 4.3.9.

5.2.3 Crushing strength of chamber and shaft units

In addition to the requirements of 4.3.5 a reinforced concrete chamber or shaft unit shall also withstand a proof (crack) load F_c of 0,67 F_n when tested in accordance with 6.4, with any stabilized surface crack in the tensile zones of the concrete being not greater than 0,3 mm over a continuous length of 300 mm or more, or the internal height of a unit, whichever is the smaller.

5.2.4 Vertical strength of cover slabs, reducing slabs and capping units

5.2.4.1 General

In addition to the requirements of 4.3.6 a reinforced concrete cover slab, reducing slab or capping unit shall, when tested in accordance with 6.5, withstand a vertical proof load F_p distributed around the access opening as shown in Figure B.1. The surface width of any residual crack after removal of the load shall not exceed 0,15 mm over a continuous length of 300 mm or more, or the full width of a concrete surface, whichever is the smaller.

The vertical strength of such units to be installed in areas other than those for all types of road vehicles shall, in addition to the requirements of 4.3.6, also be specified on the basis of vertical proof load F_p.

5.2.4.2 Loading requirement

The vertical proof load F_p for units as described in 5.2.4.1 and to be installed in areas for all types of road vehicles shall be 120 kN.

5.2.5 Conformity of proof (crack) load tested units

Reinforced concrete units tested only to proof (crack) load in accordance with 6.4 or 6.5 and meeting the requirements of 5.2.3 or 5.2.4 as appropriate conform to this European Standard.

5.2.6 Loading requirements for units not subject to 5.2.3 or 5.2.4

The evaluation of the structural strength of tapers with a vertical height of the sloping face greater than, or equal to, (DN_{max} - DN_{min}) mm or (LN_{max} - DN_{min}) mm and base units shall be carried out in accordance with the technical provisions of relevant national standards, valid in the place of use of the units.

NOTE 1 Complementary requirements at national level (see the foreword) should list the specific technical provisions of relevant national standards that are to apply. It is not sufficient, for example, to refer simply to the national standard for the design of precast concrete elements.

NOTE 2 Adjusting units are excluded from the requirements of this clause because they are wholly in compression when installed (see Figure 1).

6 Test methods for finished products

6.1 General

6.2 to 6.9 inclusive shall apply to all units, unless stated otherwise in Table 5 for conformity evaluation.

Table 5 — Summary of test requirements

Clause	Requirement where specified	Vertical units			Cover slabs, reducing slabs and tapers (reducing units)	Adjusting units
		Chamber and shaft units	Base units	Capping units		
4.2.2.1	Drilled core strength[a]	-	T/R	T/R	T/R[b]	T/R
4.2.7.1	Water absorption	T/R	T/R	T/R	T/R	T/R
4.3.2	Visual inspection of finish	T/R	T/R	T/R	T/R	T/R
4.3.3	Geometrical characteristics:					
	- units	T/R	T/R	T/R	T/R	T/R
	- joint profiles	T/R	T/R	T/R	T/R	-
4.3.5	Crushing strength	T/R	-	-	-	-
4.3.6	Vertical strength	-	-	T/R	TR[c]	-
4.3.7	Installed steps	T/R	T/R	T/R	T/R	-
4.3.8	Watertightness:					
	- hydrostatic	T/R[d]	T/R[d]	T/R[d]	-	-
	- individual joint assemblies	T/R	T/R	T/R	T/R	-
	- joint between a vertical unit and a connecting pipe or adaptor	T/R	T/R	-	-	-
5.2.1	Reinforcement	T/R	T/R	T/R	T/R	T/R
5.2.2	Concrete cover	T/R	T/R	T/R	T/R	T/R

T means initial type test;

R means routine inspection test;

a means only applicable to units whose conformity is not specified in this European Standard to be verified by routine performance testing

b means only applicable to tapers with a vertical height of the sloping face greater than, or equal to, $(DN_{max} - DN_{min})$ mm or $(LN_{max} - DN_{min})$ mm;

c means not applicable to tapers with a vertical height of the sloping face greater than, or equal to, $(DN_{max} - DN_{min})$ mm or $(LN_{max} - DN_{min})$ mm

d means not applicable to units with a design wall thickness > 125 mm

6.2 Joint profiles

The critical dimensions of joint profiles and their respective tolerances shall be evaluated for conformity to the factory documents.

6.3 Reinforcement

A section shall be cut from an undamaged part of a reinforced concrete unit that has been tested to collapse as required under a routine or initial type test, to enable the reinforcement to be examined and the concrete cover evaluated for conformity to 5.2.1 and 5.2.2.

6.3.1 Placing and content of reinforcement

The spacing and content of circumferential bars in vertical units and the reinforcement in other units shall be measured over a length of at least 1 metre or the internal height of the unit, whichever is the smaller, then evaluated for conformity to the factory documents and 5.2.1.

Longitudinal reinforcement (if any) shall be evaluated for conformity to the factory documents.

6.3.2 Concrete cover

The reinforcement shall be exposed, the concrete cover measured, and the minimum recorded to the nearest millimetre. The cover shall then be evaluated for conformity to 5.2.2.

6.4 Crushing strength of chamber and shaft units

The crushing strength of chamber and shaft units shall be determined in accordance with the relevant method specified in annex A.

6.5 Vertical strength of reducing units and capping units

The vertical crushing strength of reducing units and capping units shall be determined in accordance with the relevant method specified in annex B.

6.6 Watertightness

Watertightness of individual vertical units, and of individual joint assemblies, shall be determined in accordance with the methods specified in annex C.

6.7 Water absorption

Water absorption shall be determined in accordance with the method specified in annex D.

6.8 Concrete strength in base units, capping unit walls, adjusting units and certain tapers

Compressive strength shall be determined in accordance with ISO 4012. The test shall be carried out by drilling a sample from each third-point along the internal height of base units, capping unit walls and tapers as required by Table 5 (i.e. two samples from each unit), and one at each quarter point around the circumference or perimeter of adjusting units. In each case the mean value of the results shall be calculated.

Tests shall be carried out on drilled cores with a height equal to their diameter ± 10 mm:

— when 100 mm ± 1 mm diameter cores are used, the result shall be applied without any conversion factor;

— when 50 mm ± 1 mm diameter cores are used, a conversion factor of 0,9 shall be applied to the results.

Linear interpolation for intermediate diameters of core is permissible.

6.9 Installed steps

The resistance of installed steps to vertical loading and horizontal pull-out force shall be determined in accordance with the methods specified in annex E.

7 Conformity evaluation

7.1 General

The manufacturer's quality assurance system shall be as specified in annex F.

NOTE 1 It is recommended that conformity to this European Standard should be demonstrated by means of product certification by an approved certification body complying with the requirements of EN 45011. However, attention is drawn to Table ZA.2 regarding the clauses to which the EU Commission's decision on the level of attestation of conformity applies for the purposes of CE marking, within the context of the Construction Products Directive (89/106). In order not to submit the manufacturer to a double procedure, the Commission has declared that the more severe procedure, if applied, can satisfy the less severe one reported and applying as described in ZA.2.

NOTE 2 When units are certified by an approved certification body (and in accordance with EN 45011) receiving inspection by, or on behalf of, the purchaser is not necessary, except for the marking.

7.2 Product evaluation procedures

7.2.1 General

The procedures are as follows:

1) initial type testing of units;

2) factory production control;

3) further testing of samples in accordance with a sampling plan prescribed in this European Standard.

7.2.2 Initial type testing

Initial type testing shall be undertaken to show conformity to this European Standard. Tests previously performed in accordance with the requirements of this standard (same product or specified product grouping, same characteristics, same method of sampling and same or more demanding test) may be taken into account. Initial type testing shall also be undertaken:

— at the start of production of a new type;

— whenever there is a significant change in design, type of material or method of manufacture.

The initial type test consists of taking samples (as indicated in Tables G.1 and G.2) from the production line and subjecting them to the relevant test(s). To satisfy the requirements of the initial type test, all samples shall conform to the requirements of this European Standard.

The results from initial type tests shall not be included for the purposes of routine inspection.

When the manufacturer's test equipment is officially calibrated, initial type testing shall normally be carried out with that equipment.

7.2.3 Factory production control

Factory production control shall be based on a quality assurance system as described in annex F.

7.2.4 Further testing of samples taken at the factory

Conformity to this European Standard shall be demonstrated by taking samples during initial type testing and at further routine inspection as described hereinafter. Tests shall be carried out on the samples at the minimum age declared by the manufacturer for conformity to this European Standard.

For routine crushing and watertightness (vertical unit hydrostatic) tests, the manufacturer shall use continuous inspection for each type, nominal size and strength of unit in accordance with the provisions of annex H.

7.2.5 Tasks for a certification body

Where conformity to this European Standard is to be demonstrated by means of product certification by an approved certification body, the tasks for that body shall be as specified in annex I.

8 Marking

Each unit or, where this is not practicable, each package of units, shall be marked indelibly and in a clearly visible manner. Identification of the unit(s) shall be made in such a way that no doubt is possible.

Marking shall include the following minimum information:

a) the manufacturer's name, trade mark or identification mark, and site of production;

b) the number of this European Standard, EN 1917;

c) the date of manufacture;

d) identification of material of unit;

e) identification of any third party certification body;

f) strength class or specified minimum vertical crushing load (each as confirmed by annex H);

g) identification of serviceability conditions other than normal;

h) identification of special use, where applicable.

NOTE Where the marking requirements of ZA.3 require the same information as this clause, the requirements of this clause are met.

Annex A
(normative)

Test method for crushing strength of chamber and shaft units

A.1 Principle

The purpose of this test is to evaluate the relevant crushing strength of a chamber or shaft unit. For an initial type test and when using continuous inspection, see Table A.1. The reference test for crushing strength shall always be in accordance with this annex, whether an unreinforced concrete unit has been inspected in accordance with annex J, or a reinforced unit has been subjected to basic inspection (see H.1.1).

Table A.1 — Prescribed crushing strength tests for chamber and shaft units

Crushing strength	Unreinforced concrete units (in accordance with annex H)		Steel fibre concrete units	Reinforced concrete units	
	not using annex J option	Using annex J option		Regular inspection[a]	Basic inspection[a]
Proof, F_c = 0,67 F_n	-	-	T/R	T/R	-
Proof, F_c = 0,8 F_n	-	-	-	-	T/R
Ultimate (collapse), F_u	T/R	T/R	T/R	T/R	-
1,2 F_n	-	-	-	-	T/R
Minimum crushing, F_n	-	T/R	-	-	-
0,67 F_n re-applied	-	-	T/R	-	-
T Means initial type test;					
R Means routine (continuous) inspection test;					
[a] See H.1.1.					

A.2 Apparatus

The apparatus shall consist of a testing machine capable of applying the full test load without shock or impact and with an accuracy of 3 % of the specified test load. The testing machine shall be equipped with a load-recording facility.

A.3 Preparation

At the manufacturer's discretion it is permissible to soak the unit for a maximum of 28 hours before testing.

A.4 Procedure

A.4.1 Horizontal arrangement

Circular units shall be positioned in the testing machine as shown in Figure A.1a and be supported and loaded through rigid bearers placed parallel to the unit's longitudinal axis. The bearers may be continuous or segmented.

The centroid of the load shall be at a distance of $h/2$ from the outside face of the socket and the load shall be distributed uniformly as shown in figure A.1a. At the manufacturer's discretion it is permissible for the loaded length of the unit used in the test to extend over the socket. When using segmented bearers the loaded length shall be not less than 40 % of the internal height.

