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SPECIFICATION FOR PERFORATED CONCRETE PIPES

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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SPECIFICATION FOR PERFORATED CONCRETE PIPES

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SPECIFICATION FOR PERFORATED CONCRETE PIPES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 21 February 1974, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Perforated concrete pipes are used for underdrainage work in infiltration galleries, reclaiming water logged areas and for similar other purposes. This standard has been prepared with the object of providing guidance to the manufacturers and users in obtaining perforated concrete pipes capable of giving satisfactory service.

0.3 This standard contains a clause **5.3.1** which call for agreement between the purchaser and the supplier.

0.4 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.

1. SCOPE

1.1 This standard lays down the requirements for perforated non-reinforced concrete pipes for use in underdrainage work.

NOTE — Reinforced cement concrete perforated concrete pipes may be supplied by mutual agreement between the purchaser and the supplier.

2. CLASSIFICATION

2.1 Pipes manufactured according to this standard shall be of the following two classes:

a) *Circular Perforations Pipes* — Pipe with perforations conforming to **4.3.1**.

b) *Slotted Perforations Pipe* — Pipe with perforations conforming to **4.3.2**.

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

3. MATERIALS

3.1 Cement — Cement used for the manufacture of perforated concrete pipes shall either conform to IS : 269-1967*, IS : 455-1967† or IS : 1489-1967‡.

3.2 Aggregates — Aggregates used for the manufacture of perforated concrete pipes shall conform to IS : 383-1970§. The maximum size of aggregates should not exceed one third the thickness of the pipe or 20 mm, whichever is smaller.

3.3 Concrete — Concrete used for the manufacture of perforated concrete pipes and collars shall conform to IS : 456-1964‖.

3.3.1 In the case of concrete other than the controlled concrete the mix shall have a minimum cement content of 360 kg/m^3 and a minimum compressive strength of 185 kg/cm^2 at 28 days in work tests. If mortar is used it shall have a minimum cement content of 450 kg/m^3, and a compressive strength not less than 185 kg/cm^2 at 28 days in work tests.

3.3.2 Compressive strength tests shall be conducted on 15 cm concrete cubes or 10 cm mortar cubes in accordance with the relevant requirements of IS : 456-1964‖ and IS : 516-1959¶.

4. SIZES AND DIMENSIONS

4.1 The sizes and dimensions of the perforated concrete pipes shall be as given in Table 1.

4.2 Permissible Variations in Dimensions — The permissible variations from the dimensions specified in Table 1 shall not exceed those stated in **4.2.1**. It is not to be construed, however, that heavier wall thickness pipe cannot be supplied at the option of the manufacturer.

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*Specification for ordinary, rapid-hardening and low heat portland cement (*second revision*).

†Specification for Portland blastfurnace slag cement (*second revision*).

‡Specification for Portland Pozzolana cement (*first sevision*).

§Specification for coarse and fine aggregates from natural sources for concrete (*second revision*).

‖Code of practice for plain and reinforced concrete (*second revision*).

¶Methods of test for strength of concrete.

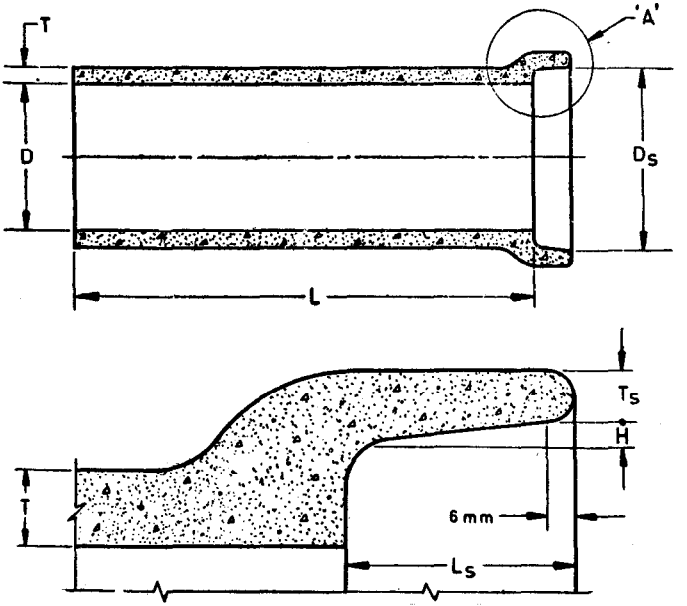

FIG. 1 DIMENSIONS OF PERFORATED CONCRETE PIPE

TABLE 1 PHYSICAL TEST AND DIMENSIONAL REQUIREMENTS FOR STANDARD STRENGTH BELL AND SPIGOT, PERFORATED NONREINFORCED CONCRETE UNDERDRAINAGE PIPE

