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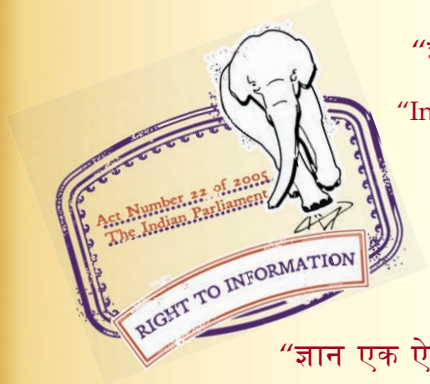

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Indian Standard

SPECIFICATION FOR PITCH IMPREGNATED FIBRE PIPES AND FITTINGS FOR DRAINAGE PURPOSES

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SPECIFICATION FOR PITCH IMPREGNATED FIBRE PIPES AND FITTINGS FOR DRAINAGE PURPOSES

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SPECIFICATION FOR PITCH IMPREGNATED FIBRE PIPES AND FITTINGS FOR DRAINAGE PURPOSES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 28 November 1986, after the draft finalized by the Water Supply and Sanitation Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Even though pitch impregnated fibre pipes have not been used in India so far, they have found wide acceptance and recognition in many countries and the continent as a means for transportation of waste water, sewage effluent, gas purposes, etc. The manufacture of these pipes has started recently in the country and standards are being formulated to control their quality and ensure their satisfactory performance in usage.

0.3 The pitch impregnated fibre pipes are of light weight and have shown their durability in service. The pipe can be easily jointed in any weather condition as internally tapered couplings joint the length without the use of jointing compound. They are flexible, resistant to heat, freezing or thawing and earth currents which set up electrolytic action. They are also unaffected by acids and other chemicals water softeners, sewer gas, oils and greases, laundry detergent and pipe cleaning compound. They can be cut to required length on the site. They are generally recommended for all drainage uses, such as, house connection to sewers and septic tanks, farm drainage and low head irrigation conductor pipes, down pipes, leaders and storm drains, industrial waste drainage, etc.

0.4 In the preparation of this standard considerable assistance has been derived from BS 2760 : 1973 'Pitch impregnated fibre pipes and fittings, for below and above ground drainage', issued by the British Standards Institution.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard covers materials, dimensions and methods of testing of pitch impregnated fibre pipes and fittings in diameters ranging from 50 to 200 mm for drainage purposes below and above ground level.

1.1.1 The standard also covers perforated pipes of the same materials for sub-surface drainage.

2. TERMINOLOGY

2.0 For the purpose of this standard the following definitions shall apply.

2.1 Pipe — A hollow cylinder of uniform internal diameter and having uniform wall thickness throughout its length, except for the tappered ends.

2.2 Couplings — A short hollow cylinder for connecting two pipes or pipes and fittings of equal nominal bore.

2.3 Fitting — A unit in a pipeline other than a pipe or a coupling.

3. MATERIAL

3.1 Pipes shall consist of a preformed felted fibrous structure impregnated, with pitch, bitumen or other no less suitable compound, conforming to requirements given in **7**.

3.2 Couplings and fittings shall be made of:

a) the same material as the pipe, or

b) polypropylene or other plastics material no less suitable, or

c) mineral fibre moulded from an inert aggregate mixed with an inorganic cement and impregnated with pitch, bitumen or other no less suitable material and conforming to requirements given in **7**.

3.3 Where rubber rings are used for jointing, the material shall be to the requirements of IS : 5382-1969*.

4. PIPES

4.1 General — The length of pipes shall be not less than 1·5 m and not more than 3·5 m. This length shall be subject to a manufacturing tolerance of ± 25 mm. The length measurement shall include the machined ends.

4.1.1 The permissible tolerance of a pipe length from straight, measured on the inside of the curve and using a straight edge 1 m long shall not be more than 10 mm.

*Specification for rubber sealing rings for gas mains, water mains and sewers.

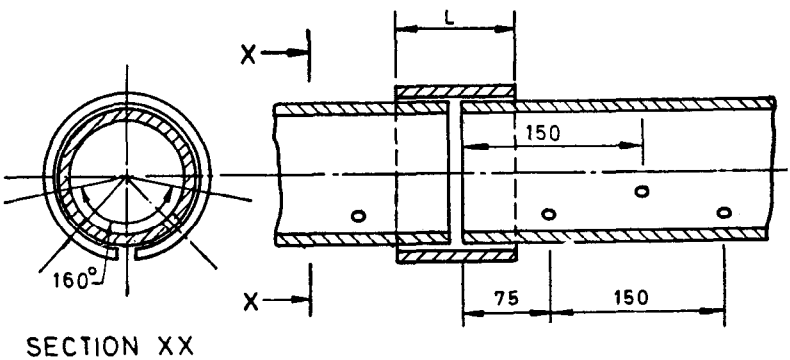
4.1.2 The bore of pipes shall be circular in cross section within the limits specified in Table 1.