For circular units the load shall be applied through one top bearer. The bottom bearer shall be formed as a V-shaped support with an included angle (β) of 150° ± 3° as shown in Figure A.1a.

Elliptical and rectangular units shall be positioned in the testing machine as shown in Figures A.1a and A.1b respectively. For such units having uniform wall thickness and uniform steel content and positioning, the test shall only be carried out with the shortest wall or axis vertical; otherwise the test shall be carried out with units in both attitudes.

The elastomeric material for bearers shall have a mean hardness of 50 IRHD ± 5 IRHD with a thickness of 20 mm ± 5 mm.

Any bearing strips shall have a maximum width as decided by the manufacturer and in accordance with Table A.2, except for V-shaped bearers for which there is no limit.

At the manufacturer's discretion it is permissible for elastomeric bearing strips to be replaced by gypsum or sulfur, provided that their widths do not exceed the values given in Table A.2.

Table A.2 — Maximum width of bearing strips

Size or width of unit DN or WN	Maximum width mm
DN/WN ≤ 400	50
400 < DN/WN ≤1 250	100

A.4.2 Vertical arrangement

Circular units shall rest on a level base as shown in Figure A.2 and shall be supported and loaded through rigid bearers. The bearers shall consist of a back member, being a rigid beam on which two bearing strips are symmetrically disposed, parallel to a plane passing through the longitudinal axis of the unit; and a front member, also being a rigid beam, on which one bearing strip is centred and disposed so that it lies in the plane passing through the longitudinal axis of the unit.

An equivalent arrangement shall be used for rectangular and elliptical units, the latter being tested in a vertical arrangement by applying the load horizontally through the minor axis.

The load shall be applied through the front bearer in such a way that the bearer is free to rotate in a horizontal plane through the longitudinal centre-lines of the front and back bearers.

A low carbon steel plate to face the inside flange of the back beam shall be used. The facing shall be straight and free of warping or twisting and be centrally and permanently located on the flange of the beam. The cross-section of the facing shall be rectangular, 330 mm x 25 mm minimum, without a joint and with the addition of steel wedge strips attached to it as shown in figure A.2.

The bearing strips shall consist of elastomeric material having a mean hardness of 50 IRHD ± 5 IRHD; of rectangular cross-section, width 150 mm and thickness 20 mm ± 5 mm.

The two back bearing strips shall be parallel and 25 mm apart.

All bearing strips shall remain firmly fixed in position while carrying the specified load. If wood or metal strips are used along the edges of the bearing strips to hold them in position, the thickness of each positioning strip shall not exceed half the thickness of the bearing strip.

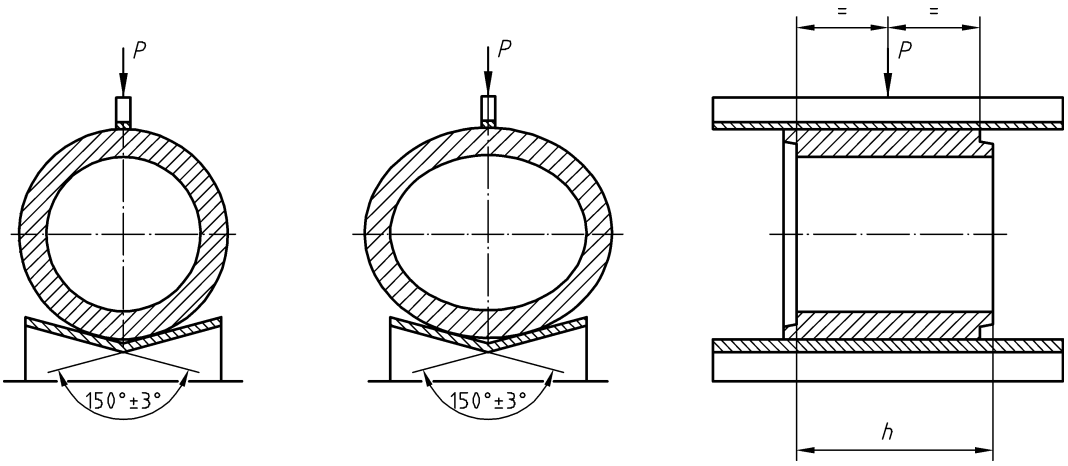


Figure A.1a

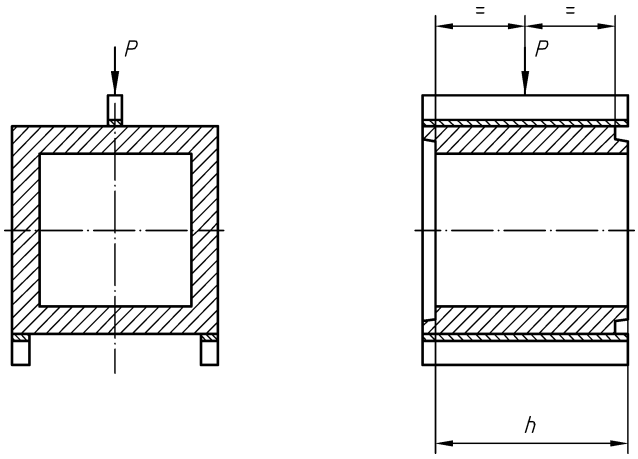
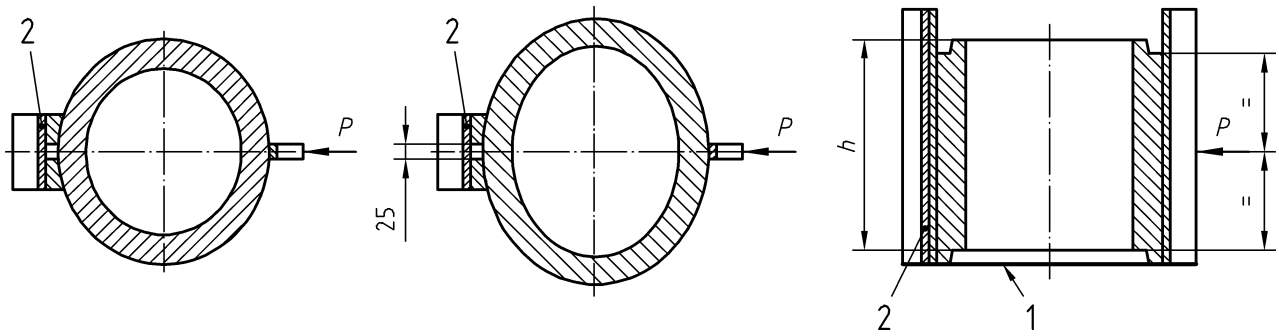


Figure A.1b

Figure A.1 — Crushing test on units in a horizontal arrangement



Key

1 Sheet material to permit any sliding or removable support

2 Low carbon steel facing plate, 330 mm x 25 mm minimum cross-section

Figure A.2 — Crushing test on units in a vertical arrangement

A.4.3 General

A.4.3.1 Loading

The load shall be applied ensuring that loading is continuous up to the test load specified in A.4.3.2, A.4.3.3 or A.4.3.4 as appropriate. During application of the specified test load, it shall be increased at a rate between 20 kN/m and 25 kN/m per minute, but no adjustments in the controls of the testing machine shall be made while any unit begins to deform rapidly prior to ultimate collapse.

A.4.3.2 Unreinforced concrete units

Where the manufacturer opts not to inspect crushing strength in accordance with annex J, the load shall be taken to the ultimate (collapse) load and a record made of that load. Where inspection is in accordance with annex J for a specific process, the load shall be taken to the minimum crushing load or the ultimate (collapse) load, as appropriate, and a record made of whether the unit withstood the former, or the latter load, as the case may be.

A.4.3.3 Steel fibre concrete units

The load shall be taken to the specified proof load, held for one minute, and the unit inspected for any crack. The result of that inspection shall be recorded. If no crack is found the load shall then be taken to the ultimate (collapse) load and a record made of that load. After the sustained load has fallen to 95 % (or less) of the recorded load it shall be released, re-applied to 0,67 times the specific minimum crushing load, held for one minute and a record made of whether the unit withstood the reapplied load for that time.

A.4.3.4 Reinforced concrete units

The load shall be taken to the specified proof (crack) load and held. Any crack that occurs shall be measured on the surface, optically by a magnifier or equivalent, after three to five minutes and again at intervals of one to two minutes with the load held at the specified proof (crack) load in order to ensure that it has stabilized. The crack shall be judged to have stabilized when two of these consecutive measurements are the same. The results of each inspection shall be recorded. For the initial type test, and where required by Table H.1, the load shall then be increased to the ultimate (collapse) load and a record made of that load.

Where the manufacturer opts for basic inspection of crushing strength for a specific process (see H.1.1), the load shall be increased only to 1,2 times the minimum crushing load F_n instead of the ultimate (collapse) load F_u and the proof (crack) load F_c shall be increased from 0,67 F_n (see 5.2.3) to 0,8 F_n.

A.5 Expression of results

The test result shall be expressed as the total load according to the manufacturer's chosen and recorded testing arrangement, divided by the internal height.

The effective test result F_a shall be obtained from the following formula:

$$F_a = (P + P^*)/h$$

where

F_a is the effective test result, in kilonewtons per metre;

h is the internal height, in metres;

P is the measured test load, in kilonewtons;

P^* is the effective self-weight of the load bearer(s), in kilonewtons.

Annex B
(normative)

Test methods for vertical strength of reducing units and capping units

B.1 Principle

The purpose of these tests is to evaluate the vertical strength of reducing units and capping units.

B.2 Apparatus

The apparatus shall consist of steel or cast iron plates, through which the specified load is applied to the unit whilst it is supported around its perimeter. The width of beddings in contact with the unit shall correspond to the conditions that would be achieved in the structure for which the unit was designed.

B.3 Preparation

The unit shall be bedded on elastomeric material with a mean hardness of 50 IRHD ± 5 IRHD with a thickness of 20 mm ± 5 mm; alternatively, at the manufacturer's discretion, it shall be bedded on a layer of cement mortar or gypsum. At the manufacturer's further discretion, a taper may be positioned together with its appropriate seal on a chamber unit with which it was designed to fit.

Steel or cast iron loading plates shall be faced on their underside with elastomeric material as specified for the bedding.

