

Precast concrete pipes, fittings and ancillary products —

Part 100: Specification for unreinforced and reinforced pipes and fittings with flexible joints

UDC 621.643.25:666.97:628.2:621.643.44:620.1

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Cement, Gypsum, Aggregates and Quarry Products Standards Committee (CAB/-) to Technical Committee CAB/12, upon which the following bodies were represented:

- Association of Consulting Engineers
- Association of Metropolitan Authorities
- British Precast Concrete Federation Ltd.
- Cement and Concrete Association
- Cement Makers' Federation
- Concrete Pipe Association
- Concrete Society
- County Surveyor's Society
- Department of the Environment (Property Services Agency)
- Department of Transport (Highways)
- Federation of Civil Engineering Contractors
- Glassfibre Reinforced Cement Association
- Institution of Civil Engineers
- Institution of Highways and Transportation
- Institution of Public Health Engineers
- Institution of Water and Environmental Management
- Ministry of Agriculture, Fisheries and Food
- Sand and Gravel Association Limited
- Water Authorities Association

This British Standard, having been prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Committee, was published under the authority of the Board of BSI and comes into effect on
30 June 1988

© BSI 03-1999
First published as BS 5911-1
February 1981
First revision June 1988

The following BSI references relate to the work on this standard:
Committee reference CAB/12
Draft for comment 85/12154 DC

ISBN 0 580 16333 4

Amendments issued since publication

Amd. No.	Date of issue	Comments
6269	December 1989	
7588	April 1993	Indicated by a sideline in the margin

Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
Section 1. General	
1 Scope	1
2 Definitions	1
3 Marking	2
Section 2. Materials	
4 Cement	4
5 Aggregates	4
6 Other concrete materials	4
7 Concrete mix, casting and finish	5
8 Reinforcement	6
Section 3. Dimensions and tolerances	
9 Nominal size and effective length	8
10 Internal manufacturing diameter and actual diameter	8
11 External manufacturing diameter	8
12 Variation in the thickness of wall	8
13 Squareness of ends	8
14 Deviation from straightness	8
15 Surface cracking	8
16 Joints	9
17 Bends	9
18 Junctions	10
Section 4. Tests	
19 General	14
20 Test requirements	14
Section 5. Inspection procedures	
21 Type of inspection and batch size	19
22 Inspection procedures for pipes	20
23 Inspection procedures for bends and junctions	23
Appendix A Information to be supplied in an enquiry and order	24
Appendix B Methods of assessing surface finish	24
Appendix C Method of assessment of deviation from straightness	26
Appendix D Crushing strength test methods for pipes	26
Appendix E Method of test for water absorption	29
Appendix F Hydrostatic test method	29
Appendix G Bending moment resistance (BMR) test methods	30
Appendix H Methods of testing pipe joints for angular deflection, straight draw and shear	32
Appendix J Methods of measuring depth of cover to reinforcement	34
Appendix K Facilities for purchasers	34
Appendix L Anchorage pull-out test	34

	Page
Figure 1 — Effective length of pipes	2
Figure 2 — Typical flexible joints	11
Figure 3 — Typical bends	12
Figure 4 — Typical junctions	13
Figure 5 — Joint test measurements	18
Figure 6 — Gauge for assessing surface evenness	25
Figure 7 — Gauge for assessing surface voids	25
Figure 8 — Gauge for measuring deviation from straightness	26
Figure 9 — Testing arrangements for the crushing test	28
Figure 10 — Dimensions of feeler gauge for inspecting cracks in reinforced units	29
Figure 11 — Diagrammatic arrangement of the four-point loading test method	31
Figure 12 — Wooden bearing block for the three-point loading test method	31
Figure 13 — Diagrammatic arrangement of the three-point loading test method	32
Figure 14 — Loading arrangement for shear test on joints	33
Figure 15 — Diagram of typical anchorage pull-out testing machine on longitudinal section of pipe wall	35
Table 1 — Limits of chloride content of concrete	5
Table 2 — Nominal sizes and tolerances for units	9
Table 2A — Rationalized metric nominal sizes of units	8
Table 3 — Minimum effective lengths and typical nominal angles of bends	10
Table 4 — Right-angled junctions	10
Table 5 — Oblique-angled junctions	10
Table 6 — Summary of test requirements and inspection procedures	15
Table 7 — Crushing test loads	17
Table 8 — Bending moment resistance (BMR)	17
Table 9 — Minimum angular deflection and straight draw for joints	18
Table 10 — Maximum number of individual defectives in last 10 batches permitted for switching to reduced inspection (hydrostatic and works proof load crushing test)	19
Table 11 — Inspection plans for hydrostatic and works proof load crushing tests	21
Publications referred to	Inside back cover

Foreword

This revision of those clauses of BS 5911-1 dealing with pipes, bends and junctions has been prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Committee.