TABLE 1 NOMINAL DIAMETER OF PIPES

	Nominal Bore, mm						
	50	75	100	125	150	200	225
Limits of Internal diameter, mm:							
Minimum	50	75	100	125	150	200	225
Maximum	54	80	106	133	160	213	239

4.1.3 Pipes shall be made with ends suitable for the joint specified; square cut plain ends for snap joints and 'C' coupling joints and with machined ends for taper coupling joints, soil 'O' ring joints and for spigot and socket joints (*see* **5.1**).

4.2 Additional Requirements for Perforated Pipes — Perforations shall be evenly spaced in rows parallel to the axis of the pipe as shown in Fig. 1.



All dimensions in millimetres.

FIG. 1 PERFORATED PIPE

4.2.1 The perforations shall be not less than 5 mm, dia and not greater than 16 mm, dia and the spacing in any row of perforations shall be 150 $\pm$ 10 mm between adjacent holes in that row.

4.2.2 For pipes up to 100 mm bore there shall be two rows of holes and for larger sizes there shall be four rows of holes unless otherwise specified.

4.2.3 The centre lines of all perforations shall be contained within an arc of 160° and shall be cleanly drilled (*see* Fig. 1).

4.2.4 Perforated pipes shall comply with the same test requirements as for pipes prior to perforation.

5. JOINTS AND COUPLING

5.1 General — The joints specified in this clause are each used for specific purposes. Joints specified in **5.2**, **5.3** and **5.4** shall meet the water-tightness test in **7.2.3**. The joints specified in **5.5** and **5.6** shall not be required to meet the water-tightness test. Where joints require 'O' rings or snap rings the rings shall comply with the requirements of IS : 5382-1969*.

5.2 Taper Coupling Joint — These joints and couplings shall be machined or moulded and shall conform to the dimensions given in Table 2 read with Fig. 2.

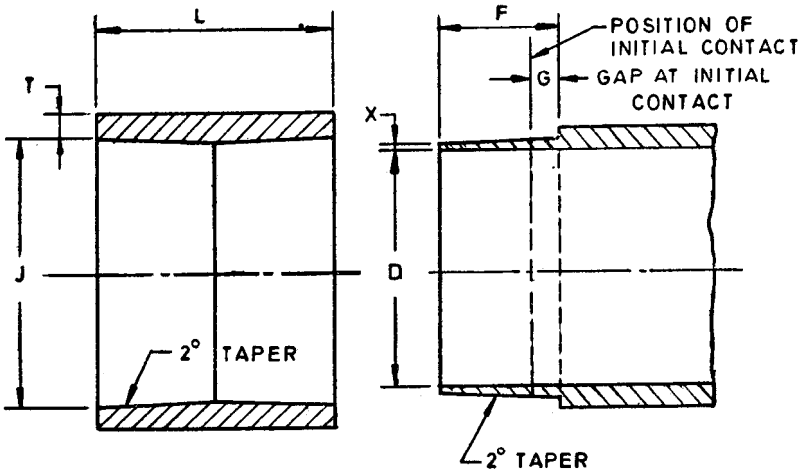


FIG. 2 TAPER COUPLING JOINTS

5.3 Snap Ring Joints — These joints and couplings for use below ground, shall comply with the dimensions shown in Table 3 read with Fig 3.

5.4 Soil Pipe 'O' Ring Joints — These joints and couplings for use only in discharge pipe installations, are telescopic and shall comply with the dimensions shown in Table 4 read with Fig. 4.

*Specification for rubber sealing rings for gas mains, water mains and sewers.