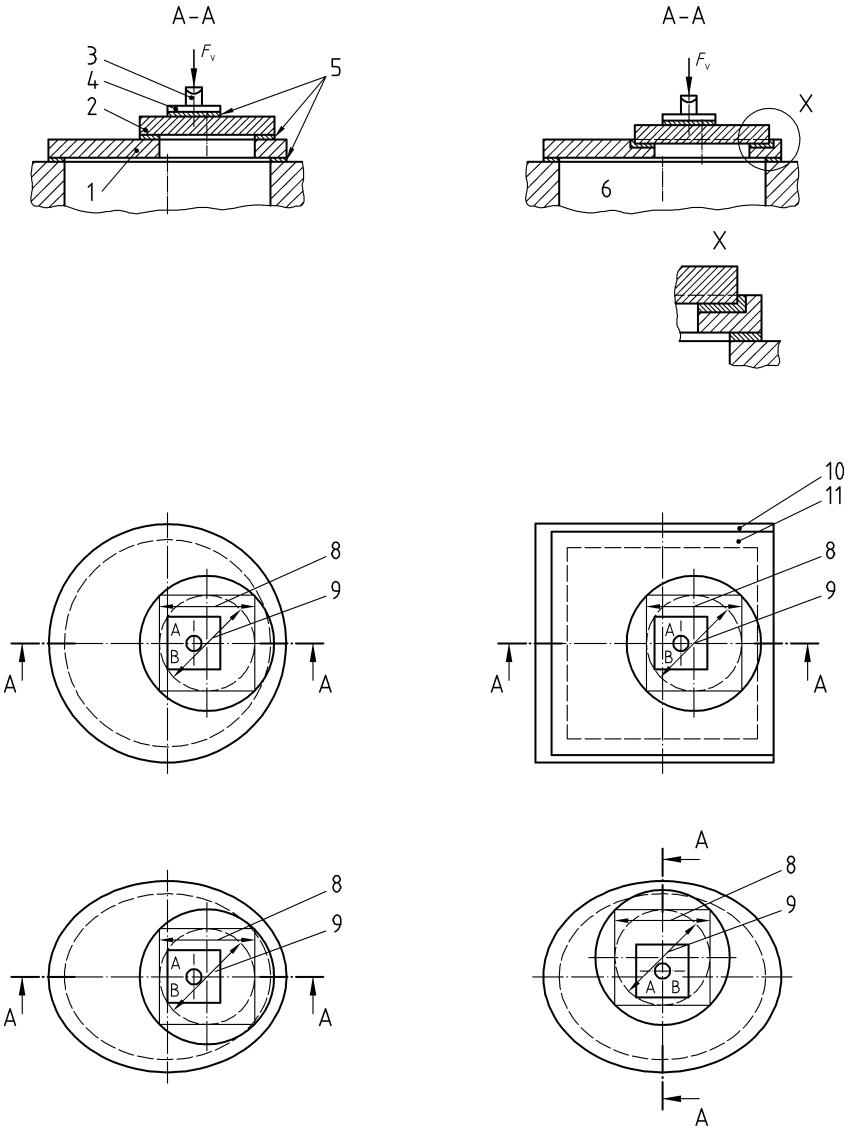
B.4 Procedure

B.4.1 Unreinforced and steel fibre concrete units

A unit as specified in 4.3.6 shall be supported as described in B.3 and the relevant minimum vertical crushing load F_v shall then be applied vertically over the opening as shown in Figure B.1 or B.2 as appropriate, ensuring that loading is continuous up to the ultimate (collapse) load F_u and without shock. A record shall then be made of that load.

B.4.2 Reinforced concrete units

Reinforced concrete cover slabs, reducing slabs and capping units shall be supported as described in B.3 and the relevant vertical proof load F_p shall be applied vertically over the opening as shown in Figure B.1, ensuring that loading is continuous up to the specified load and without shock. The load shall then be removed and any residual crack measured on the surface, optically by magnifier or equivalent. For an isolated initial type test and where required by the relevant sampling procedures, the load shall be taken continuously up to the ultimate (collapse) load F_u without shock and a record made of that load.

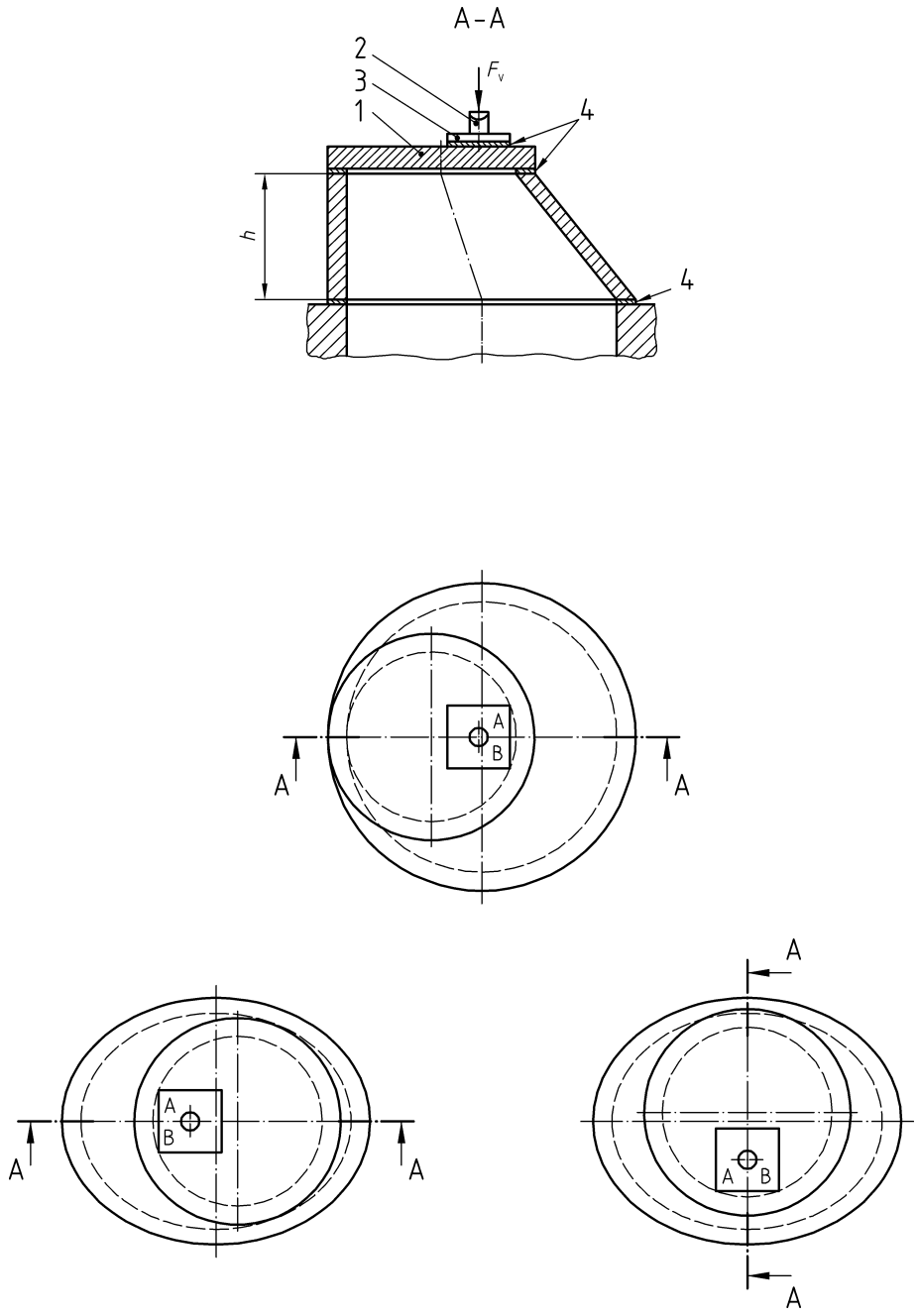


Key

1 Slab
2 Steel or cast iron plate
3 Ball and socket
4 Loading plate 300 mm x 300 mm
5 Bedding
6 Slabs can incorporate a rebate, in which case packers shall be provided in the test
7 Packers
8 Square opening
9 Circular opening
10 Rectangular slab
11 Square slab

NOTE Side AB of the loading plate forms a 300 mm chord to the circular opening, or to the inscribed circle of a square opening

Figure B.1 — Vertical strength tests for capping units, cover slabs and reducing slabs



Key

1 Steel or cast iron plate

2 Ball and socket

3 Loading plate 300 mm x 300 mm

4 Rubber or gypsum, thickness 20 mm ± 5 mm

NOTE Side AB of the loading plate forms a chord to the circular opening.

Figure B.2 — Vertical strength test for certain tapers

B.5 Expression of results

B.5.1 Vertical crushing load tests

A record shall be made of whether the ultimate (collapse) load was greater than the minimum vertical crushing load.

B.5.2 Vertical proof load tests

A record shall be made of whether the unit had any residual crack as described in 5.2.4.1 after removal of the vertical proof load.

Annex C
(normative)

Test methods for watertightness

C.1 Principle

The purpose of these tests is to evaluate whether an individual vertical unit, or an individual joint assembly, remains watertight under specified internal hydrostatic pressure. The hydrostatic test is not applicable to vertical units having a design wall thickness greater than 125 mm.

C.2 Apparatus

The apparatus for each test shall enable the unit(s) to be securely clamped, shall allow closure of the ends or openings by appropriate devices and shall be capable of applying the specified internal hydrostatic test pressure for the requisite period of time. The pressure shall not exceed that specified by more than 10 % and shall not be less. For the joint assembly test, the apparatus shall accommodate two units, jointed as stated in the factory documents.

C.3 Preparation

At the manufacturer's discretion it is permissible to soak the units for a maximum of 28 hours before testing and, prior to carrying out the test, he shall record whether this option was exercised. The external surface of units shall be sufficiently dry to let any possible tightness defects appear.

C.4 Procedure (vertical unit hydrostatic test - routine and initial type tests)

The unit shall be clamped securely in the apparatus, its ends and any connecting pipe(s) or adaptors closed, and then filled with water, taking care to ensure that all the air is removed. The internal hydrostatic pressure shall then be raised gradually to the relevant level as follows:

— 40 kPa (0,4 bar or approximately 4 metre water column) for the base unit of an inspection chamber and 30 kPa (0,3 bar or approximately 3 metre water column) for chamber, shaft and capping units of inspection chambers;

— 50 kPa (0,5 bar or approximately 5 metre water column) for manhole base, chamber, shaft and capping units.

When units are tested in a vertical arrangement, the hydrostatic pressure shall be measured to the plane of the upper joint, except that where a base unit has one or more connecting pipes or adaptors it shall be measured from the lowest centre-line of any connection. When a chamber, shaft or capping unit is tested in a horizontal arrangement, the hydrostatic pressure shall be measured to the lowest possible axis of the unit.

The internal hydrostatic pressure shall be maintained for a period of 15 minutes, during which time the unit shall be evaluated for conformity to 4.3.8, before reducing the internal pressure to zero.

C.5 Procedure (joint assembly test)

The two units shall be assembled in the apparatus with a joint seal or sealing material as stated in the factory documents and closed at their ends or openings. Where the manufacturer proposes to carry out routine measurement of joints (see Table G.2), the initial type test shall be carried out by assembling the units using the

most unfavourable combination of permitted tolerances. Whilst filling the assembly with water, care shall be taken to ensure that all the air is removed.

An internal hydrostatic pressure of 30 kPa (0,3 bar or approximately 3 metre water column) shall be applied for inspection chamber units, and 50 kPa (0,5 bar or approximately 5 metre water column) for other units, and maintained for a period of 15 minutes, during which time the joint assembly shall be evaluated for conformity to 4.3.8, before reducing the internal pressure to zero.

When tested in a vertical arrangement, the hydrostatic pressure shall be measured to the plane of the joint between the units; when tested in a horizontal arrangement, the hydrostatic pressure shall be measured to the lowest possible axis of the jointed units.

C.6 Alternative procedure for assembled structures

At the manufacturer's discretion it is permissible to combine the procedures specified in C.4 and C.5 by assembling a complete structure from units to be tested and simultaneously applying the relevant internal hydrostatic pressure to those units.

C.7 Procedure (joint between a vertical unit and a connecting pipe or adaptor)

C.7.1 General

The vertical unit and the connecting pipe(s) or adaptor(s) shall be assembled in the apparatus with any necessary joint seal(s) and closed at their ends. Whilst filling the assembly with water prior to testing, care shall be taken to ensure that all the air is removed.