(*Clauses* 4.1, 4.2, 4.3.1, 4.3.2, and *Fig.* 1)

Internal Diameter, *D* mm	Minimum Thickness of Barrel, *T* mm	Minimum Laying Length, *L* m	Inside Diameter at Mouth of Socket, *DS* mm	Depth of Socket, *LS* mm	Minimum Taper of Socket, *H* : *LS*	Minimum Thickness of Socket, *TS*	Rows of Perforation	Perforations per Row	Length of Slots mm	Spacing of Slots mm	Minimum Strength, kg/m, Three Edge Bearing Method	Maximum Absorption, Percent
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
80	25	1	130	40	1 : 20	3/4 *T* all sizes	4	9	25	50	—	8
100	25	1	150	40	1 : 20		4	9	25	75	1560	8
150	25	1	210	50	1 : 20		4	9	37·5	75	1560	8
200	25	1	275	57	1 : 20		4	9	50	100	1560	8
225	25	1	305	65	1 : 20		6	10	50	100	1670	8
250	25	1	330	65	1 : 20		6	10	50	100	1670	8
300	30	1	390	65	1 : 20		6	10	75	150	1790	8
350	32	1	475	65	1 : 20		6	10	75	150	1880	8
400	32	1	525	65	1 : 20		8	10	75	150	2020	8
450	35	1	565	70	1 : 20		8	10	75	150	2230	8

Note 1 — Shorter lengths may be used for closures and specials.

Note 2 — When pipes are furnished having an increase in thickness over that given in col 2, then the diameter at the inside of the socket shall be increased by an amount equal to twice the increase of the barrel.

Note 3 — This measurement *TS* shall be taken 6 mm from the outer end of the socket.

Note 4 — For laying lengths greater than 1 m, the perforations per row shall be increased to provide a spacing of approximately 75 mm.

4.2.1 *Tolerances* — The following tolerances shall apply:

a) Overall length	± 1 percent of standard length
b) Internal diameter of pipes or socket :	
1) 300 mm and under	+ 3 mm − 1·5 mm
2) 400 mm	+ 6 mm − 3 mm
3) Over 400 mm	+ 1·5 percent − 0·75 percent
c) Barrel wall thickness :	
1) Up to 25 mm	± 1·5 mm
2) Over 25 up to 35 mm	± 2·0 mm
3) Over 35 up to 50 mm	± 3·0 mm
4) Over 50 mm	± (3 mm + 1 mm for every 15 mm or part thereof over 50 mm, limited to a maximum of 5 mm)
d) Depth of Socket	
1) Up to 100 mm	− 3 mm
2) Over 100 mm	− 6 mm

e) *Deviation from Straight* — The deviation from straight in any pipes throughout its effective length, tested by means of a rigid straight edge parallel to the longitudinal axis of the pipe shall not exceed, for all diameter 3 mm for every metre run.

4.3 Perforations

4.3.1 *Circular Perforations* — Perforations shall be circular, not more than 8 mm nor less than 5 mm in diameter, and arranged in rows parallel to the axis of the pipe. Perforations shall be approximately 75 mm centre to centre, along rows. The spigot end shall be unperforated for a length equal to the depth of socket. The total number of rows shall be as shown in Table 1. The rows shall be spaced over not more than 165° of the circumference.

4.3.2 *Slots* — Slots shall be circumferential in direction, not more than 5 mm nor less than 3 mm in width, and of the lengths shown in Table 1. There shall be two rows of slots, spaced 165°. Slots shall be spaced as given in Table 1, except as modified herein for plain end pipe. The distance from the spigot end, or from the shoulder of the tongue end, to

the first pair of slots shall be not more than 25 mm greater than the specified slot spacing, nor less than 25 mm less than the specified slot spacing. Slots shall continue at uniform spacing along the entire length of the barrel.