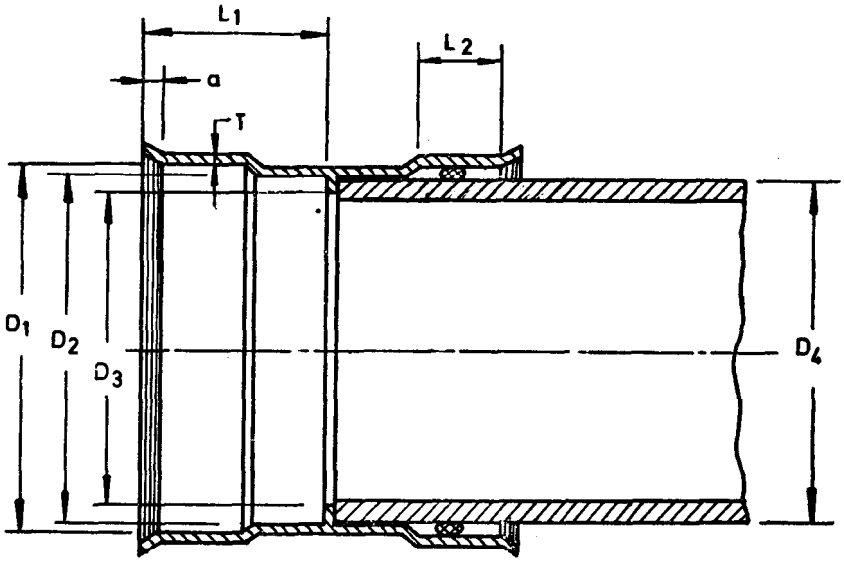


FIG. 3 SNAP RING JOINT

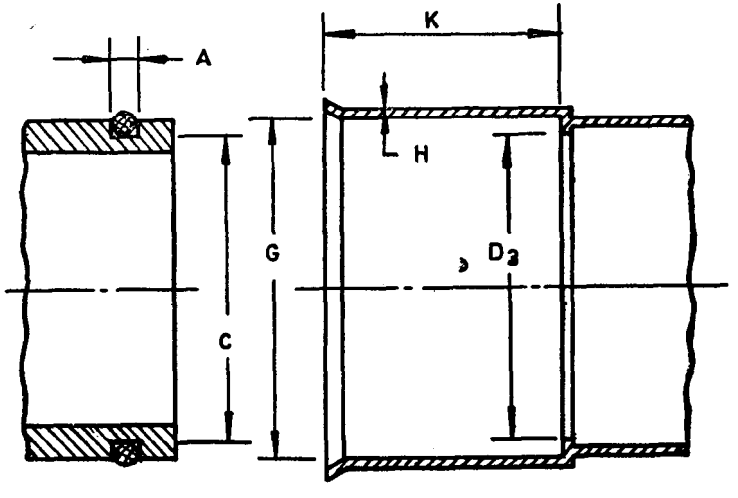


FIG. 4 'O' RING JOINT

5.5 Spigot and Socket or Rebated Joints — These joints shall have a rebate as shown in Table 5 at midwall thickness read with Fig. 5.

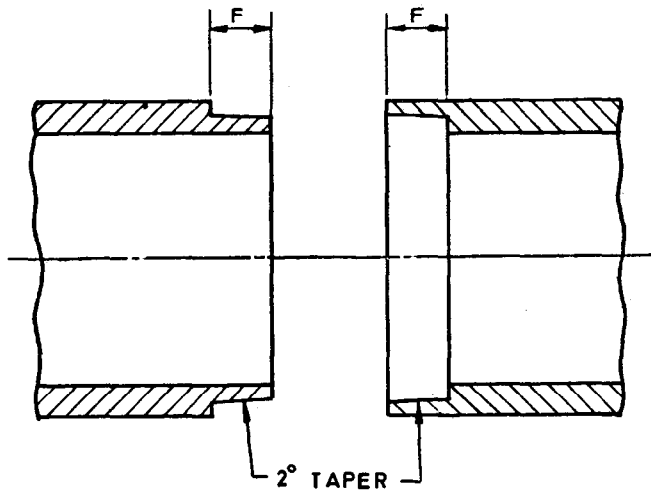


FIG. 5 SPIGOT AND SOCKET JOINTS

5.6 'C' Coupling Joints — These joints and couplings for perforated pipes shall conform to the dimensions given in Fig. 1.

6. FITTINGS

6.1 Typical fittings are shown in Fig. 6, 7 and 8. The dimensions shall be as required.

6.2 Fittings made from impregnated fibre shall be either moulded to shape, or fabricated from pipe prior to impregnation. When an adhesive is used for fabrication it shall be no less resistant to chemical attack or to boiling water and shall have no greater degree of water absorption than the pipe material and shall comply with the test in **7.1.8**.

6.3 Polypropylene fittings shall be black and consist of polypropylene polymer or copolymer composed principally of isotatic polypropylene together with suitably compounded stabilizers, lubricants and fillers. Body wall thickness shall not be less than that shown in Table 6.

TABLE 2 TAPER COUPLING JOINTS

(*Clause* 5.2, and *Fig.* 2)

All dimensions in millimetres.

	Nominal Bore						
	50	75	100	125	150	200	225
Coupling length, *L*:							
Minimum	73·7	86·9	99·6	99·6	99·6	127·0	127·0
Maximum	76·2	89·4	102·1	102·1	102·1	129·5	129·5
Pipe joint length, *F* (tolerance ± 0·25 mm)	36·3	42·9	49·3	49·3	49·3	63·0	63·0
Gap at initial contact, *G*:							
Minimum	6·4	6·4	6·4	6·4	6·4	9·4	12·7
Maximum	12·7	12·7	12·7	12·7	12·7	22·0	25·4
Coupling wall thickness, *T* (impregnated fibre)							
Minimum	6·4	7·1	8·1	10·4	11·7	11·5	16·0
Coupling wall thickness, *T* (polypropylene, tapered ends)							
Minimum	3·8	4·1	4·6	5·3	6·9	9·1	9·1
Diameter inside large end of coupling at point of initial contact on pipe taper, *J*	62·7	87·6	114·0	145·5	172·2	231·3	254·5
Wall thickness at end of male taper, pitch fibre joint, *X* (*Min*)	2·5	2·5	2·5	4·8	5·1	6·6	6·6

TABLE 3 SNAP RING JOINTS

(*Clause* 5.3, and *Fig.* 3)

All dimensions in millimetres.