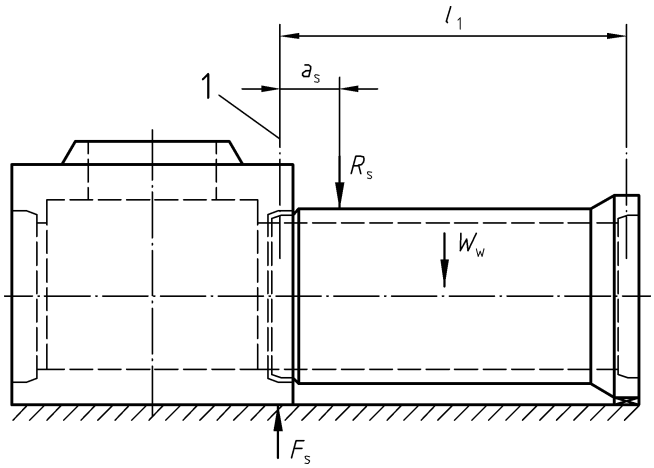
C.7.2 Watertightness during angular deflection

The connecting pipe(s) or adaptor(s) shall be deflected to an angular deflection of 12 500/DN (or 12 500/WN, as appropriate to the shape of the bore of the connecting pipe(s) or adaptor(s)) in millimetres per metre or 50 millimetres per metre, whichever is the smaller, taking care to ensure that no structural damage is caused. In the case of an egg-shaped connecting pipe or adaptor the deflection shall be in the vertical plane. During this operation the joint gap(s) shall be prevented from closing at any point by, for example, interposing at the appropriate place(s) a packing with a thickness equal to the mean value of the clearance stated in the factory documents.

An internal hydrostatic pressure of 30 kPa (0,3 bar or approximately 3 metre water column) shall be applied for inspection chamber units, and 50 kPa (0,5 bar or approximately 5 metre water column) for other units, and maintained for a period of 15 minutes, during which time the joint assembly shall be evaluated for conformity to 4.3.8, before reducing the internal pressure to zero.

C.7.3 Watertightness under shear load

The joint assembly shall be supported as shown in Figure C.1.



Key

1 Centre-line of joint seal

Figure C.1 — Shear load test

If an additional load R_s is required to generate a reaction equal to the shear load F_s (see Figure C.1) it shall be applied vertically as close as possible to the face of the base unit at a rate of approximately 10 kN per minute. The value of R_s shall be calculated according to the following formula:

$$R_s = (F_s - W_w/2) \times l_1/(l_1 - a_s) \geq 0, \text{ in kilonewtons}$$

where

W_w is the weight of the connecting pipe or adaptor filled with water, in kilonewtons

The load shall be transmitted by means of a V-shaped bearer with a minimum included angle of 120°, length 100 mm. At the manufacturer's discretion it is permissible to equip the bearer with a layer of elastomeric material having a maximum thickness of 20 mm and a mean hardness not less than 45 IRHD.

An internal hydrostatic test pressure of 30 kPa (0,3 bar or approximately 3 metre water column) shall be applied for inspection chamber units, and 50 kPa (0,5 bar or approximately 5 metre water column) for other units. A shear load F_s in kilonewtons of 0,03 times DN or WN, as appropriate to the shape of the bore of the connecting pipe(s) or adaptor(s), shall then be applied and maintained for a period of 15 minutes, during which time the joint assembly shall be evaluated for conformity to 4.3.8, before reducing the internal pressure to zero.

C.7.4 Watertightness during angular deflection under shear load

As an alternative to testing separately for angular deflection and shear load in accordance with C.7.2 and C.7.3 respectively, at the manufacturer's discretion it is permissible to combine the two tests.

The combined test shall consist of a watertightness test during angular deflection in accordance with C.7.2 and at the same time a shear load test in accordance with C.7.3, except that the shear load F_s in kilonewtons shall be 0,01 times DN or WN, as appropriate to the bore of the connecting pipe(s) or adaptor(s). The angular deflection and shear load shall be applied in the same plane and in the same direction.

When the specified angular deflection is reached, the shear load procedure shall begin and the internal hydrostatic pressure then applied in accordance with C.7.2 and C.7.3.

This situation shall be maintained for a period of 15 minutes, during which time the joint assembly shall be evaluated for conformity to 4.3.8, before reducing the internal pressure to zero.

C.8 Expression of results

A record shall be made of the test method used and whether the individual vertical unit or individual joint assembly conformed to the specified requirement.

Annex D
(normative)

Test method for water absorption

D.1 Principle

The purpose of this test is to evaluate the water absorption of hardened concrete by immersion, which is defined as the difference between the mass of a given sample immersed in water and the mass of the same sample when dried, expressed in terms of the mass of the dry sample.

D.2 Sample

The sample shall have a mass of not less than 2 kg and not more than 4 kg when cut from a hardened unit.

D.3 Apparatus

The apparatus shall consist of a ventilated oven controlled at 105 ^{o}C ± 5 ^{o}C and scales sensitive to 0,05 % of the sample's mass.

D.4 Procedure

D.4.1 Determination of mass of immersed sample m_1

The sample shall be brought to a temperature of 20 °C ± 3 °C, then immersed in tap water at the same temperature until a constant mass has been reached. This shall be achieved in stages by successively immersing the sample at intervals of one hour to approximately 1/3 of the height, approximately 2/3 of the height and the total height, with a final water level of 20 mm above the top surface of the sample.

The constant mass m_1 shall be assumed to have been achieved when two weighings, 24 hours ± 1 hour apart, result in a difference in mass smaller than 0,1 % of the mean value of the mass of the immersed sample.

The surface of the sample shall be dried before each weighing, for example by a sponge (wet and squeezed) so as to remove all surface water.

D.4.2 Determination of mass of dried sample m_2

The sample shall be dried to constant mass in a ventilated oven at a temperature of 105 °C ± 5 °C.

NOTE It is recommended to check that the capacity and ventilation of the oven are sufficient to dry the number of samples placed in it. Wet samples should not be placed in the oven before earlier samples have been completely dried.

After cooling the sample to 20 °C ± 3 °C the mass m_2 shall be determined. The state of constant mass m_2 shall be assumed to have been reached when two weighings at least 24 hours apart result in a difference smaller than 0,1 % of the mean value of the mass of the dry sample.

D.5 Expression of results

The absorption of water by immersion A_w expressed in per cent to two decimal places, is obtained from the following expression and recorded.

$A_w = 100 \times (m_1 - m_2)/m_2$

where

m_1 is the constant mass of immersed sample;

m_2 is the constant mass of dry sample.

Annex E
(normative)

Test methods for installed steps

E.1 Principle

The purpose of these tests is to evaluate the resistance of installed steps to vertical loading and a horizontal pull-out force.

E.2 Apparatus

E.2.1 Vertical loading test

The apparatus shall consist of:

— a test block capable of distributing the load evenly over a length of 90 mm ± 5 mm;

— a device capable of applying a load at least 25 % greater than F_d. The device shall have an accuracy of ± 3 % of the load applied;

— a device suitable for measuring deflection, with an accuracy of ± 0,5 mm.

E.2.2 Horizontal pull-out test

The apparatus shall consist of:

— a test block capable of distributing the force evenly over a length of 90 mm ± 5 mm;

— hydraulic or mechanical equipment capable of exerting a force in excess of F_l and with a means of measuring the force. The testing device shall have an accuracy of ± 3 % of the applied force.

E.3 Preparation

The step shall be fixed in a unit in accordance with the method stated in the factory documents and left until the fixing material has hardened.

E.4 Procedure

E.4.1 Vertical loading test

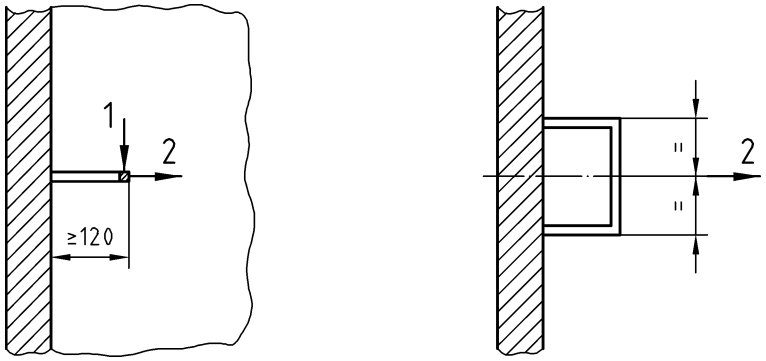
A datum shall be established at the centre of the step tread from which to measure deflection.

The load shall then be applied centrally and normal to the tread as shown in Figure E.1 at a rate of 1 kN per minute to 3 kN per minute. The deflection at the test load shall be noted after the load has been held for 1 minute. The load shall then be removed and a reading taken at the centre of the tread.

Both readings of the deflection shall be recorded.

E.4.2 Horizontal pull-out test

The pull-out force shall be applied at the centre of the front tread of the step as shown in Figure E.1 in a maximum elapsed time of 60 seconds, without shock, and sustained for 1 minute.



Key

1 Vertical load

2 Pull-out force

Figure E.1 — Test arrangements for vertical loading and horizontal pull-out

E.5 Expression of results

E.5.1 Vertical loading test

A record shall be made of the deflection under the vertical load and the permanent deflection after its removal.

E.5.2 Horizontal pull-out test

A record shall be made of whether the step withstood the horizontal pull-out force.

Annex F
(normative)

Manufacturer's quality assurance system

F.1Organization

F.1.1 Responsibility and authority

The responsibility, authority and the interrelation of all personnel who manage, perform and verify work affecting quality shall be defined, particularly for personnel who need the organizational freedom and authority to:

— initiate action to prevent the recurrence of defectives;

— identify and record any product quality problem.

F.1.2 Management representative for factory production control

The manufacturer shall appoint a person who, in addition to any other duties, shall have the appropriate authority, knowledge and experience of the production of units to be responsible for conducting and supervising factory production control procedures and for ensuring that the stated requirements are implemented and maintained.

F.1.3 Management review

The production control system adopted to satisfy the requirements of this annex shall be reviewed by the manufacturer's management at the intervals specified in the factory documents to ensure its continuing suitability and effectiveness. Records of such reviews shall be maintained.

F.1.4 Factory documents

Factory documents shall include the following specifications as appropriate:

— joints between vertical units (4.1.2/C.2/C.5);

— characteristic concrete compressive strength (4.2.2);

— internal height of vertical units and tapers (4.3.3);

— wall thickness of tapers and base units (4.3.3);

— vertical spacing of steps (4.3.3);

— dimensions and tolerances of joint profiles (4.3.3/6.2) and seals and frequency of measurement (G);

— steel fibre content (5.1.1);

— reinforcement (5.2.1/6.3.1/F.9);

— installation of steps (E.3);

— intervals for review of production control system (F.1.3);

— whether regular or basic inspection used for crushing strength of reinforced concrete chamber and shaft units (H.1.1);

— bending tensile stresses (J);

— geometry of unit cross-section (J).

F.2 Factory production control system

The manufacturer shall establish and maintain a documented factory production control system as a means of ensuring that units conform to the specified requirements. Particular attention shall be paid to the following aspects:

— the preparation of documented factory production control system procedures and instructions in accordance with the requirements of this European Standard;

— the effective implementation of the documented factory production control system procedures and instructions.

F.3 Inspection and testing

F.3.1 General

All necessary facilities, equipment and personnel shall be available to carry out the necessary inspections and tests. This requirement may also be fulfilled if, by means of a contract, the manufacturer or his agent employs a subcontractor (whilst retaining prime responsibility) having the necessary facilities, equipment and personnel. All test and measuring equipment shall be calibrated, inspected and maintained such that the conformity of units to the specified requirements can be demonstrated. Documentation and certificates for this equipment shall be made available. Equipment shall be used in a manner which ensures that measurement uncertainty is known and is consistent with its ability to measure the requirement.