The opportunity has been taken to revise the Part numbering system for BS 5911 and this Part becomes Part 100. The clauses on manholes and soakaways in Part 1 have been revised to from the subject of a new Part, Part 200¹⁾. When Part 200 is published, BS 5911-1 will be withdrawn. Other types of precast concrete pipe and fittings will be covered by Part 101 onwards, and other ancillary concrete products by Part 201, etc.

The revision incorporates all previously published amendments together with additional material to improve the meaning and interpretation of some of the original clauses, as for example expanding the requirements relating to finish and dealing with the use of adhesives. At the same time a bending moment resistance test for pipes has been introduced.

This Part of BS 5911 is a specification incorporating tests, on pipes in manufacturers' works or in testing stations, that relate to performance of buried pipelines. The criteria are intended to ensure that the pipeline will carry sewage or surface water at atmospheric pressure without leaking or suffering structural damage. Pipes conveying sea water, industrial waste, etc. and those to be installed in an environment aggressive to concrete should be the subject of special consideration, for example as regards concrete cover.

In order to pave the way for an orderly transition to the forthcoming harmonized European Standard for concrete pipes, this Part of BS 5911 now provides for the manufacture and supply of units with rationalized metric sizes.

This standard does not include the structural or hydraulic design of the pipeline, its durability under unusual environmental conditions or standards of workmanship and supervision during construction and operation. For guidance on these topics, work on further British Standards is in hand.

For an enquiry or order to be fully understood it is essential that the manufacturer be given the information set out in Appendix A.

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

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 36, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

¹⁾ In preparation.

Section 1. General

1 Scope

This Part of BS 5911 specifies requirements and describes methods of test for precast concrete cylindrical pipes, bends and junctions with flexible joints, either unreinforced or reinforced with steel, intended to be used for the conveyance, under atmospheric pressure, of sewage or surface water, and for the construction of culverts. Requirements are given for materials, dimensions and inspection procedures.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 5911 the following definitions apply.

2.1 unit

a pipe, bend or junction

2.2 unreinforced concrete pipe

a hollow cylinder manufactured from concrete, cast as one piece and of uniform cross section throughout its length, except at the joint profile

NOTE The inclusion of reinforcement solely for handling purposes does not exclude a pipe from this definition.

2.3 reinforced concrete pipe

a pipe, as defined in 2.2, but reinforced with one or more prefabricated steel cages or hoops suitably positioned to resist tensile stresses imposed by the specified test loads

2.4 nominal size (DN)

a numerical designation of the bore of a unit, which is a convenient round number approximately equal to the internal diameter in millimetres

2.5 manufacturing diameter

a diameter of a unit that a manufacturer seeks to achieve

2.6 actual diameter

a diameter found by measurement

2.7 effective length

the length of a pipe measured as shown in Figure 1

2.8 characteristic strength of concrete

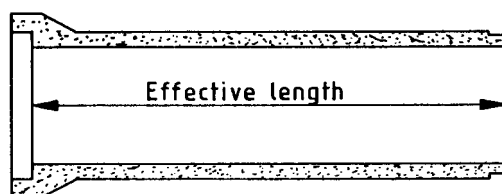
that value of cube strength below which 5 % of all possible strength measurements of the specified concrete are expected to fall

2.9 batch

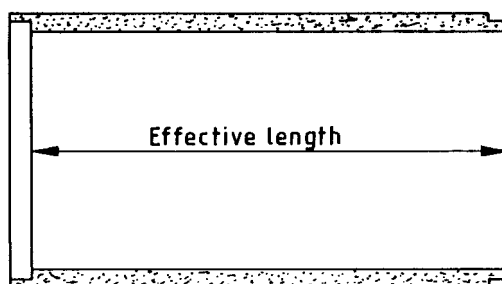
the number of units of a particular specification produced under uniform conditions during a given production period by one particular process

2.10 reinforcement

steel, other than stainless steel, cast within a unit so as to reinforce the concrete or to locate steel for that purpose