		Nominal Bore			
		75	100	125	150
Mid zone diameters:					
Socket, *D*1		108·3	135·0	174·7	201·8
Throat, *D*2		98·7	125·4	159·6	186·3
Distance register *D*3		86·4	114·3	132·4	167·6
Axial lengths:					
Insertion depth, *L*1		67·4	67·4	96·8	96·8
Ring seal depth, *L*2		31·8	31·8	47·6	47·6
Lead in, '*a*', *Min*		6·6	6·6	6·6	6·6
Thickness, *T*, *Min*		2·3	2·5	2·5	2·5
Outside diameter of pipe *D*4	*Min*	92·7	120·0	152·4	179·1
	Max	97·8	125·1	158·8	185·4

TABLE 4 'O' RING JOINTS

(*Clause* 5.4, and *Fig.* 4)

All dimensions in millimetres.

	Nominal Bore	
	100	150
Internal diameter of coupling *G* (mid-zone)	123·1	163·4
Thickness of coupling, *H*, *Min*	2·8	3·8
Diameter at groove root, *C*	113·9	172·0
Width of groove, *A*	8·2	9·5
Length of socket, *K*, *Min*	88·9	88·9
Distance register, *D3*, *Min*	114·3	167·6

TABLE 5 SPIGOT AND SOCKET

(*Clause* 5.5, and *Fig.* 5)

All dimensions in millimetres.

	Nominal Bore						
	50	75	100	125	150	200	225
Length of spigot, *F* (tolerance + 2·5)	19	19	25	29	32	45	45

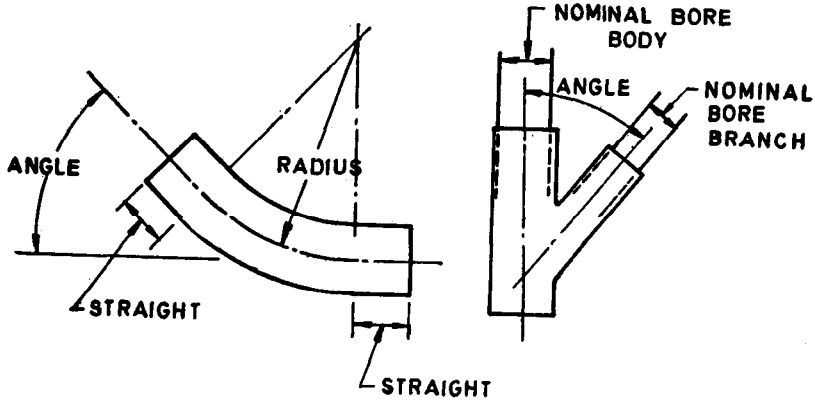


Fig. 6 Bends and Junctions (Pitch Impregnated Fibre)

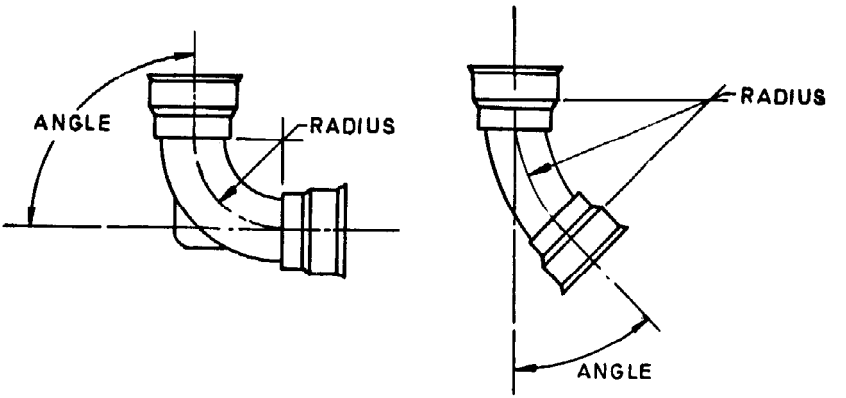


FIG. 7 BENDS (PLASTIC)

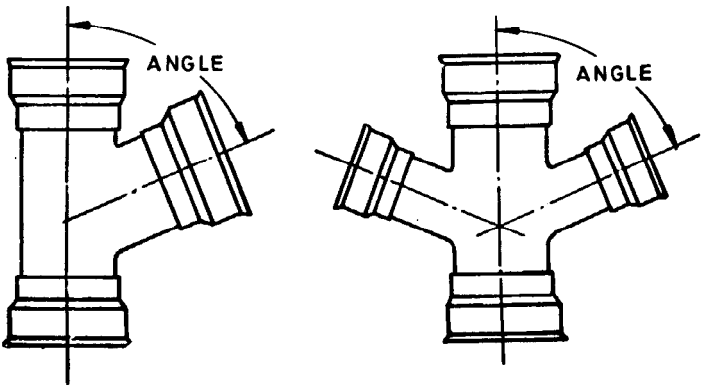


FIG. 8 JUNCTION (PLASTICS)

TABLE 6 BODY WALL THICKNESS OF POLYPROPYLENE FITTINGS

(*Clause* 6.3)

All dimensions in millimetres.