4.3.2.1 Slots in plain-end pipe shall be spaced as shown in Table 1 except that smaller spacing shall be used where necessary to provide not less than three equally spaced slots in each row. Slots shall be centered with respect to the ends of the pipe and there shall be not more than the specified slot spacing from the pipe end to the first pair of slots, or less than one half of the slot spacing employed.

5. WORKMANSHIP AND FINISH

5.1 Absence of Defects — Pipes shall be substantially free from fractures, large or deep cracks and blisters, laminations and surface roughness.

5.2 Finish of Ends — The planes of the ends of the pipe shall be perpendicular to their longitudinal axis, subject to the requirements of **4.2.1**.

5.3 Joints

5.3.1 Unless otherwise mentioned, the perforated concrete pipe shall be provided with spigot and socket type joint (*see* Fig. 1). Tongue and groove joint, collar joint or other approved type joint may be provided by mutual agreement between the purchaser and the supplier.

5.3.2 The ends of the pipe shall be so formed that when the pipes are laid together and joined, they will make a continuous and uniform line of pipe with a smooth and regular interior surface. The joints shall be of such design as will permit effective placement without appreciable irregularities in the flow line.

5.4 Specials — Special shapes shall have a plain spigot and a socket end corresponding in all respects with the dimensions specified for pipe of the corresponding internal diameter. Branches shall be furnished to lay the same lengths as straight pipe. All specials shall conform to the requirements of **5.1** and **5.2** in respect of workmanship and finish.

5.4.1 Slants shall have their spigot ends cut at an angle of approximately 45° with the longitudinal axis.

5.4.2 Curves shall be at angles of 90, 45, 22½°, as required. They shall conform substantially to the curvature specified.

5.4.3 Branches shall be furnished with the connection or connections of the size or sizes specified, securely and completely fastened in the process of manufacture to the barrel of the pipe. T-branches and double T-branches shall have their axes perpendicular to the longitudinal axis of the pipe. Y-branches, double Y-branches and V-branches shall have

their axes approximately 45° from the longitudinal axis of the pipe measured from the socket end. All branches shall terminate in sockets, and the barrel of the branch shall be of sufficient length to permit making a proper joint when the connecting pipe is inserted in the branch socket.

5.5 Curing

5.5.1 *Water Curing* — Pipes manufactured in compliance with this standard shall be water cured for a period of not less than 2 weeks in case of pipes made from ordinary Portland cement or blastfurnace slag cement, and not less than 1 week in case of pipes made from rapid-hardening Portland cement. Pipes may be water cured by immersing in water, covering with water-saturated material or by a system of perforated pipes, mechanical sprinklers, porous hose; or by any other approved method that will keep the pipe moist during the specified curing period. In the case of large pipes projecting partly above water level, the projecting portion shall be kept wet by any suitable means.

NOTE — For pipes made from Portland pozzolana cement, the curing period may have to be suitably increased to achieve the required strength.

5.5.2 *Steam Curing* — Steam curing may be permitted provided the requirements of pressure or non-pressure steam curing are fulfilled. For non-pressure steam curing, the pipe may be placed in a curing chamber, free from outside drafts, and cured in a moist atmosphere maintained by the injection of steam for such time and such temperature as may be needed to enable the pipe to meet the strength requirements. The curing chamber shall be so constructed as to allow full circulation of steam around the entire pipe.

5.5.3 The manufacturer may, at his option, combine the methods described in **5.5.1** and **5.5.2** as long as the specified strength is attained.

6. TESTS

6.1 Test Specimens — All pipes for testing purposes shall be selected at random from the stock of the manufacturer and shall be such as would not otherwise be rejected as per requirements of this standard.

6.1.1 During manufacture tests on concrete shall be carried out as detailed in IS : 456-1964*. The manufacturer shall supply, when required to do so by the purchaser or his representative, the results of compressive tests of concrete cylinders or cubes made from the concrete used for the pipes. The manufacturer shall supply cubes for test purposes required by the purchaser, and such cubes shall withstand the tests prescribed in IS : 456-1964*.

