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SPECIFICATION FOR CONCRETE POROUS PIPES FOR UNDER DRAINAGE

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Indian Standard

SPECIFICATION FOR CONCRETE POROUS PIPES FOR UNDER DRAINAGE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 20 October 1967, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

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

0.3 When porous pipes are to be used for under drainage work in injurious soils they may have to be manufactured from sulphate-resisting cement of high alumina cement, and in such cases the purchaser will have to specifically indicate his requirements (*see* **3.1**) along with other information to be supplied under Appendix A for guidance of the manufacturers.

0.4 This standard contains clauses which permit the purchaser to use his option for selection to suit his requirements and also require the purchaser to supply certain technical information at the time of placing orders (*see* Appendix A). The relevant clauses are **3.1, 4.1.1, 4.2, 4.3.1.1** and **8.2**.

0.5 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

0.6 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 porous pipes made of concrete for use in under drainage. The requirements cover pipes ranging from 80 mm nominal internal diameter to 900 mm nominal internal diameter with three types of joints.

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

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definition shall apply.

2.1 Porous Pipe — A hollow cylinder made of porous concrete and having the ends of the cylinder square with the longitudinal axis.

3. MATERIALS

3.1 Cement — Cement used for the manufacture of porous pipes shall conform to IS : 269-1958* or IS : 455-1962†. When so required by the purchaser, high alumina cement or sulphate-resisting portland cement may be used (*see* **0.3** and Appendix A). The high alumina cement and sulphate-resistant cement shall be of quality approved by the purchaser.

3.2 Aggregates — The quality of the aggregates used for the manufacture of porous pipes shall conform to IS : 383-1963‡. The aggregate shall completely pass through 20-mm IS Sieve and shall be completely retained on 4·75-mm IS Sieve. The aggregate shall be suitably graded to comply with the infiltration test (*see* **6.4**).

4. SHAPE AND DIMENSIONS

4.1 Unless otherwise agreed to between the purchaser and the manufacturer, the porous pipe shall be supplied in any of the following alternative forms:

a) Pipe with uniform internal diameter as well as uniform wall thickness throughout its length and with both ends in the form of a butt (*see* Fig. 1).

b) Pipe with uniform internal diameter as well as uniform wall thickness throughout its length and having a portion at each end in which one ogee or rebate is formed in the wall thickness; the ogee or rebate at one end facing inwards and at the other end facing outwards, so that when the complimentary ends of two pipes are brought together, the ends fit into each other to form a joint (*see* Fig. 1).

4.1.1 When so required by the purchaser the porous pipes with non-porous inverts may be supplied. The non-porous inverts shall extend for the full length of the pipe and to a height equal to one-third of the internal diameter measured from the invert of the pipe as laid (*see* Fig. 2).

4.2 Pipes of shapes other than those indicated in **4.1** may be supplied by mutual agreement between the purchaser and the supplier.

*Specification for ordinary, rapid hardening and low heat portland cement (*revised*).

†Specification for portland blastfurnace slag cement (*revised*).

‡Specification for coarse and fine aggregates from natural sources for concrete (*revised*).

4.3 Dimensions

4.3.1 *Diameter and Length* — The nominal internal diameter, the effective length (*see* Fig. 1) of the pipe and the minimum wall thickness shall be as in Table 1

4.3.1.1 Pipes of internal nominal diameter and effective lengths other than those specified inTable 1 may be supplied by mutual agreement between the purchaser and the manufacturer.

4.3.2 *Collars* — For pipes having butt ends, the dimensions of the collars shall conform to the requirements given in Table 2.

4.4 Tolerances

4.4.1 The permissible deviation for the effective length shall be plus or minus one percent of the specified effective length.

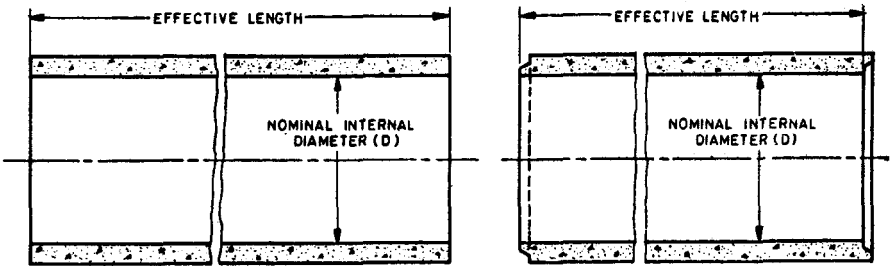

FIG. 1 TYPICAL SKETCH OF CONCRETE POROUS PIPE FOR UNDER DRAINAGE

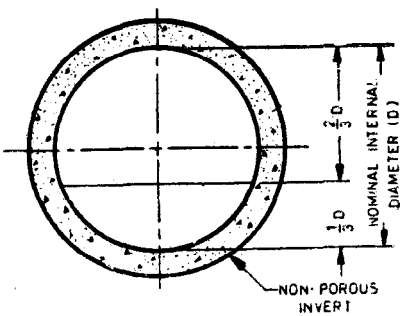

FIG. 2 TYPICAL CROSS-SECTION OF CONCRETE POROUS PIPE WITH NON-POROUS INVERT

TABLE 1 DIMENSIONS FOR CONCRETE POROUS PIPES

(*Clause* 4.3.1)