	NOMINAL BORE						
	50	75	100	125	150	200	225
Minimum thickness for below ground work	3·5	3·5	4·0	5·2	5·2	7·0	7·0
Minimum thickness above ground work	2·7	2·7	2·7	3·8	3·8	3·8	3·8

7. TEST REQUIREMENTS

7.1 Pipes, Couplings and Fittings (Except Plastic Materials) — These shall conform to the requirements given in **7.1.1** to **7.1.8.**

7.1.1 *Chemical Resistance* — Three 150 mm test lengths shall be cut from the pipe. Both ends of the test pieces shall be cleanly sawn. These couplings/fittings shall be immersed for 30 days at 27 ± 2°C as follows:

One piece in a 0·1 normal solution of sulphuric acid.

One piece in a 0·1 normal solution of sodium carbonate.

One piece in a 0·1 normal solution of sodium sulphate.

At the end of the test period none of the test pieces shall show any evidence of softening or disintegration.

7.1.2 *Water Absorption* — A 300 mm test length shall be cut from the pipe; both ends shall be cleanly sawn, wiped clean and the sample or couplings/fittings accurately weighed. It shall have had no opportunity to gain a significant amount of moisture since manufacture. It shall then be immered in water and maintained at 27 ± 2°C for 48 hours. It shall then be removed, wiped to remove surface water and immediately re-weighed. The gain in mass, expressed as a percentage of the original mass, shall not exceed 2 percent.

NOTE — This same test piece may also be used for the wet crushing strength of pipes [*see* **7.1.6** (2)].

7.1.3 *Resistance to Boiling Water* — A 300 mm test length shall be cut from the pipe and the same or couplings/fittings immersed in water, which shall be kept at boiling point for 6 hours. Upon removal, the specimen shall be placed in water at 27 ± 2°C and maintained at this temperature for 3 hours or, alternatively, stored overnight in air at 27 ± 2°C. At the end of the test period the test piece shall show no sign of disintegration or separation into laminations. Sporadic detachment or slight blistering of the superficial layer of impregnant during the test shall not be regarded as disintegration.

After examination the crushing test specified in **7.1.6**(4) shall then be carried out on the pipe specimen and the load at rupture shall be not less than 90 percent of that specified in Table 8.

7.1.4 *Heat Resistance* — Any convenient length of pipe or coupling/fittings shall be laid horizontally on a flat surface in an oven maintained at 80 ± 1°C for a period of 8 hours. At the end of the test period the test piece shall show no appreciable distortion and no appreciable exudation of impregnant.

7.1.5 *Resistance to Flattening (Pipes Only)* — Two 75 mm test lengths shall be accurately and cleanly sawn from the pipe and accurately measured for inside diameter, and the points at which measurements are taken shall be marked for identification. These two lengths shall be placed in an oven on a common flat base with their axis parallel and with the measured diameter in a vertical position as in Fig. 9. They shall be bridged symmetrically with a flat plate and the plate shall be symmetrically loaded to produce a total load in accordance with Table 7.

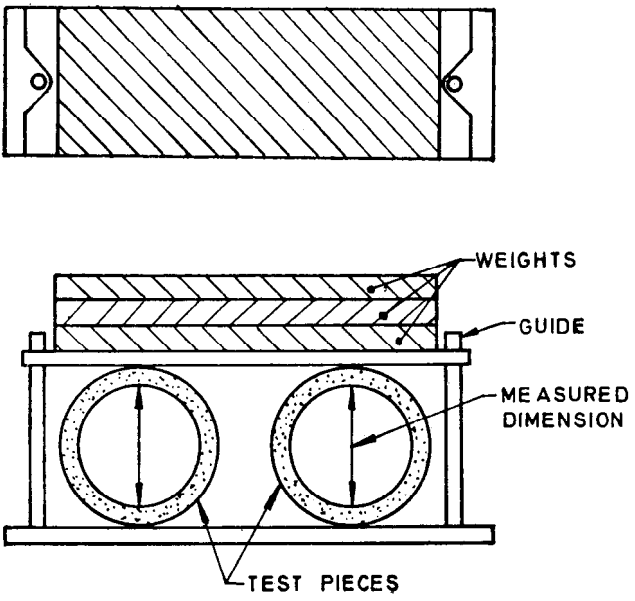


FIG. 9 FLATTENING TEST

The oven shall be maintained at 65 ± 1°C for 48 hours. At the end of this time the load shall be removed from the two test pieces: they shall be removed from the oven and allowed to cool for an hour in air at 27 ± 2°C, after which the inside dimensions shall again be measured. Change in the inside dimensions, expressed as a percentage of the original diameter, shall be recorded.