F.3.2 Inspection and test status

Where appropriate, the inspection and test status of units shall be identified by means which indicate their conformity or nonconformity with regard to inspections and tests performed.

It is permissible to complete the marking of units during production, provided any certification mark and the EN number are deleted on defectives.

F.3.3 Testing

Testing shall be performed in accordance with the test methods specified in this European Standard.

F.3.4 Inspection and test records

The results of factory production control shall be recorded in a satisfactory manner. The log(s) shall contain a record of the description of the units, the date of manufacture, the testing method, the test results, the limits used and the signature of the person carrying out the inspection.

Where inspected units do not conform to this European Standard, or if there is an indication that they do not do so, a note shall be made in the manufacturer's log(s) as to the steps taken to deal with the situation (e.g. carrying out of a new test and/or measures to correct the specific process).

The manufacturer's log(s) shall be kept for at least five years.

F.3.5 Complaints

Details of all complaints received relating to the quality of units shall be recorded in a satisfactory manner. The log(s) shall contain a record of the description of the units, identification of the site, the date of manufacture, the nature of the complaint and the resultant action taken.

F.4 Action required in the case of defectives

F.4.1 Unsatisfactory results

If the result of a test on or inspection of a unit is unsatisfactory, the manufacturer shall immediately take the steps necessary to rectify the shortcoming. When the shortcoming has been rectified, the relevant test or inspection shall be repeated without delay, provided that this is technically possible and is necessary as evidence of rectification.

F.4.2 Defectives

Defectives (being units that do not conform to one or more requirements of this European Standard) shall be segregated and marked accordingly.

F.4.3 Purchaser information

Notification shall be made to purchasers if necessary for the purpose of avoiding any consequential damage, if units have been dispatched before the test results are available. If units have been delivered and the next determination of acceptability after their manufacture rejects production, the manufacturer shall notify each purchaser of units manufactured and delivered since the preceding determination that the conformity of those units cannot be ensured.

F.5 Handling, storage, packing and delivery of units

F.5.1 General

The manufacturer shall establish, document and maintain procedures where applicable for the handling, storage, packing and delivery of units.

F.5.2 Handling

The manufacturer shall use methods of handling that prevent damage or deterioration.

F.5.3 Storage

The manufacturer shall provide secure storage areas to prevent damage or deterioration of products before delivery.

F.5.4 Packing and marking

The manufacturer shall control packing, preservation and marking processes (including materials used) to the extent necessary to ensure conformity to this European Standard.

F.5.5 Traceability

Delivered units or groups of units shall be definitively identifiable and traceable with regard to their production data. For this purpose, the manufacturer shall establish and maintain the records required in the relevant technical specification, and shall mark the units or their delivery documents accordingly.

F.6 Training and personnel

The manufacturer shall establish and maintain procedures for the training of all personnel activities affecting quality. Personnel performing specific assigned tasks shall be qualified on the basis of appropriate education, training and/or experience as required. Appropriate training records shall be maintained.

F.7 Materials control

Numerical results and those requiring action from the inspections and tests specified in Tables F.1 to F.8 inclusive shall be recorded.

Table F.1 applies to all materials.

Table F.2 also applies to any materials:

— not certified by a third party complying with EN 45011;

— not produced under a quality assurance system according to EN ISO 9001 and certified by a third party complying with EN 45012;

— not produced by a supplier operating a quality scheme in accordance with this clause and audited by the manufacturer.

Table F.1 — Control for all materials

Material	Inspection/test	Purpose	Minimum frequency
All materials	Inspection of delivery ticket (and, where applicable, label on the container) showing conformity to the order (the order shall mention the specification(s))	To ascertain if consignment is as ordered and from the correct source	Each delivery

Table F.2 — Control for certain materials

Material	Inspection/test	Purpose	Minimum frequency
1. Cements	Producer shall verify conformity to specification(s)	To ensure conformity	Per 1000 tonnes with a minimum of twice per month
2. Aggregates	Visual inspection of consignment	For comparison with normal appearance with respect to grading, shape and impurities/contamination	Each delivery Each source and grading
3.	Test by sieve analysis	To assess conformity to standard or agreed grading	1. First delivery from new source 2. In case of doubt following visual inspection 3. Once per week, more often as required by local or delivery conditions
4. Aggregates	Test for organic impurities or shell content	To assess the presence and quantity of impurities or contaminations	1. First delivery from new source 2. In case of doubt following visual inspection
5. Admixtures	Visual inspection of the admixture	For comparison with normal appearance	Each delivery
6.	Test for density	For comparison with normal density	Each delivery
7. Additions	Visual inspection of the addition	For comparison with normal appearance	Each delivery
8. Mixing water	Test by chemical analysis or in accordance with the reference specification	To ascertain that the water is free from harmful constituents	Only if the water is not taken from a public distribution system: 1. When new source is used for the first time 2. In any case of doubt 3. Every year 4. Three times per year where water is taken from a watercourse
9. Steel fibre	Producer shall verify conformity to specification(s)	To ensure conformity	Each delivery but not more than once per month
10. Reinforcing steel	Producer shall verify conformity to specification(s)	To ensure conformity	Each delivery but not more than once per month
11. Joint seals and sealants	Producer shall verify conformity to specification(s)	To ensure conformity	Each delivery but not more than once per month
12. Steps	Producer shall verify conformity to specification(s)	To ensure conformity	Each delivery but not more than once per month

F.8 Equipment control

For equipment control Table F.3 applies.

Table F.3 — Equipment control

Equipment	Inspection/test	Purpose	Minimum frequency
1. Storage	As appropriate	To prevent risk of contamination	Weekly
2. Weighing equipment	Visual inspection of performance	To ascertain that the weighing equipment is functioning correctly	Daily
3.	Test of weighing accuracy	To avoid inaccurate weighing	1. On installation 2. Twice per year 3. In any case of doubt
4. Admixture dispenser	Visual inspection of performance	To ascertain that the dispenser is in a clean condition and functions correctly	First batch of the day for each admixture
5.	Test of accuracy	To avoid inaccurate dispensing	1. On installation 2. Twice per year 3. In any case of doubt
6. Water metering equipment	Comparison of the actual amount dispensed with the reading of the meter	To avoid inaccurate dispensing	1. On installation 2. Twice per year 3. In any case of doubt
7. Volumetric batching system	Visual inspection	To ascertain that the batching equipment is functioning correctly	Daily
8.	Comparison of the actual mass of the batch constituents with the intended mass by a suitable method for volumetric batching system	To ascertain batching accuracy	1. On installation 2. Three-monthly intervals 3. In any case of doubt
9. Mixers	Visual inspection	To check the wear of the mixing equipment	Weekly
10. Moulds and pallets	Visual inspection	To check for cleanliness of the moulds and pallets	Daily
11.	Dimensional checks	To check for excessive wear	On installation or reinstallation of mould or renewal of equipment

F.9Process control

For the control of concrete mix in accordance with the mix design, Table F.4 applies.

For the control of production, Table F.5 applies.

For the control of marking and storage, Table F.6 applies.

For the control of delivery, Table F.7 applies.

Table F.4 — Control of concrete mix

Process element	Inspection/test	Method	Minimum frequency
1. Concrete	Chloride content	By calculating the chloride content	At start and each change of supply
2.	Correct mixing	Visual check	Daily for each mixer
Mix composition	Correct Proportions	By verifying that the correct recipe is used	Daily for each mixer

Table F.5 — Control of factory production

Process element	Inspection/test	Method	Minimum frequency
4. Production	Correct manufacturing process	By verifying conformity to factory documents	Daily
5. Reinforcement	- mean spacing and content of circumferential bars over internal height; - spacing from ends of spigot and socket; - mean spacing and content of reinforcement in all other units	By verifying conformity to factory documents, to this EN and to design specification	Daily
6. Product	Significant dimension(s) according to specific process	Measurement	At start and daily

Table F.6 — Control of marking and storage

Process element	Inspection/test	Method	Minimum frequency
7. Marking	Marking of units	Visual check	Daily
8. Storage	Segregation of defectives	Visual check	Daily

Table F.7 — Control of delivery

Process element	Inspection/test	Method	Minimum frequency
9. Marking	Correct marking of units/documents	Visual check	Daily
10. Loading	Correct loading	Visual check	Daily

F.10 Control of laboratory equipment

For the control of laboratory equipment Table F.8 applies.

Table F.8 — Control of laboratory equipment

Equipment	Inspection/test	Method	Minimum frequency
1. Measuring equipment	Determination of dimensions	Calibration by reference to official standard	Once per year
2. Weighing equipment	Determination of mass	Calibration by reference to official standard	Once per year
3. Temperature measuring device	Determination of temperature	Calibration by reference to official standard	Once per year
4. Load test equipment	Determination of loading	Calibration by reference to official standard	Once per year
5. Watertightness equipment	Determination of pressure	Calibration by reference to official standard	Once per year

Annex G
(normative)

Sampling procedures for inspection of finished products

Table G.1 shall apply to the inspection of finished products, where required by 6.1.

Table G.1 — Sampling procedures

Clause	Test where specified	Initial type test	Routine inspection
4.2.2.1	Drilled core strength	1 N	J *)
4.2.7.1	Water absorption	3 S	1 G/month
4.3.2	Visual inspection of finish	Every tested unit	Every tested unit
4.3.3	Geometrical characteristics: - units - joint profiles	 3 N See Table G.2	 3 Y See Table G.2
4.3.5	Crushing strength	3 S for unreinforced and steel fibre concrete 1 S for reinforced concrete	See Table H.1
4.3.6	Vertical strength	3 S for unreinforced and steel fibre concrete 1 S for reinforced concrete	See Table H.1
4.3.7	Installed steps	3 Z	1 Z/1 000 installed
4.3.8	Watertightness: - hydrostatic ($t \leq 125$ mm) - individual joint assemblies - joint between a unit and a connecting pipe or adaptor	 3 W See Table G.2 See Table G.2	 See Table H.2 See Table G.2 See Table G.2
5.2.1	Reinforcement	1 N	Every reinforced concrete unit that has been tested to collapse
5.2.2	Concrete cover	1 N using every unit that has been type-tested to 5.2.3 or 5.2.4, or covermeter for other units	Every unit that has been tested to 5.2.3 or 5.2.4 and, using covermeter, 2 N/day

G is test per group;

J is test per 500 produced per group, with a minimum of one per month;

N is test per type and nominal size;

S is test per type, nominal size and strength;

W is test per type, nominal size and same wall thickness;

Y is test per type, nominal size and strength produced per 1 000, with a minimum of one per type and year;

Z is test per type of step and method of installation;

*) means that J is multiple cores from the same unit (see 6.8).

Table G.2 — Sampling procedures for watertightness tests on joint assemblies and joints between units and connecting pipes or adaptors

Tests	
1) Individual joint assemblies 2) Joints between units and connecting pipes or adaptors: - angular deflection and - shear load, or - angular deflection and shear load combined	
Initial type test	Routine inspection
Two identical joint assemblies	One assembly per 1 000 produced but not less than one test per year: - having the same seal profile (where applicable); - having the same joint profile that is effective when jointing; or, at the manufacturer's discretion, if the initial type test has been successfully carried out with the most unfavourable tolerances, it is permissible to verify only joint and seal profile dimensions at a frequency as stated in the factory documents, but not less than: - one unit per 25 produced for each nominal size and type; - one unit per day for each nominal size and type.