*Code of practice for plain and reinforced concrete (*second revision*).

6.2 The specimens of pipes selected in accordance with **6.1** and subjected to the following tests in the given sequence shall withstand the design loads:

a) Three-edge bearing test or sand bearing test as described in IS : 3597-1966*;

b) Absorption test, as described in IS : 3597-1966*.

6.2.1 The manufacturer shall regularly carry out absorption tests on specimens corresponding to the pipe manufactured and shall provide sufficient proof to the purchaser that the pipes supplied satisfy the absorption test. If, however, the purchaser desires to have absorption test. carried out on any sample, the cost of the pipe from which the sample is cut shall be borne by the purchaser unless otherwise agreed to between the purchaser and the manufacturer.

6.2.2 The absorption test, when conducted in accordance with the method described in 6 of IS : 3597-1966*, shall satisfy the requirement that the total absorption at the end of 24 h shall not exceed 8 percent of the dry weight.

6.2.3 Compression test on cubes or cylinders and bursting test shall be carried out if required by the purchaser. The cost of these tests shall be borne by the purchaser.

7. SAMPLING AND INSPECTION

7.1 Scale of Sampling

7.1.1 *Lot* — In any consignment, all the pipes of same class and size and manufactured under similar conditions of production shall be grouped together to constitute a lot.

7.1.1.1 The conformity of a lot to the requirements of this specification shall be ascertained on the basis of tests on pipes selected from it.

7.1.2 The number of pipes to be selected from the lot shall be in accordance with col 1 and 2 of Table 2.

7.1.3 These pipes shall be selected at random. In order to ensure randomness, all the pipes in the lot may be arranged in a serial order and starting from any pipe, every rth pipe be selected till the requisite number is obtained, r being the integral part of N/n where N is the lot size and n is the sample size.

*Methods of tests for concrete pipes.

TABLE 2 SAMPLE SIZE AND CRITERION FOR CONFORMITY

(*Clauses* 7.1.2, 7.2.2 *and* 7.3.2)

Lot Size	For Requirements Under 4 and 5		Sample Size for Tests Under 6.2
	Sample Size	Permissible Number	
(1)	(2)	(3)	(4)
Up to 50	10	1	2
51 to 100	15	1	3
101 to 200	20	2	4
201 to 300	30	3	5
301 to 500	40	3	7
501 and above	55	4	10

7.2 Number of Tests

7.2.1 All the pipes selected as in **7.1.2** shall be inspected for dimensional requirements (*see* **4**), finish (*see* **5.2**) and deviation from straight [*see* **4.2.1** (c)].

7.2.2 The number of pipes to be tested for tests under **6.2** shall be in accordance with col 4 of Table 2. These pipes shall be selected from pipes that have satisfied the requirements mentioned in **7.2.1**.

7.3 Criterion for Conformity

7.3.1 A lot shall be considered as conforming to the requirements of this specification if the conditions mentioned in **7.3.2, 7.3.3** and **7.3.3.1** are satisfied; otherwise it shall be considered as not conforming to the requirements of this specification.

7.3.2 The number of defective pipes (those not satisfying one or more of the requirements for dimensions, finish and deviation from straight) shall not be more than the permissible number given in col 3 of Table 2.

7.3.3 All the pipes tested for various tests under **6.2** shall satisfy corresponding requirements of the tests.

7.3.3.1 In case the number of pipes not satisfying requirements of any one or more tests is, one or two, a further sample of same size shall be selected and tested for the test or tests in which failure has occurred. All these pipes shall satisfy the corresponding requirements of the test.

7.4 Marking of Rejected Specimens — All rejected pipes shall be plainly marked by the inspector and shall be replaced by the manufacturer or seller with pipes which will meet the requirements of these specifications, without additional cost to the purchaser.

8. MARKING

8.1 The following information shall be clearly marked on each pipe. Markings shall be indented on the pipe section or painted thereon with waterproof paint:

a) The class of pipe,

b) The date of manufacture,

c) The name or trade-mark of the manufacturer, and

d) Identification of the plant.

8.1.1 Each pipe may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

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