To comply, neither test piece shall show a decrease in diameter exceeding 3 percent at the point of application of the load.

TABLE 7 IMPOSED LOADS FOR RESISTANCE TO FLATTENING

(*Clause* 7.1.5)

	Nominal Bore, mm						
	50	75	100	125	150	200	225
Test load, kg	25	25	25	29	29	36	36
Equivalent load, kg per metre of length	167	167	167	194	194	240	240

7.1.6 *Crushing Strength Tests* — A testing machine having a head speed of 13 mm per minute shall be employed. Test pieces shall be laid horizontally between two flat plates extending over their entire length. All such test pieces (except couplings and fittings) shall be 300 mm in length and cleanly sawn from a pipe. The entire coupling and fitting shall be tested. Loads at rupture shall be recorded.

1) *Dry crushing* — Test pieces shall be conditioned in air at 27 ± 2°C for 24 hours prior to test. The load at rupture shall be not less than that shown in Table 8 for pipes.

2) *Wet crushing* — Test pieces shall be conditioned by immersion in water at 27 ± 2°C for 24 hours prior to test. The test shall be made within half an hour of removal from water. The load at rupture shall be not less than that shown in Table 8 for pipes.

3) *Resistance to kerosene* — Test pieces shall be immersed in kerosene having a boiling range of 150-270°C for 10 days and within half an hour of removal shall be wiped and tested. The load at rupture shall be not less than that shown in Table 8 for pipes.

4) *Crushing after boiling water* (*see* **7.1.3**) *for pipes* — After the boiling water test the same specimen shall be stored overnight in air at 27 ± 2°C prior to crushing or shall be placed in water at 27 ± 2°C and maintained at this temperature for 3 hours. The load at rupture shall be not less than 90 percent of value shown in Table 8 for pipes.

5) *Crushing strength for couplings and fittings* — Entire couplings shall be tested after conditioning in air at 27 ± 2°C for 24 hours. The load at rupture shall be not less than that given in Table 8 for couplings.

TABLE 8 MINIMUM CRUSHING STRENGTHS

(*Clause* 7.1.6)

		Nominal Bore, mm						
		50	75	100	125	150	200	225
Pipes	kg per m	1 640	1 640	1 640	1 940	1 940	2 380	2 530
	kg per test length	500	500	500	590	590	725	760
Couplings (kg per coupling)		122	143	169	195	195	304	317

7.1.7 *Beam Strength and Deflection of Pipes* — A testing machine having a head speed of 13 mm per minute shall be employed. A test piece of length L given in Table 9 and Fig. 6 shall be cleanly sawn from a pipe. The test piece shall be kept in conditions where the ambient temperature is maintained at 27 $\pm$ 2°C for a period of 14 days immediately before testing. The test rig shall consist of V blocks and a central load shall be applied either by a flexible strap as shown in Fig. 10 or by other means capable of exerting a similar bending stress. The central deflection of the test piece at rupture shall be not less than 5 mm for all pipe bores shown in the table and the load at rupture shall be not less than the load shown in Table 9 for the appropriate nominal bore.

TABLE 9 MINIMUM BEAM STRENGTH OF PIPE (See Fig. 10)

(*Clause* 7.1.7)

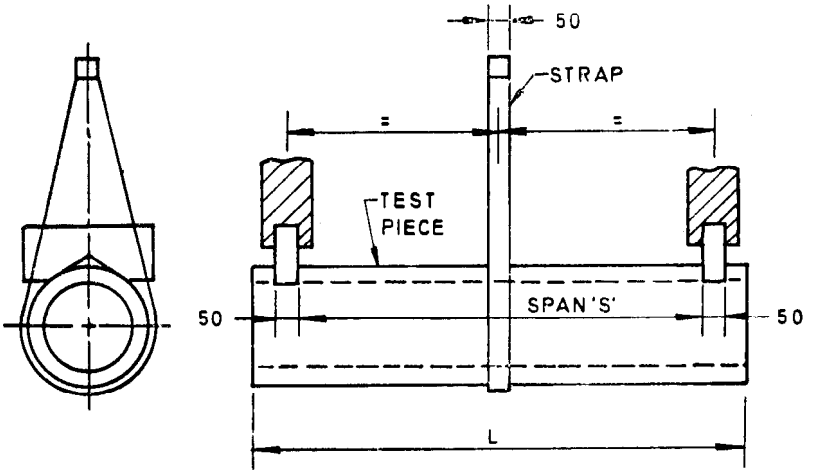
	Nominal Bore, mm						
	50	75	100	125	150	200	225
Span, S, mm	305	610	610	610	915	1 220	1 220
Overall length, L, mm	500	760	760	760	1 070	1 420	1 420
Load, kg	450	450	1 000	1 900	2 000	3 175	4 060