Annex H
(normative)

Sampling procedures for continuous inspection of crushing strength, vertical strength and watertightness (vertical unit hydrostatic)

H.1 Inspection rates and interpretation of results

H.1.1 Inspection rates

Tightened inspection shall always be applied when assessing unreinforced and steel fibre concrete unit crushing and vertical strength test results when inspecting on the basis of individual assessments (see H.4.1). When assessing any other test results, inspection rates shall be in three forms, of descending severity as follows:

— **tightened inspection:** This shall be applied, requirement by requirement, when a new production or a change in process occurs, or when the switching rules in H.2 apply;

— **normal inspection:** This shall be applied, requirement by requirement, according to the relevant rates when the specific process is under a state of control, or when the switching rules in H.2 apply;

— **reduced inspection:** A lower rate of sampling may be applied, requirement by requirement, when so permitted by the switching rules in H.2.

Inspection of the crushing strength of unreinforced concrete chamber and shaft units is normally to the ultimate (collapse) load F_u. Alternatively, for a specific process and at the manufacturer's discretion, it is permissible for such inspection to be primarily to the minimum crushing load F_n in accordance with annex J.

At the manufacturer's discretion, inspection of the crushing strength of reinforced concrete chamber and shaft units shall be at either the "regular" or "basic" level specified in Table H.1, the chosen level being stated in the factory documents.

H.1.2 Interpretation of results

The acceptability results of routine tests and inspection shall be determined individually or statistically in accordance with the provisions of H.4.

H.2 Operating of switching rules

H.2.1 Tightened to normal inspection

Tightened inspection shall continue until five consecutive samples show conformity with the relevant requirement, at which time normal inspection may be instituted or reinstated.

H.2.2 Discontinuation of inspection

If 10 consecutive samples remain on tightened inspection, the provisions of these sampling procedures shall be discontinued pending action to improve the quality of the submitted products.

H.2.3 Normal to reduced inspection

It is permissible to introduce reduced inspection when normal inspection is in effect, provided that the following conditions are met:

— the last 10 samples have shown conformity with the relevant requirement;

— the production is in a state of control.

H.2.4 Reduced to normal inspection

When reduced inspection is in effect, normal inspection shall be reinstated if any of the following occur on original inspection (i.e. before any non-acceptance):

— a sample has shown nonconformity with the relevant requirement;

— production becomes irregular or is delayed;

— other conditions warrant the reinstatement of normal inspection.

H.2.5 Normal to tightened inspection

When normal inspection is in effect, tightened inspection shall be reinstated if two or more samples have shown nonconformity with the relevant requirement in any five consecutive tests of normal inspection.

H.3 Tightened, normal and reduced inspection

H.3.1 Tightened inspection

Tightened inspection corresponds to twice the sampling rate of normal inspection.

H.3.2 Normal inspection

Samples shall be selected and tested in accordance with the following:

— crushing and vertical strength:

  As defined in Table H.1.

— watertightness (vertical unit hydrostatic):

  As defined in Table H.2;

Table H.1 — Inspection of crushing strength (chamber and shaft units) and vertical strength (reducing units and capping units)

Material	Symbol(s)		Frequency of testing sample[a] units of the same nominal size and strength, produced using a specific machine or manufacturing facility (normal inspection)		
	Crushing strength	Vertical strength	Initially, or after a break of 18 calendar months or more	Overall[b]	
				Production per week[c]	Sampling rates
1	2	3	4	5	6
Unreinforced concrete (not using annex J option)	F_u	F_u	One at the start[d] of production	< 750 units	One per 500 units produced, but not less than four per year
				≥ 750 units	One per 750 units produced
Unreinforced concrete (using annex J option)	F_n	-	-	< 750 units	One per 500 units produced, but not less than four per year
				≥ 750 units	One per 750 units produced
	F_u	-	One at the start[d] of production	One for every five of those selected for F_n but not less than one every four weeks	
Steel fibre concrete	0,67 F_n + F_u + 0,67 F_n	F_u	One at the start[d] of production	< 750 units	One per 500 units produced, but not less than four per year
				≥ 750 units	One per 750 units produced
Reinforced concrete (regular inspection)	F_c = 0,67 F_n	F_p	One at the start[d] of production	< 250 units	One per 250 units produced, but not less than two per year
				250 ≤ units < 750	One per week
				≥ 750 units	One per 750 units produced
	F_u	F_u	One at the start[d] of production	One for every 10 of those selected for F_c but not less than one per year	
Reinforced concrete (basic inspection)	F_c = 0,8 F_n	-	One at the start[d] of production	< 250 units	One per 500 units produced, but not less than two per year
				250 ≤ units < 750	One every two weeks
				≥ 750 units	One per 1 500 units produced
	1,2 F_n	-	One at the start[d] of production	One for every 10 of those selected for F_c but not less than one per year	

[a] One sample means one unit

[b] including the sample as per column 4

[c] means five sequential days producing units of the same nominal size and strength

[d] means excluding initial type tests (see 7.2.2), but, since all samples have to be randomly selected (see 3.1.30), not necessarily the first unit under routine production

NOTE The relevant effective test result for chamber and shaft units F_a is used for F_c, F_n and F_u as appropriate (see A.5).

Table H.2 — Inspection of watertightness (vertical unit hydrostatic)

Design wall thickness (t) mm	Maximum production on consecutive working days before a sampling under normal inspection of each type, nominal size and same wall thickness[a]
$t \leq 40$	≤ 250
$40 < t \leq 100$	≤ 500
$100 < t \leq 125$	≤ 1 000
$125 < t$	--

[a] If a particular nominal size, type or design wall thickness has not been produced for a period of 60 consecutive working days, a sampling shall be carried out when production recommences, subject to at least one sampling per year

H.3.3 Reduced inspection

Reduced inspection corresponds to half the sampling rate of normal inspection.

H.3.4 Examples

Examples of the frequency of sampling for the inspection of crushing strength and vertical strength in accordance with Table H.1 are given in Table H.3.

Table H.3 — Examples of sampling rates for inspection of crushing strength (chamber and shaft units) and vertical strength (reducing units and capping units) (regular inspection)

Specific machine or manufacturing facility	Material	Product	Action	Days producing cumulative numbers of units														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Machine “A”	Unreinforced concrete	LN/WN 600/450 inspection chamber unit, strength class 20	Units produced:	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750
			Sample(s) taken:	1[1] >>			<	1[2]	>	<	1[2]	>	<	1[2]	>	<	1[2]	>
Machine “B”	Unreinforced concrete	DN 1 200 chamber unit, strength class 30	Units produced:	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
			Sample(s) taken:	1[1] >>					<		1[3]		>	<		1[3]		>
Machine “C”	Unreinforced concrete	DN 1 000 shaft unit, strength class 20	Units produced:	100	200	300	400	500[4]						600[4]	700	800	900	1000
			Sample(s) taken:	1[1] >>										<		1[3]		>
	Steel fibre concrete	DN 1 000 chamber unit, strength class 30	Units produced:						100	200	300	400	500[5]					
			Sample(s) taken:						1[1] >>									
Machine “D”	Reinforced concrete	DN 1 200 chamber unit, strength class 30	Units produced:	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750
			Sample(s) taken (F_c):	1[1] >>			<	1[6]	>	<	1[6]	>	<	1[6]	>	<	1[6]	>
			Sample(s) taken (F_u):	1[1] >>														
Machine “E”	Reinforced concrete	DN 1 200 cover slab with DN 900 clear opening	Units produced:	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
			Sample(s) taken (F_p):	1[1] >>					<		1[7]		>	<		1[7]		>
			Sample(s) taken (F_u):	1[1] >>														
Manufacturing facility “F”	Reinforced concrete	DN 1 200 chamber to DN 1 000 shaft reducing slab	Units produced:	50	100	150	200	250[4]						300[4]	350	400	450	500
			Sample(s) taken (F_p):	1[1] >>										<		1[8]		>
			Sample(s) taken (F_u):	1[1] >>														
		DN 1 000 shaft capping unit	Units produced:						30	60	90	120	150[9]					
			Sample(s) taken (F_p):						1[1] >>									
			Sample(s) taken (F_u):						1[1] >>									
Manufacturing facility “G”	Reinforced concrete	DN 1 250 to DN 1 000 taper with 200 mm vertical height	Units produced:	10	20	30					40	50	60				70	80
			Sample(s) taken (F_p):	1[1] >>														
			Sample(s) taken (F_u):	1[1] >>														

1) see column 4 of Table H.1;
2) see columns 5 and 6 of Table H.1 for more than 750 unreinforced concrete units produced per week;
3) see columns 5 and 6 of Table H.1 for less than 750 unreinforced units produced per week;
4) sequential days’ production;
5) less than 750 steel fibre concrete units produced in the week, so the sample at the start of production represents the one required (see columns 5 and 6 of Table H.1);
6) see columns 5 and 6 of Table H.1 for more than 750 reinforced concrete units produced per week;
7) see columns 5 and 6 of Table H.1 for between 250 and 750 reinforced concrete units produced per week;
8) 250 reinforced concrete units produced in the week, so the sample at the start of production represents the one required (see columns 5 and 6 of Table H.1);
9) see columns 5 and 6 of Table H.1 for less than 250 reinforced concrete units produced per week.

H.4 Acceptability determination

H.4.1 Inspection on the basis of individual assessments

H.4.1.1 Application

Inspection on the basis of individual assessments shall be applied to crushing strength, vertical strength and watertightness (vertical unit hydrostatic) test results for all samples, except the ultimate (collapse) load test results for unreinforced and steel fibre concrete units satisfying the prerequisites for statistical assessment (see H.4.2.2).

H.4.1.2 Procedure

Every test result (F_a, F_c , F_n, F_u as appropriate for crushing strength) is compared with the relevant requirement of this European Standard.

The requirement for the ultimate (collapse) load F_u is:

$F_u > F_n$ or F_v as appropriate

where

F_n is the minimum crushing load and

F_v is the minimum vertical crushing load.

The procedure for the ultimate (collapse) load F_u (excluding inspection of unreinforced units using the annex J option and basic inspection of reinforced units) is shown diagrammatically in Figure H.1.

The procedure for the basic inspection of reinforced units is shown diagrammatically in Figure H.2.

H.4.1.3 Acceptance criteria

If the result is in conformity with the requirement in H.4.1.2, the corresponding production shall be accepted.

If a crushing strength or hydrostatic test result other than an ultimate (collapse) load test result is not in conformity with the requirement, a sample of two more units from the same production shall be tested. If both results of this second sample are in conformity, the corresponding production shall be accepted, with the exception of any defectives. If one or both results from this second sample are not in conformity, it shall be determined which part of the corresponding production is concerned and that part shall be rejected.

If an ultimate (collapse) load test result is not in conformity with that requirement, the following applies:

— if $F_u \geq 0{,}95\ F_n$ or $0{,}95\ F_v$ as appropriate a sample of two more units from the same production shall be tested and acceptance shall be determined on the basis of statistical assessment (see H.4.2.4) of a set of both results of this second sample added to the nonconforming result;

— if $F_u < 0{,}95\ F_n$ or $0{,}95\ F_v$ as appropriate the corresponding production shall be rejected.

If a test result on a reinforced unit tested to $1{,}2\ F_n$ under basic inspection is not in conformity with that requirement (i.e. the unit collapses), the determination of acceptability shall be as above, except that the test result F_a shall be compared to $1{,}14\ F_n$ (instead of $0{,}95\ F_n$) and $1{,}2\ F_n$ used (instead of F_n) for determining the lower quality statistic Q (see H.4.2.4.2).