(a) Pipe with flexible spigot and socket joint



(b) Pipe with flexible rebated joint

Figure 1 — Effective length of pipes

3 Marking

3.1 Requirements for marking

Each unit shall be clearly marked with the following information:

- a) the number of this British Standard, i.e. BS 5911-100²⁾;
- b) the letter “R”, if the unit is reinforced;
- c) an indication of the crushing test load(s), which shall consist of either the letters “L”, “M” or “H” to denote “light”, “medium” or “heavy” class pipes, or, where higher crushing test loads have been specified, the specified works proof and maximum crushing test loads in kilonewtons per metre of effective length (see 20.4.1);
- d) the letter “S”, where sulphate-resisting Portland cement has been used;
- e) the letter “B”, where ground granulated blastfurnace slag (g.g.b.s.) has been used;
- f) the letter “P”, where pulverized-fuel ash (p.f.a.) has been used;
- g) the letter “A”, where an admixture has been used;
- h) the day, month and year of manufacture;
- i) the manufacturer’s mark and works identification mark;
- j) where tests, as specified in 20.2, 20.3 or 20.4.2 have been successfully carried out on the unit;
 - 1) the words “Abs”, “Hyd” or “Proof” as appropriate,
 - 2) a reference symbol after the words in item 1) to identify the results of the tests in the manufacturer’s quality control records.

In addition to the information given in items a) to j), bends shall be marked externally with indelible stripes at least 25 mm wide and 225 mm long, at each end of the two springing lines, to denote the longest and shortest lengths along the outside of the bend.

²⁾ Marking BS 5911-100 on or in relation to a product represents a manufacturer’s declaration of conformity, ie a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

In addition to the information given in items a) to j), reinforced pipes designed to meet the maximum stresses set up by loading only when tested or laid in a specified position shall be marked “LIFT HERE — TOP” at the crown of the pipe and “INVERT” at the bottom of the pipe.

NOTE Examples of marking

1. “C” “X”
BS 5911 Pt 100 “R M S A”
2.5.88
“Hyd” “Z”

The above marking on a concrete pipe would signify:

“Claimed by manufacturer “C” to have been made at his works “X” and to comply with BS 5911-100; to be reinforced, of class M and made with sulphate-resisting Portland cement; to contain an admixture; to have been made on 2 May 1988, and to have been successfully tested hydrostatically, as specified in **20.3**, with results recorded in the manufacturer’s quality control records “Z”.”

2. “D” “Y”
BS 5911 Pt 100 R 240/300
3.6.88
“Proof” “T”

The above marking on a concrete pipe would signify:

“Claimed by manufacturer “D” to have been made at his works “Y” and to comply with BS 5911-100; to be reinforced and made to resist works proof and maximum crushing test loads of 240 and 300 kN per metre of effective length, respectively; to have been made on 3 June 1988, and to have been successfully subjected to the works proof load test, as specified in **20.4.2**, with results recorded in the manufacturer’s quality control records “T”.”

3.2 Method of marking

Units shall be marked with either:

- a) indelible paint, applied by stencil brush or spray as soon as possible after removal from the mould; or
- b) impressed characters approximately 2 mm deep.

All marks shall be visible and legible. For units of nominal size DN 675 and above, marking shall be on the internal surface of the unit.

Section 2. Materials

4 Cement

The cement shall:

- a) be factory-produced by the cement manufacturer and comply with one of the following standards as appropriate;

Type of cement	Standard to be complied with
ordinary and rapid-hardening Portland	BS 12
Portland-blastfurnace	BS 146-2
sulphate-resisting Portland	BS 4027
Portland p.f.a.	BS 6588

or

- b) consist of a normal or special combination of cement complying with BS 12 and g.g.b.s or p.f.a. in accordance with the following, to be included as part of the concrete mix by simultaneously combining them with the other concrete materials at the concrete mixer;

Cementitious component other than cement	Standard to be complied with	% by mass of total cementitious content	
		normal	special (additional resistance to sulphate, see note)
g.g.b.s	BS 6699	0 % to 65 %	70 % to 90 %
p.f.a.	BS 3892-1	15 % to 35 %	25 % to 40 %

NOTE The minimum cement content and maximum water/cement ratio specified in 7.1 will ensure that any of the cements listed in item a) or normal combinations of cement complying with BS 12 and g.g.b.s or p.f.a. as specified in item b) will facilitate resistance to sulphate attack equivalent to classes 1 and 2 in Table 6.1 of BS 8110-1:1985. Class 3 resistance will be provided by the use of special combinations of cement complying with BS 12 and g.g.b.s or p.f.a. as specified in item b) or by cement complying with BS 4027; the latter will also facilitate class 4 resistance if the minimum cement content is 370 kg/m³. The advice of the pipe manufacturer should be sought where class 5 conditions exist.