7.1.8 *Test of Adhesive Used in Fabricated Fittings* — A piece of fibre pipe (which has not been impregnated) 900 mm in length and 100 mm nominal bore, shall be cut and butt jointed 300 mm from one end The assembly shall then be impregnated. There shall be no internal or external fillets. The test piece shall be supported horizontally between V blocks 600 mm apart with the butt joint at 150 mm from one support. A 50 mm wide steel strap, with a 5 mm thick rubber pad beneath it, and shaped to the outside diameter of the pipe, shall be placed midway between the

supports with a suitable metal rod 1 800 mm long suspended vertically below it and having a stop at the bottom. A weight of 3·5 ± 0·05 kg centred around the rod shall be allowed to drop, with a free fall through 1 800 mm, so that the impact is transmitted directly to the pipe.

For the adhesive to be considered satisfactory and for the method of fabrication to be approved, the test piece shall withstand, without fracture of the joint, one drop of the 3·5 ± 0·05 kg weight through its full distance of 1 800 mm.

NOTE — This test is intended as a control test to be used to test both the strength of the adhesive and its bond with the fibre.



All dimensions in millimetres.

FIG. 10 BEAM TEST

7.2 Couplings and Fittings, Plastics Materials — These shall comply to the requirements given in **7.2.1** to **7.2.2.**

7.2.1 *Impact Test* — Each specimen to be tested shall be a complete fittings. It shall be tested with its major axis horizontal and laid in a dry sand bed with the sand completely covering both the inside and outside of the fitting up to its mid-diameter.

Specimens shall be preconditioned for at least 30 minutes in a water bath maintained at a temperature of 27 ± 2°C and each specimen shall be tested within 15 minutes of removal from the bath.

The test apparatus shall consist of a free falling weight machine, a suitable form of which is shown in Fig. 11. This consists essentially of a main frame fixed in a vertical position carrying guide rails on bearings which allow them to be adjusted to keep them parallel and vertical. A weighted striker is arranged to fall freely within the guide rails and an adjustable release mechanism for the striker is provided so that a given height of fall can be maintained.

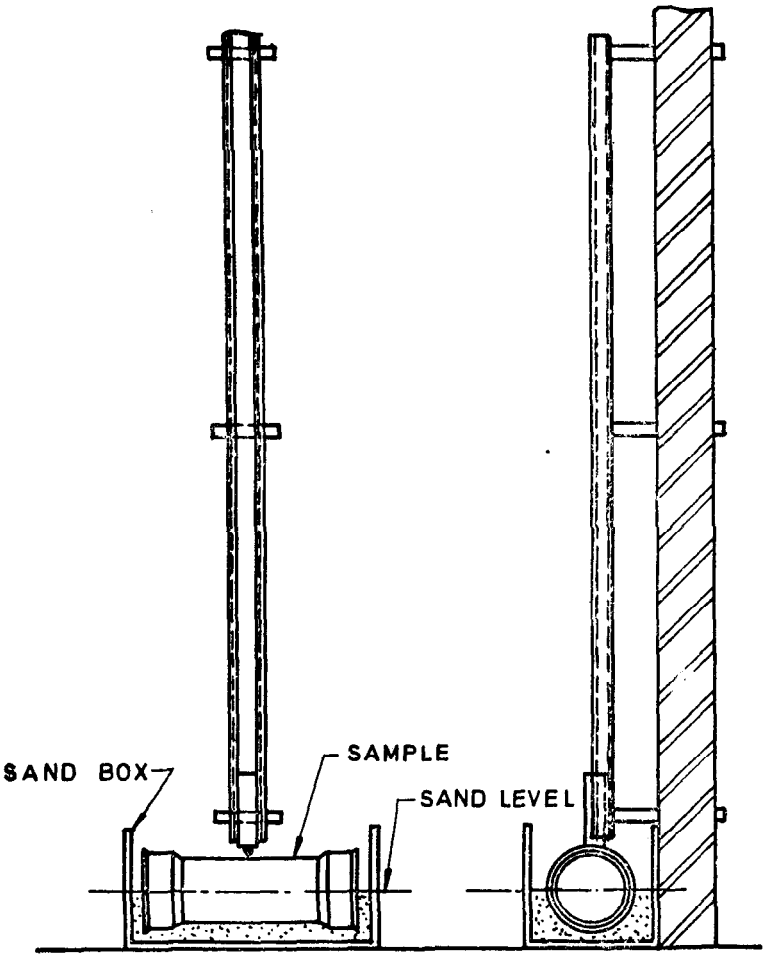


FIG. 11 IMPACT TESTING MACHINE

The striker shall weigh 1·5 ± 0·05 kg and shall have a hardened hemispherical head 25 mm in diameter.

The specimen shall be so positioned below the striking mechanism that the tip of the striker is not more than 2·5 mm from the vertical axis of the specimen.

For each test (with the exception of tests for three-quarter section slipper bends for manholes) the striker shall fall through a height of 2 m.