Nominal Internal Diameter	Effective Length	Minimum Wall Thickness	Joints
mm	m	mm	
(1)	(2)	(3)	(4)
80, 100, 150, 250	2·0	25	Butt, rebated or ogee
300, 350, 400	2·0 or 2·5 or 3·0	30	Butt, rebated or ogee
450, 500	2·5 or 3·0	35	Butt, rebated or ogee
600, 700	2·5 or 3·0	40	Butt, rebated or ogee
800	2·5 or 3·0	45	Butt, rebated or ogee
900	2·5 or 3·0	50	Butt, rebated or ogee

TABLE 2 COLLAR DIMENSIONS

(*Clause* 4.3.2)

Nominal Internal Diameter of Pipe	Collar Dimensions		Minimum Length
	Minimum Caulking Space	Minimum Thickness	
mm	mm	mm	mm
80, 100, 150, 250	13	25	150
300, 350, 400	16	30	150
450, 500	19	35	200
600, 700	19	40	200
800, 900	19	45	200

4.4.2 The internal diameter of any porous pipe throughout the effective length shall nowhere deviate from the nominal internal diameter by more than the following limits:

Nominal Internal Diameter	*Permissible Deviation from Nominal Internal Diameter*
Up to and including 300 mm	+3 mm −1·5 mm
Over 300 mm, up to 400 mm	+6 mm −3 mm
Over 400 mm	+1·5 percent −0·75 percent

4.4.3 *Permissible Deviation from Straightness* — The permissible deviation from straightness of any porous pipe, throughout its effective length measured on the inside on a line parallel to the longitudinal axis of the pipe, and by means of a rigid straight edge, shall not exceed for all diameters, 3 mm for every metre run.

5. MANUFACTURE AND FINISH

5.1 General — The methods of manufacture shall be such that the form and dimensions of the finished pipe are accurate within the limits specified in this standard. The edges of the pipe shall be well defined and their ends shall be square with the longitudinal axis. The portion of the pipe for a length of 75 mm from either end may be strengthened by grouting or any other suitable means to prevent the breakage.

5.1.1 It is not always necessary to reinforce the pipes. However, if required to add to the strength of the pipe for bearing external load or to withstand handling during transportation, the pipes may be reinforced with the galvanized steel reinforcement.

5.2 Non-porous Inverts — Non-porous inverts may be made by grouting or any other suitable method.

5.3 Maturing of Porous Pipes — Unless otherwise authorized by the purchaser no pipes shall be supplied under this specification until they have been allowed to mature under suitable conditions.

6. TESTS

6.1 Test Specimens — All pipes for testing purposes shall be selected at random in accordance with the procedure given in Appendix B from the stock of the manufacturer and shall be such as would not otherwise be rejected under this specification.

6.2 The specimens of pipes selected in accordance with **6.1** shall be subjected to the following tests:

a) Load test in accordance with requirements of **6.3**, and

b) Infiltration test in accordance with requirements of **6.4**.

6.2.1 The pipe specimens when tested in accordance with the requirements of **6.3** shall support for at least one minute a minimum load of 2 000 kg uniformly distributed per metre length of the pipe without showing any signs of failure.

6.2.2 The rate of infiltration of pipe specimens tested horizontally under a constant head of water of 50 mm above the pipe specimen in accordance with the requirements of **6.4** shall be not less than the following:

Nominal Internal Diameter	*Rate of Infiltration per Metre Length of the Pipe*
mm	l/min
80	60
100	
150	120
250	180
300	300
350	
400	
450	
500	
600	
700	
800	
900	

6.2.2.1 The rate of infiltration for porous pipes with non-porous inverts shall be not less than half the values specified in **6.2.2** for porous pipes.

6.2.3 The manufacturer shall regularly carry out infiltration tests on specimens corresponding to the pipe manufactured and shall provide sufficient proof to the purchaser that the pipes supplied satisfy the porosity test. However, if the purchaser desires to have porosity test carried out on any sample, the cost of the pipe shall be borne by the purchaser unless otherwise agreed to between the purchaser and the manufacturer.