5 Aggregates

5.1 General

Aggregates shall consist of materials complying with BS 882:1983 except for the grading requirements of clause 5 of that standard.

NOTE The pipe manufacturer may modify the gradings to suit his manufacturing process. (See clause 0 of BS 882:1983.)

5.2 Testing

5.2.1 Mechanical properties. The limiting values on the mechanical properties of coarse aggregates shall be either a minimum of 10 % fines value of 100 kN or a maximum aggregate impact value of 30 %. Flakiness index shall be not more than 35.

5.2.2 Nominal maximum size. The nominal maximum size of aggregate shall not exceed the least of the following:

- 20 mm;
- the concrete cover (see clause 8.2);
- one quarter of the minimum thickness of the unit.

6 Other concrete materials

6.1 Water

Water shall be clean and free from harmful matter in such quantities as would affect the properties of the concrete in the plastic or hardened state (see Appendix A of BS 3148:1980).

NOTE As a general rule, potable water, whether treated for distribution through the public supply or untreated, is suitable for making concrete.

6.2 Admixtures

Admixtures shall comply with BS 5075.

NOTE Admixtures, when used (see Appendix A), should not impair the durability of the concrete, nor combine with the ingredients to form harmful compounds nor increase the risk of corrosion of reinforcement.

The chloride ion content of admixtures shall not exceed 2 % by mass of the admixture or 0.03 % by mass of the cement, when used in:

- a) any concrete containing reinforcement or other embedded metal; and
- b) any concrete made with cement complying with BS 4027.

The manufacturer shall make available details of:

- 1) the relevant production records;
- 2) the admixture(s) used;
- 3) the dosage rate of each admixture;
- 4) the effect of under- and over-dosing.

7 Concrete mix, casting and finish

7.1 Cement content

The fully compacted concrete shall contain not less than 360 kg of cement (inclusive of any g.g.b.s. or p.f.a.) per cubic metre and shall have a water/cement ratio not greater than 0.45. Where a special combination of cement complying with BS 12 and g.g.b.s or p.f.a. is used (see item b) of clause 4), the minimum cementitious content shall be increased from 360 kg/m³ to 380 kg/m³.

7.2 Chloride content

The total chloride ion content of the concrete mixes shall be as given in Table 1.

Table 1 — Limits of chloride content of concrete

Type of concrete	Maximum total chloride content expressed as a percentage of chloride ion by mass of cement (inclusive of g.g.b.s. or p.f.a. when used)
Heat — cured concrete containing embedded metal	% 0.1
Concrete made with cement complying with BS 4027	0.2
Concrete containing embedded metal and made with cement complying with BS 12, BS 146, or combinations of cement complying with BS 12 and g.g.b.s or p.f.a.	0.4

7.3 Work in cold weather

Concrete, when placed, shall have a temperature of at least 5 °C, which shall be maintained until the concrete is hardened.

It is permissible to heat aggregates and water before mixing, to a temperature not exceeding 60 °C. Other materials and moulds, if at a temperature below 0 °C, shall not be used.

7.4 Compaction

All units shall be compacted so that, when hardened, they shall be free from honeycombing and from any individual large void (i.e. greater than 6 mm) as defined in 4.4.1 of BS 1881-120:1983. Blistering shall not be regarded as a void.

7.5 Surface finish

7.5.1 Surface evenness. When tested in accordance with B.1, the internal surface of a pipe shall not have irregularities that cause the central portion of the gauge to touch the pipe.

NOTE For pipes of the smaller nominal sizes, it may prove impracticable to test the central portion of the pipe.

7.5.2 Surface voids. Surfaces of units shall be free from voids that, when tested in accordance with B.2, permit diametrically opposite points of the rim of the gauge to touch simultaneously the surface of the unit.

Units exhibiting surface voids greater than 12 mm deep shall be deemed not to comply with this standard.

NOTE Voids up to and including 12 mm deep may be made good using material complying with 7.6.1.