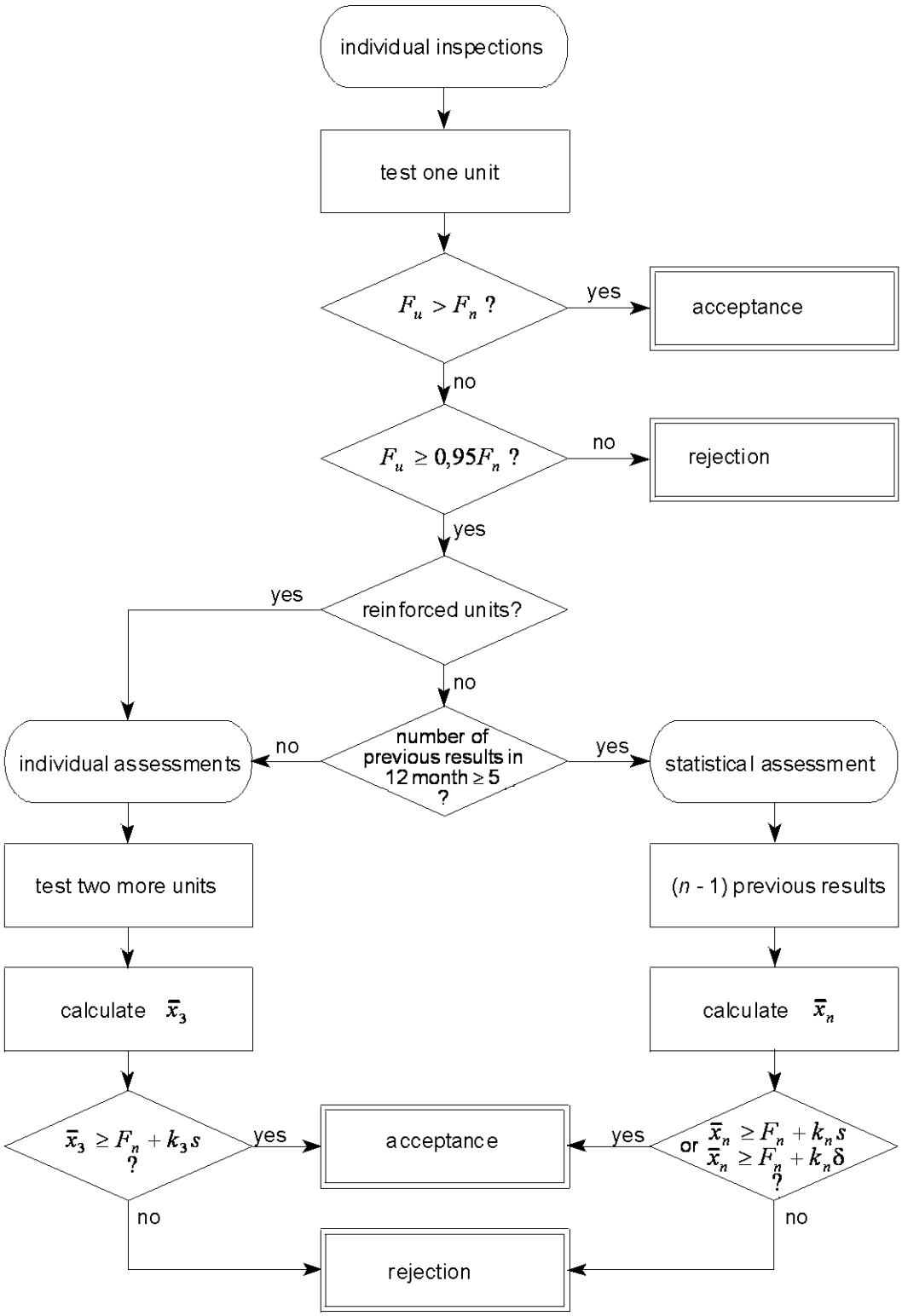


Figure H.1 — Flow chart for inspection of ultimate (collapse) load on the basis of individual assessments (excluding inspection of unreinforced units using the annex J option and basic inspection of reinforced units)

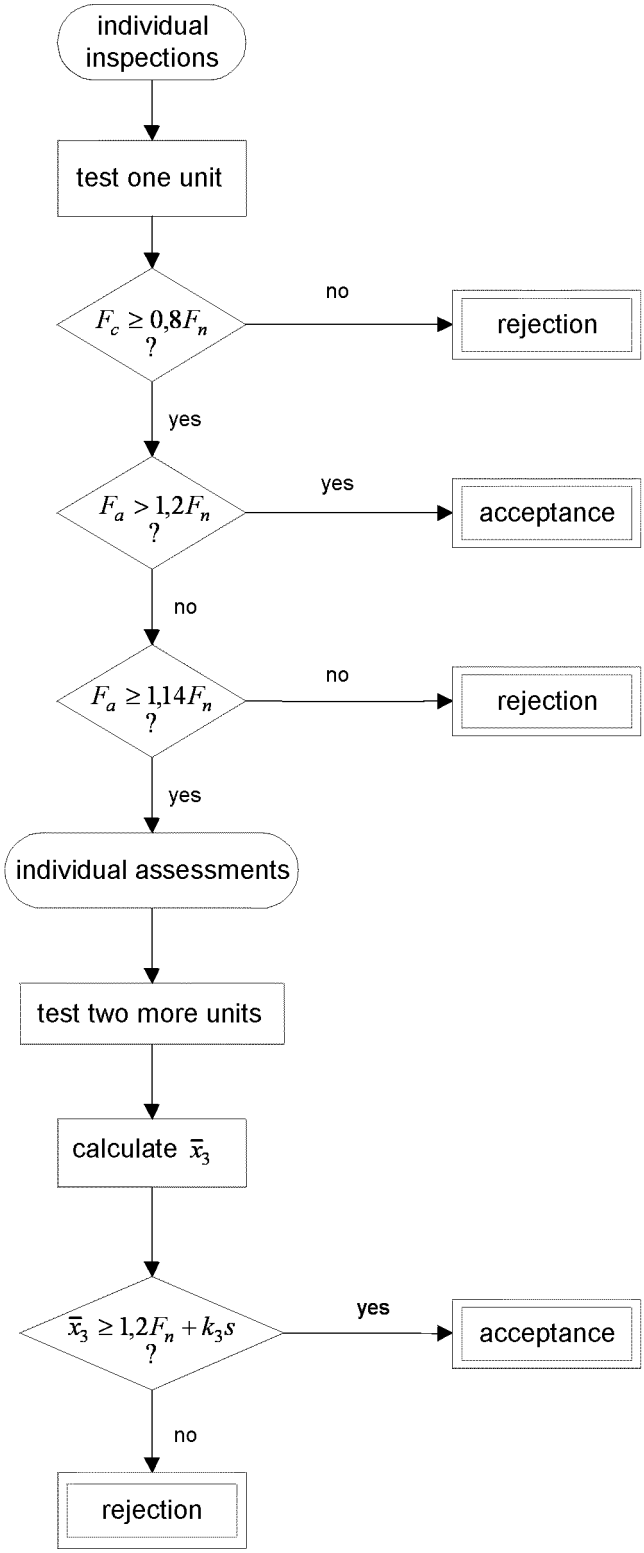


Figure H.2 —Flow chart of basic inspection of reinforced units on the basis of individual assessment

H.4.2 Inspection of crushing strength on the basis of statistical assessment

H.4.2.1 Application

Inspection of crushing and vertical strength on the basis of statistical assessment shall be applied to ultimate (collapse) load F_u test results for unreinforced and steel fibre concrete units satisfying the following prerequisites and whilst being applied, the specific process by which the samples are being manufactured shall be evaluated to have attained, and continue to be in, a state of statistical control.

H.4.2.2 Prerequisites

Inspection on the basis of statistical assessment shall be used when five consecutive crushing or vertical strength test results on samples from the same specific process conform to the requirements of this European Standard and can be deemed to be normally distributed.

Inspection on the basis of individual assessments (see H.4.1) shall be applied if the number of routine crushing or vertical strength test results obtained on samples from the same specific process is less than five per year, or if the test results are deemed not to be normally distributed.

H.4.2.3 Procedure

Inspection shall be carried out of a set of n consecutive routine crushing test results obtained on samples from the same specific process, where n is a fixed number chosen by the manufacturer and $3 \leq n \leq 15$. The first set shall consist of the three latest results conforming to the requirements of this European Standard.

As long as the number of available test results is less than n, the inspection shall be continued on the basis of consecutive sets, which shall be obtained by adding the new results to the existing set.

When the number of available test results exceeds n, progressive sets with n results shall be further used; obtained by deleting the oldest and adding the latest results.

After each change in production or testing parameters that may disturb the normal distribution of the test results, a new set shall be composed of results obtained after the change.

H.4.2.4 Acceptance criteria

H.4.2.4.1 General

Production shall be accepted if the test results conform:

— individually $F_u \geq 0{,}95\ F_n$ or $0{,}95\ F_v$ as appropriate

where

F_u is the ultimate (collapse) load, and

F_n and F_v are the minimum crushing loads;

and

— statistically with H.4.2.4.2 or H.4.2.4.3.

If one or both are not in conformity, it shall be established which part of the corresponding production is concerned and that part shall be rejected.

H.4.2.4.2 Acceptability determination when standard deviation is unknown

Consider the measured value x of the ultimate (collapse) load F_u from the last n consecutive samples.

Calculate the mean value $\bar{x}$ and the standard deviation s of these n values.

Calculate the lower quality statistic Q for the lower specification limit:

$$Q = (\bar{x} - F_n)/s \quad \text{or} \quad (\bar{x} - F_v)/s \text{ as appropriate}$$

where

F_n and F_v are the lower specification limits for the minimum crushing load.

Then compare the quality statistic with the acceptability constant k obtained from the appropriate column in Table H.4. Interpolation for intermediate values of n is permissible.

Table H.4 — Acceptability constant[1)], standard deviation unknown

Number of samples n	Acceptability constant k		
	Tightened inspection	Normal inspection	Reduced inspection
3	1,12	0,958	0,765
4	1,17	1,01	0,814
5	1,24	1,07	0,874
7	1,33	1,15	0,955
10	1,41	1,23	1,03
15	1,47	1,30	1,09

For acceptance, the quality statistic for the lower specification limit shall be greater than or equal to the acceptability constant.

H.4.2.4.3 Acceptability determination when standard deviation is known

The procedure shall be the same as that specified in H.4.2.4.2 for unknown standard deviation, but the standard deviation σ used shall be determined on the basis of measured values of the ultimate (collapse) load F_u from at least 15 consecutive samples obtained during the last 12 months at the maximum, and shall be regularly verified. The acceptability constant k shall be obtained from the appropriate column Table H.5. Interpolation for intermediate values of n is permissible.

[1)] Adapted from ISO 3951.

Table H.5 — Acceptability constant[1)], standard deviation known

Number of samples n	Acceptability constant k		
	Tightened inspection	Normal inspection	Reduced inspection
3	1,17	1,01	0,76
4	1,23	1,11	0,83
5	1,39	1,20	0,92
7	1,45	1,25	1,02
10	1,50	1,31	1,08
15	1,56	1,36	1,13

Annex I
(normative)

Tasks for a product certification body

I.1 Initial inspection of factory and factory production control

Initial inspection of the factory shall determine whether the prerequisites in annex F in terms of staff and equipment for continuous and orderly manufacture of units and for the factory production control are suitable.

All relevant facts of the initial inspection, especially the factory production control system operated by the manufacturer and the evaluation of the acceptability of the system, shall be documented in a report.