6.3 Load Test — The pipe to be tested shall be placed centrally between, and with its longitudinal axis parallel to, two hard unyielding bearers of 150 mm width, with rubber packing 150 mm wide and 25 mm thick between the bearers and the pipe (*see* Fig. 3).

6.3.1 The load shall be steadily and uniformly applied, starting from zero, at a rate not exceeding 165 kg/m length of pipe in 10 seconds. The pipe shall

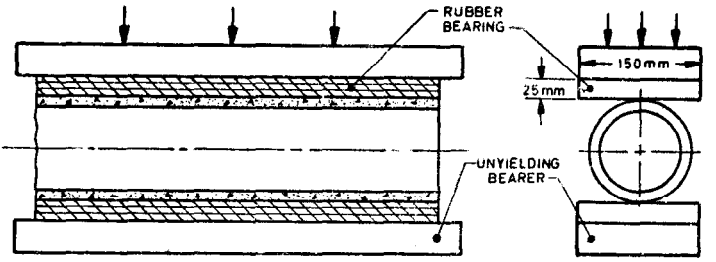

FIG. 3 DIAGRAM ILLUSTRATING THE METHOD OF CARRYING OUT LOAD TEST

support without any sign of failure for at least one minute a minimum load specified in **6.2.1.**

6.4 Infiltration Test — The porous pipe to be tested shall be thoroughly cleaned before testing to remove dust and dirt particles likely to reduce the porosity of pipe. The water used for testing shall be free from suspended impurities.

6.4.1 The pipe shall be fixed horizontally in a test tank with each end of the pipe protruding through the tank as shown in Fig. 4. A water-tight seal shall be made between the sides of the tank and the pipe with putty, plasticine or other sealing material. The tank should have some arrangement of removable ends so that, for testing different diameters of pipe, it can be dismantled and re-erected with two ends having holes of the right size to take the pipe to be tested.

6.4.2 The test tank shall be filled with water completely immersing the porous pipe. The head of water in this tank shall be maintained throughout the test at 50 mm above the pipe. Fig. 4 shows diagrammatically one method by which the water can be made to flow back through an overflow pipe from the test tank into a reservoir tank when the specified head of water is reached in the test tank and maintained by adjusting the flow. The water flowing from the collecting tank will then be diverted through the two-way control valve into the measuring tank for the specified time. The amount of water in litres per minute filling the measuring tank divided by the effective length in metres of that part of the porous pipe through which water can percolate, shall give the rate of infiltration of the pipe as specified in **6.2.2.**

7. MARKING

7.1 The following information shall be clearly marked on each pipe:

a) Date of manufacture, and

b) Name of manufacturer or his registered trade-mark or both.

7.1.1 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. Presence of this 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 during production. This system, which is devised and supervised by ISI and operated by the producer, has the further safeguard that the products as actually marketed are continuously checked by ISI for conformity to the standard. 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.