The surface finish of units containing reinforcement shall be in accordance with 8.2.

7.6 Making good

7.6.1 Materials. Materials for making good shall be one of the following.

- a) Neat cement grout, with or without the addition of styrene-butadiene rubber (SBR), the type of cement being compatible with that in the unit to be made good.
- b) 1 : 3 cement/sand mortar proportioned by mass with or without the addition of SBR. The cement shall be compatible with that in the unit to be made good and the sand shall comply with the requirements for fine aggregate in BS 882 but have a grading such that 100 % of the material passes a 5 mm sieve.
- c) A sample of the concrete mix minus the aggregate retained on the 5 mm sieve, with or without the addition of SBR.
- d) Epoxy or polyester resin, or polymer latex mortar.

NOTE For guidance on the use of epoxy and polyester resins, see CIRIA Report 69 “Effective use of epoxy and polyester resins in civil engineering structures”, published by the Construction Industry Research and Information Association³⁾. See also “The Repair of Concrete Structures” published by the Cement and Concrete Association⁴⁾ which also deals with polymer latex mortars, and 6.10.5 of BS 8110-1:1985.

7.6.2 Blistering. Any blistering shall be made good using material complying with 7.6.1 d).

NOTE Flaking of the surface of a unit would not constitute “blistering”.

7.6.3 Joint surfaces. Before a unit is tested for compliance it is permissible:

- a) subject to 7.4, to re-work a joint profile for compliance with clause 16 by the application of material complying with 7.6.1 b) or c) to a depth not exceeding 5 mm whilst the concrete is still green, or material complying with 7.6.1 d), or by grinding off;
- b) subject to 7.4 and to items 1) and 2) to make good using material complying with 7.6.1 b) or c) any spalling of the arrises of spigots or sockets that has occurred during de-moulding or handling.
 - 1) In any unit the total exposed area of broken concrete shall not exceed $6 \times (DN) \text{ mm}^2$ with no individual area greater than $3 \times (DN) \text{ mm}^2$.

NOTE For example, the total area for a DN 900 pipe is $5\,400 \text{ mm}^2$ with no individual area greater than $2\,700 \text{ mm}^2$.

- 2) No exposed area of broken concrete shall be in contact with both the outer and inner surface of the spigot or socket of a unit.

If material complying with 7.6.1 d) is used, the permissible areas in b) 1) shall be doubled and item b) 2) shall not apply.

7.6.4 Exposed steel. Where, on de-moulding, bar steel not forming part of the reinforcement of a unit is visible, or found to be within the concrete cover, it is permissible to remove a maximum of two such pieces each having a length not exceeding half the thickness of the unit and to make good the void(s) with material complying with 7.6.1 d) before the unit is assessed for compliance.

7.6.5 Rubbing down. After a unit has been cured and prior to despatch, it is permissible to rub down where necessary to produce a surface finish to comply with 7.5.

8 Reinforcement

8.1 Materials and arrangement

Reinforcement shall comply with one of the following standards, as appropriate.

Type of reinforcement	Standard to be complied with
Carbon steel bars for the reinforcement of concrete	BS 4449
Cold reduced steel wire for the reinforcement of concrete	BS 4482
Steel fabric for the reinforcement of concrete	BS 4483

³⁾ Obtainable from CIRIA, 6 Storey's Gate, London SW1P 3AU.

⁴⁾ Obtainable from C&CA, Wexham Springs, Slough, Bucks SL3 6PL.

The main reinforcement shall normally be placed in a circular arrangement, in the form of concentric hoops, either hooked, butt welded or lap welded, or in the form of a continuous helix or fabric, suitably welded. Elliptical or any other arrangement of reinforcement is permissible, provided that a lifting hole is cast into the crown of the unit and that the unit is appropriately marked (see clause 3 and 8.3). Longitudinal bars or wires or any other effective method shall be used to control spacing and shape and to ensure safe handling.

For reinforced pipes, both the barrel and the socket shall be reinforced. It is permissible for such reinforcement to be in separate cages, provided that it complies with 20.6.4.

The clear space between circumferential bars shall be not less than the nominal maximum size of the coarse aggregate plus 5 mm.

8.2 Protection for reinforcement

The concrete cover over all reinforcement and welded anchorage connectors shall be such that, in any finished unit, it is nowhere less than 12 mm.