For tests on three-quarter slipper bends the striker shall fall through a height of 1 m.

All tests shall consist of one blow of the striker per specimen after which the specimen shall show no evidence of open or closed cracking either on the inside or the outside surfaces.

7.2.2 *Method of Testing Tensile Strength of Weld Line* — A length of socket cut 25 ± 5 mm long from any fitting (*see* Fig. 12) shall be placed over a steel plug gauge to hand tight position. The polypropylene socket ring shall then be driven a distance, as indicated in the following table, axially up the plug guage to stretch the ring. The test shall be carried out at 27 ± 2°C and to comply with the requirements of this test the ring shall not fracture whilst being driven the distance specified in Table 10.

TABLE 10 DRIVE DISTANCES FOR WELD LINE TEST ON POLYPROPYLENE FITTINGS

All dimensions in millimetres.

	Nominal Bore						
	50	75	100	125	150	200	225
Distance that socket shall be driven up the steel plug gauge beyong the hand tight position	25	32	38	38	47	50	50

7.3 Tests for Joint — The apparatus shall accommodate two jointed pipes of a suitable length and shall be such that the pipes are firmly held but may be moved axially and horizontally if so required to the limits required for each test. The pipes shall be placed in the apparatus so that at the commencement of each test they are held firmly in line both axially and horizontally. The assembly shall be filled with water, means being provided to evacuate entrained air and to apply an internal hydraulic pressure.

1) *Static head test for all joints other than telescopic joints* — Joints shall be capable of withstanding an internal pressure of 6 m head of water for 1 hour without leakage when placed in the apparatus and restrained from movement.

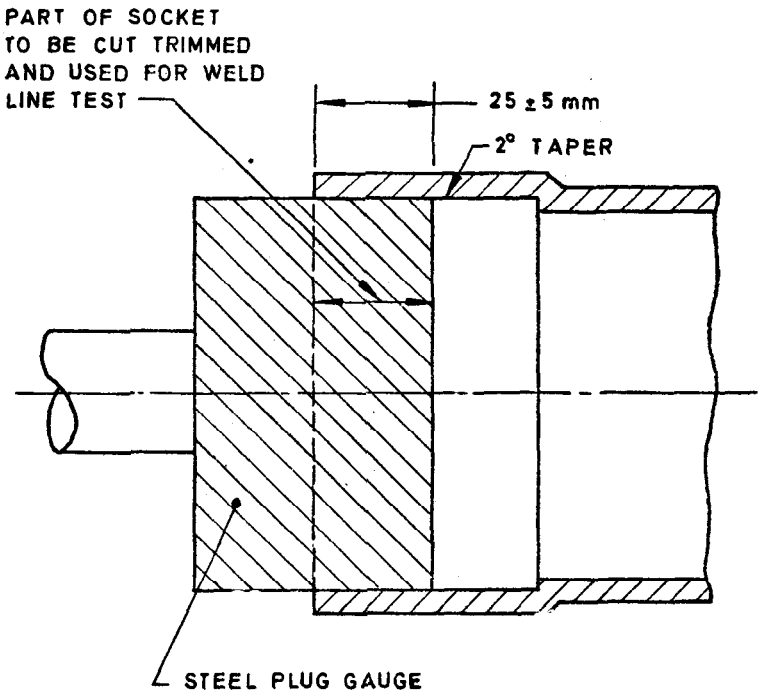


FIG. 12 PART OF SOCKET TO BE CUT, TRIMMED AND USED FOR WELD LINE TEST

2) *Straight Draw Test for Telescopic Joints* — Telescopic joints shall be capable of withstanding an internal pressure of 6 m head of water without leakage whilst being extended axially 10 mm and restrained from further movement for a period of 1 hour.

3) *Deflection Test for other Joints* — The joints shall be capable of withstanding an internal pressure of 6 m head of water for 1 hour without leakage whilst being subjected to angular displacement of 45 mm per metre of deflected pipe length for 75 mm to 150 mm bore pipe and 25 mm per metre for pipes of 200 mm and above.

4) *Shear Resistance Test for All Joints* — In addition to the tests specified in **7.2.3**(2) and **7.2.3**(3) all joints shall be capable of withstanding an internal pressure of 6 m head of water whilst being subjected to the following test. Two fully engaged jointed pipes shall be

held in the apparatus in such a manner that the axis of the pipes shall be free to separate in parallel. One pipe and its coupling only shall be restrained from all movement and the other pipe uniformly loaded over 300 mm and within 600 mm of the joint by a stirrup or other suitable means. The applied load shall be 2·5 kg per mm of nominal bore of the pipe. There shall be no visible sign of leakage over a period of 1 hour.

8. MARKING

8.1 The pipes, couplings and fittings for drainage purposes shall be marked with a suitable mark identifying the manufacturer and manufacturer's batch number.

8.2 BIS Certification Marking

The product may also be marked with Standard Mark.

8.2.1 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

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