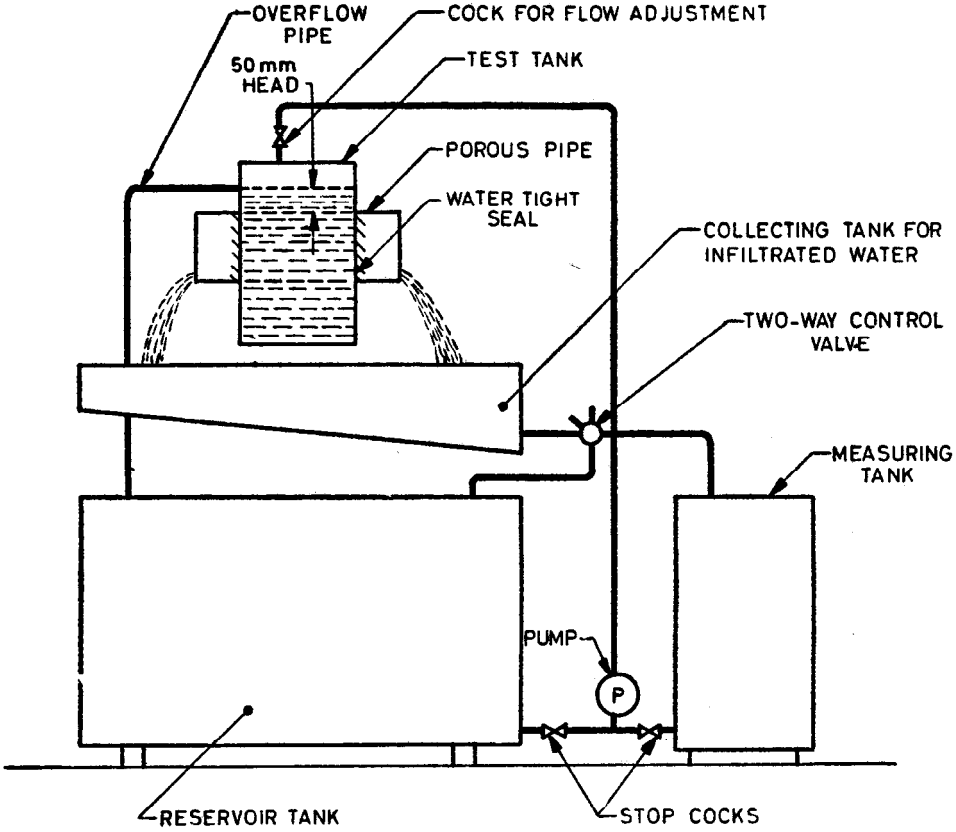

FIG. 4 TYPICAL ARRANGEMENT OF TESTING APPARATUS FOR INFILTRATION OF CONCRETE POROUS PIPE

8. DELIVERY, INSPECTION AND TESTING FACILITIES

8.1 The purchaser or his representative shall at all reasonable times have free access to the place where the pipes are manufactured for the purpose of examining and sampling the materials and pipes, and for supervising the testing and marking, if necessary, of the pipes. The manufacturer shall provide, free of extra charge, every facility and all labour required for such examination, sampling, inspecting, testing and marking before delivery and shall provide and maintain in good working order suitable, convenient and accurate apparatus for testing sample pipes. Failing facilities at his own works for making the prescribed tests the manufacturer shall bear the cost of carrying out the tests elsewhere.

8.2 Porous Pipes Supplied from Stock — When pipes made to this specification are supplied from stock the manufacturer shall, if so required, furnish to the purchaser a certificate that the pipes have been made in all respects in accordance with and comply with the requirements of this standard. Should the purchaser so desire, any or all of the tests, herein specified, shall be made by the manufacturer, and if the pipes pass the tests they shall be deemed to comply, provided that they comply with the other requirements of this specification. In the event of failure to pass the tests, they shall be deemed not to comply.

9. SAMPLING AND CRITERIA FOR CONFORMITY

9.1 The method of drawing representative samples of the material and the criteria for conformity shall be as prescribed in Appendix B.

APPENDIX A

(Clauses 0.3 *and* 0.4)

INFORMATION RECOMMENDED TO BE SUPPLIED BY THE PURCHASER WITH ENQUIRY OR ORDER

A-1. The information with regard to the following requirements shall be supplied to the manufacturer while making an enquiry or placing order for porous concrete pipes:

a) Type and nominal diameter of pipes required,

b) Type of cement to be used (*see* **0.3** and **3.1**),

c) Whether a sample of the aggregate is required, and

d) Whether the process of manufacture and the finished pipes are to be inspected.

APPENDIX B

(*Clauses* 6.1 *and* 9.1)

SAMPLING AND CRITERIA FOR CONFORMITY

B-1. SAMPLING

B-1.1 Scale of Sampling

B-1.1.1 *Lot* — In any consignment, all the pipes of the same form and size and manufactured under similar conditions of production shall be grouped together to constitute a lot. The conformity of a lot to the requirements of this specification shall be ascertained on the basis of tests on pipes selected from it.

B-1.2 The number of pipes to be selected from the lot shall be in accordance with col 2, 3 and 4 of Table 3.

TABLE 3 SAMPLE SIZE AND CRITERION FOR CONFORMITY

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

B-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 the sample size.

B-2. NUMBER OF TESTS

B-2.1 All the pipes selected as in **B-1.2** shall be inspected for dimensional requirements, finish and deviation from straightness (*see* **4**).

B-2.2 The number of pipes to be tested for tests under **6.2** shall be in accordance with col 4 of Table 3. These pipes shall be selected from pipes that have satisfied the requirements mentioned in **B-2.1.**

B-3. CRITERION FOR CONFORMITY

B-3.1 A lot shall be considered as conforming to the requirements of this specification if the conditions mentioned in **B-3.2**, **B-3.3**, and **B-3.3.1** are satisfied; otherwise it shall be considered as not conforming to the requirements of this specification.

B-3.2 The number of defective pipes (those not satisfying one or more of the requirements for dimensions, finish and deviation from straightness) shall not be more than the permissible number given in col 3 of Table 3.

B-3.3 All the pipes tested for various tests under **6.2** shall satisfy corresponding requirements of the tests.

B-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 the same size shall be selected and tested for the test(s) in which failure has occurred. All these pipes shall satisfy the corresponding requirements of the test.

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