I.2 Evaluation and approval of initial type testing of units

Where a factory does not already have a certified production in accordance with this European Standard, in order to evaluate and approve the initial type testing, the certification body shall attend at tests on each standard requirement for each nominal size group.

Where a factory already has a certified production in accordance with this European Standard, in order to evaluate and approve the initial type testing of a new product or units coming from a new manufacturing facility, the certification body shall be notified by the manufacturer at least seven days before such products or units from such equipment are supplied.

I.3 Periodic surveillance, evaluation and approval of factory production control

The certification body's principal objective shall be to check whether the prerequisites in annex F for manufacturing and the agreed factory production control system are being maintained.

The certification body shall operate an inspection schedule such that all the relevant requirements in annex F are periodically inspected at a minimum frequency of twice a year.

The results from the manufacturer's production control shall be examined as part of a periodic inspection to ensure that the required routine testing has been carried out at the specified frequency and that proper actions have been taken, including those of calibration and maintenance of test equipment. Conformity to the requirements for marking shall also be checked.

The results of periodic inspections shall be documented in the records of the inspection.

I.4 Audit testing of samples taken at the factory

Since the basis of product certification is factory production control, the aim of audit testing shall be to check confidence in the results of such control and not to decide conformity or nonconformity of the units produced.

The audit testing shall be performed on units declared to conform to this European Standard. When the manufacturer's test equipment is standardized or calibrated, testing shall normally be carried out using this equipment.

Audit testing shall be carried out in such a way as to ensure that a representative range of nominal sizes and strengths of units is tested during successive three-year periods.

I.5 Quality system

Where the manufacturer proposes to establish a certified quality system (in accordance with EN ISO 9001), it shall be verified and accepted by the approved product certification body prior to its application.

Annex J
(normative)

Procedure for unreinforced concrete chamber and shaft units where routine (continuous) inspection of crushing strength is primarily to minimum crushing load

At the manufacturer's discretion it is permissible for routine (continuous) inspection of the crushing strength of unreinforced concrete chamber and shaft units to be carried out for a specific process by testing primarily to the minimum crushing load F_n in accordance with the following procedure, providing:

— the units are circular units;

— a separate procedure is applied for units of the same nominal size, cross-section and strength class, produced using a specific machine or manufacturing facility;

— all aspects of the procedure are recorded in the factory documents.

NOTE For inspection of crushing strength on the basis of individual assessments, see H.4.1.

Step 1: From the start of production inspect crushing strength using tightened inspection (see H.1.1) by testing to ultimate (collapse) load F_u in accordance with Table H.1 for "Unreinforced concrete units (not using the annex J option)".

Step 2: Continue inspection until a set of n consecutive routine crushing test results is obtained on samples, where n is a fixed number chosen by the manufacturer using results not more than 12 months old and $5 \leq n \leq 15$.

Step 3: Calculate the bending tensile stress f_{bt} for each of the n units using the following formula:

$$f_{bt} = (6 \times F_u \times r_m) / (\pi \times t_{act}^2)$$

where

f_{bt} is the bending tensile stress in megapascals (newtons per square millimetre);

F_u is the ultimate (collapse) load in kilonewtons per metre;

r_m is the mean radius of the unit in millimetres;

t_{act} is the mean measured wall thickness at the point of contact with the single bearer, in millimetres.

Step 4: Calculate the characteristic value of the bending tensile stress f_{ch} from n results, then select a design bending tensile stress f_{des} not greater than the characteristic value f_{ch}.

Step 5: Calculate the bending tensile stress f_{bt} in the designed cross-section of the unit using the following formula:

$$f_{bt} = (6 \times F_n \times r_m) / (\pi \times t_{min}^2)$$

where

f_{bt} is the bending tensile stress in megapascals (newtons per square millimetre);

F_n is the minimum crushing load in kilonewtons per metre;

r_m is the mean radius of the designed unit in millimetres;

t_{min} is the minimum permissible wall thickness at the point of contact with the single bearer, in millimetres.

If the bending tensile stress f_{bt} does not exceed the design bending tensile stress f_{des} the designed cross-section of the unit is verified.

Step 6: After verifying the designed cross-section of the unit, start routine (continuous) inspection in accordance with Table H.1 for "Unreinforced concrete units (using the annex J option)".

Step 7: Using the formula in Step 3, calculate the bending tensile stress f_{bt} in the concrete of the next unit subjected to the ultimate (collapse) load F_u and substitute that result for the oldest one of the n results.

Step 8: Determine the acceptability as follows:

Consider the measured value x of the bending tensile stress at the ultimate (collapse) load F_u from the last n consecutive samples.

Calculate the mean value $\bar{x}$ and the standard deviation s of these n values.

Calculate the lower quality statistic Q for the lower specification limit:

$$Q = (\bar{x} - f_{des})/s$$

where

f_{des} is the lower specification limit for the bending tensile stress,

then compare the quality statistic with the acceptability constant k obtained from the appropriate column in Table H.3. Interpolation for intermediate values of n is permissible.

For acceptance, the quality statistic for the lower specification limit shall be greater than or equal to the acceptability constant.

Step 9: If acceptability is determined, repeat Steps 7 and 8 for each subsequent test to the ultimate (collapse) load F_u, otherwise revert to Step 1.

Annex ZA
(informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M/118 “Waste water engineering products” given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard shown in this annex meet the requirements of the Mandate 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 herein; reference shall be made to the information accompanying the CE marking.

WARNING — Other requirements and other EU Directives, not affecting the fitness for intended use may be applicable to construction products falling within the scope of this European 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. *Note: 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/comm/enterprise/construction/internal/hygiene.htm).*

This annex has the same scope as clause 1 of this European Standard with regard to the products covered. It establishes the conditions for the CE marking of precast concrete manholes and inspection chambers intended for the use indicated below and shows the relevant clauses applicable (see Table ZA.1).

Construction product(s): Precast concrete manholes and inspection chambers, unreinforced, steel fibre and reinforced.

Intended use(s): To permit access for and to allow aeration and ventilation of drain or sewer systems, for example on carriageways, parking areas, hard shoulders and outside buildings.

Table ZA.1 — Relevant clauses

Essential characteristics	Requirement clauses in this EN	Levels and/or classes	Notes
Opening size	4.3.3.5	None	Safety regulations or provisions at the place of use of the units will normally specify minimum size in mm, and possibly shape
Mechanical resistance	4.2.2, 4.3.5, 4.3.6 and 5.2.6	None	Although minimum crushing load is expressed in kN/m, crushing strength is expressed by means of the corresponding strength class; compressive strength of concrete in units whose strength is not verified by routine performance testing is expressed in MPa (Nmm^2)
Load bearing capacity of any installed steps	4.3.7	None	Vertical loading strength is expressed in kN, with corresponding values of initial and permanent deflections in mm; horizontal pull-out resistance is expressed in kN
Watertightness	4.3.8	None	Characteristic is demonstrated by no leakage or other visible defects during the test
Durability	4.3.10	None	Durability requirements are detailed and cross-referenced in 4.3.10

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

ZA.2.1 System of attestation of conformity

The system of attestation of conformity, consistent with annex III of the Mandate, of concrete manholes and inspection chambers indicated in Table ZA.1 is shown in Table ZA.2 for the intended uses and relevant level(s) and classes.

Table ZA.2 — Attestation of conformity system

Product(s)	Intended use(s)	Level(s) or class(es)	Attestation of conformity system
Concrete manholes and inspection chambers	to permit access to and to allow aeration and ventilation of drain or sewer systems, for example on carriageways, parking areas, hard shoulders and outside buildings	-	4
System 4: See Directive 89/106/EEC (CPD) Annex III.2.(ii), Third possibility			

The attestation of conformity of the concrete manholes and inspection chambers 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

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all characteristics of Table ZA.1 relevant for the intended use	7.2.3
	Initial type testing	All characteristics of Table ZA.1 relevant for the intended use	7.2.2

ZA.2.2 Declaration of conformity

When compliance with this annex is achieved, the manufacturer or his agent established in the European Economic Area (EEA), shall prepare and retain a declaration of conformity, which entitles the manufacturer to affix the CE marking. This declaration shall include:

— name and address of the manufacturer, or his authorized 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 European Standard);

— 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 authorized representative.

The above mentioned declaration 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 authorized 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 and shall be shown on the accompanying commercial documents (e.g. the delivery note). It may also be shown on at least one unit in any package or on any packaging. The following information shall accompany the CE marking symbol when on the label or package:

a) last two digits of the year of CE marking;

b) product name and type;

c) the information required by clause 8 excluding c) and e).

The following characteristics shall accompany the above information on the commercial documents:

d) intended use and type of the component (e.g. unreinforced, steel fibre or reinforced concrete);

e) opening size - dimensions in millimetres and shape;

f) mechanical resistance (except where required by clause 8) in the form of:

   1) crushing strength of chamber and shaft units - strength class (as confirmed by annex H);

   2) vertical strength of reducing units and capping units - minimum vertical crushing load in kilonewtons (as confirmed by annex H);

   3) characteristic compressive strength of concrete in units whose strength is not verified by routine performance testing, in megapascals (newtons per square millimetre), together with a reference to the national standard(s) used to evaluate the relevant structural requirement and the results of that evaluation.

g) load bearing capacity of any installed steps - vertical loading strength, in kilonewtons, with corresponding values of initial and permanent deflections, in millimetres, and horizontal pull-out resistance, in kilonewtons;

h) watertightness of:

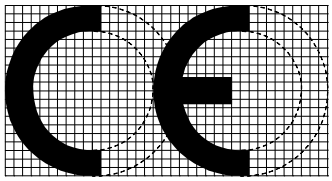
1) manhole units and their joints - no leakage at an internal hydrostatic test pressure of 50 kPa (0,5 bar);

2) inspection chamber base units - no leakage at an internal hydrostatic test pressure of 40 kPa (0,4 bar);

3) other inspection chamber units and all inspection chamber joints - no leakage at an internal hydrostatic test pressure of 30 kPa (0,3 bar);

i) durability - serviceability conditions appropriate to intended use; normal or more severe conditions as stated.

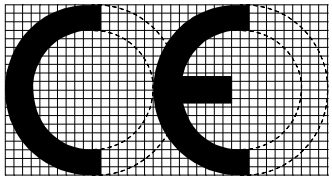
Figure ZA.1 gives examples of the information to be given on the commercial documents.



AnyCo Ltd, P.O.Box 21, B-1050
01

EN 1917:2002
Precast component for use in a manhole.
Unreinforced concrete chamber unit with installed single steps.
Watertightness: No leakage of joint or unit at 50 kPa (0,5 bar) internally.
Mechanical resistance: Strength class 30.
Load bearing capacity of installed steps:
- deflection ≤ 5 mm under 2 kN vertical load, with permanent deflection ≤ 1 mm;
- resistant to 5 kN pull-out force.

Durability: Adequate for normal serviceability conditions.



AnyCo Ltd, P.O. Box 21, B-1050
01

EN 1917:2002
Precast component for use in an inspection chamber.
Reinforced concrete cover slab.
Watertightness: No leakage of joint at 30 kPa (0,3 bar) internally.
Mechanical resistance: Vertical strength 50 kN.
Opening size: 500 mm x 500 mm square.
Durability: Adequate for normal serviceability conditions.

Figure ZA.1 — Examples of CE marking information

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.*

Bibliography

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EN 45012, *General requirements for bodies operating assessment and certification/ registration of quality systems (ISO/IEC guide 62:1996).*

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

ISO 3951, *Sampling procedures and charts for inspection by variables for percent nonconforming.*

ISO 12491, *Statistical methods for quality control of building materials and components.*

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