An effective means shall be provided for maintaining the reinforcement in position and for ensuring correct cover during manufacture of the unit. Spacers for this purpose shall be of grade 316S31 austenitic stainless steel complying with BS 970-1 or other rustproof material. Units exhibiting rust marks that originate from steel within the unit shall be deemed not to comply with this Part of BS 5911.

Except the exposed section of a cast-in anchorage as described in 8.3.1, there shall be no steel, other than stainless steel, within the concrete cover. There shall be 25 mm minimum clearance provided between such a cast-in anchorage and any part of the reinforcement by means of welded connectors of steel complying with BS 4449 or BS 4482.

Reinforcement and welded anchorage connectors shall be free from mud, oil, paint, retarders, loose rust, loose mill scale, snow, ice, grease or any other substance which can be shown to affect adversely the steel or concrete chemically, or to reduce the bond.

8.3 Lifting facilities

8.3.1 A lifting facility shall be one of the following.

- a) A hole through the pipe wall through which a lifting device may be fitted.
- b) A recess housing a cast-in steel anchorage complying with BS 4360, hot dip galvanized in accordance with BS 729, and to which a lifting device can be attached. The recess shall be of sufficient depth to enable the anchorage subsequently to be covered to a minimum depth of 12 mm.

NOTE In either a) or b) materials used for making good on site should comply with 7.6.1 b), c) or d). Manufacturers should have available advice on the site work.

8.3.2 A cast-in lifting facility or facilities shall be provided to identify the designed crown of the pipe where elliptical or other non-circular arrangement of main reinforcement is used [see 8.1 and Appendix A g)].

NOTE It is permissible to provide lifting facilities for other pipes [see Appendix A o)].

Section 3. Dimensions and tolerances

9 Nominal size and effective length

9.1 Nominal size (DN)

The nominal sizes (see 2.4) of units shall be either:

- a) those given in column 1 of Table 2; or
- b) for units in the ranges given in Table 2A, those at the intervals specified.

Table 2A — Rationalized metric nominal sizes of units [see 9.1 b)]

Nominal size of unit DN	Interval DN
150 to 500	50
500 to 1 000	100
1 000 to 2 200	200
2 200 to 2 800	300

If nominal sizes as specified in item b) are used, the tolerances on diameter and wall thickness shall be those relating to the next higher nominal size given in Table 2.

9.2 Effective length of pipes

The effective length of pipes (see 2.7) shall be between 0.45 m and 5 m inclusive with a maximum of 3 m for pipes DN 600 or less. The manufacturer shall make available information on the effective lengths of pipes that he is able to supply in a given nominal size named in an enquiry or order (see Appendix A).

NOTE In cases where differential settlement is expected, “rocker pipes” are normally laid as the first pipe after the short section built into the manhole wall. For pipes up to and including DN 450, the effective length of “rocker pipes” will normally be in the range 0.5 m to 0.75 m; for larger pipes the range would be 0.75 m to 1.0 m.

10 Internal manufacturing diameter and actual diameter

The manufacturer shall make available, at the enquiry stage, information on the internal manufacturing diameters (see 2.5) that he is able to supply (see Appendix A). The internal manufacturing diameter shall not be outside the limits given in column 2 of Table 2.

The actual internal diameter (see 2.6) shall not deviate from the manufacturing diameter by an amount greater than that given in column 3 of Table 2.

11 External manufacturing diameter

The external manufacturing diameter of the barrel of a unit (see 2.5) shall be stated by the manufacturer, if so required. (See Appendix A.)

12 Variation in the thickness of wall

The radial thickness of the wall of a unit shall not vary by more than the amount stated in column 4 of Table 2.

13 Squareness of ends

Pipes shall be capable of being jointed in any orientation with their axes coincident within the limits specified in 20.6.2.

NOTE 1 Squareness of ends of pipes and fittings is significant only as it relates to the performance of the joint assembly.

NOTE 2 A pipeline jointed in accordance with the pipe manufacturer's instructions should provide competently sealed joints when tested in accordance with either BS 8301 or BS 8005.

14 Deviation from straightness

When assessed as described in Appendix C, the pipe shall satisfy the criteria for straightness.

15 Surface cracking

It is permissible for either of the following types of crack to be visible in the surface of the unit:

- a) structural cracks that have developed in the tensile zone of reinforced concrete, within the limit specified in 20.4.2.2, as a result of testing in accordance with Appendix D;