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(दूसरा पुनरीक्षण)

Indian Standard

CONCRETE PIPES — METHODS OF TEST

(Second Revision)

(Incorporating Amendment No. 1)

ICS 23.040.90, 91.100.30

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

Price Group 4

Cement Matrix Products Sectional Committee, CED 53

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Cement Matrix Products Sectional Committee had been approved by the Civil Engineering Division Council.

Apart from the requirements regarding the design, materials, processes of manufacture, dimensions, shape, workmanship and finish, etc, acceptability of pipes is determined by the results of various tests to evaluate the properties stipulated in the relevant Indian Standard specifications. This standard lays down the procedures for conducting tests relating to load bearing, absorption, hydrostatic, permeability and straightness of concrete pipes, both reinforced concrete and prestressed concrete of pressure and non-pressure types.

In addition to the tests specified in this standard, inspection of the process of manufacture, the quality of the finished pipe and other tests for the quality control of materials during manufacture shall be carried out as per requirements of relevant Indian Standards.

This standard was first published in 1966 and subsequently revised in 1985. This revision incorporates modifications mainly in respect of hydrostatic test and permeability test which was found necessary in the light of experience gained during the use of this standard.

The composition of the technical committee responsible for the formulation of this standard is given in Annex A.

This edition 3.1 incorporates Amendment No. 1 (March 2003). Side bar indicates modification of the text as the result of incorporation of the amendment.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

CONCRETE PIPES — METHODS OF TEST

(Second Revision)

1 SCOPE

This standard covers methods for carrying out the following tests on concrete pipes, both reinforced concrete and prestressed concrete and of pressure and non-pressure types to evaluate the properties stipulated in the relevant Indian Standards:

a) Three-edge bearing test,
b) Absorption test,
c) Hydrostatic test,
d) Permeability test, and
e) Straightness test.

2 INSPECTION

The quality of all materials, process of manufacture and the finished pipes shall be subject to inspection and approval by the purchaser. If the pipe is tested for three-edge bearing or absorption, inspection of the reinforcement shall be made on the pipe sections used for those tests.

3 GENERAL PRECAUTIONS

3.1 The test specimens shall not have been exposed to a temperature below 4°C for 24 hours immediately preceding the test and shall be free from all visible moisture. The specimens shall be inspected and any specimen with visible flaws shall be discarded.

3.2 If any test specimen fails because of mechanical reasons, such as failure of testing equipment or improper specimen preparation, it shall be discarded and another specimen taken.

4 SELECTION OF TEST SPECIMENS

In addition to the requirements specified in this standard, the number of test specimens and the method of their selection shall be in accordance with the specification for the type of pipe being tested.

5 THREE-EDGE BEARING TEST

5.1 General

Three-edge bearing test shall be performed by the method given in **5.2**. The pipe shall be surface dry when tested. The test specimen shall be tested in a machine so designed that a crushing force may be exerted in a true vertical plane through one diameter and extending the full length of the barrel of the pipe but excluding the sockets, if any.

5.2 Three-Edge Bearing Method

5.2.1 *Apparatus*

5.2.1.1 *Testing machine*

Any mechanical or hand-powered device may be used in which the head that applies the load moves at such a speed as to increase the load at a uniform rate of approximately 20 percent of the expected crushing load per linear metre per minute. The loading device shall be calibrated within an accuracy of ±2 percent. The testing machine used for the load tests should produce a uniform deflection throughout the full length of the pipe and shall be so substantial and rigid throughout, that the distribution of the test load along the length of the barrel of the pipe will not be appreciably affected by the deformation or yielding of any part of the machine during the application of the load.

5.2.1.2 *Lower bearing block*

The lower bearing block (*see* Fig. 1) shall consist of two hardwood or hard rubber strips fastened to a wooden or steel beam or direct to a concrete base, which shall provide sufficient rigidity to permit application of maximum load without appreciable deflection. Wooden or rubber strips shall be straight, have a cross-section of not less than 50 mm in width and not less than 25 mm nor more than 40 mm in height and shall have the top inside corners rounded to a radius of approximately 15 mm. The interior vertical sides of the strips shall be parallel and spaced apart a distance of not more than 1/12th of the specimen diameter but in no case less than 25 mm. The bearing faces of the bottom strips shall not vary from a straight line vertically or horizontally by more than 1 mm in 375 mm of the length under load.

About 6 mm thick hard rubber or felt should be placed/fixed at the lower face of the upper wooden block which shall come in contact with the surface of the pipe.

5.2.1.3 *Upper bearing block*

The upper bearing shall be a rigid hardwood block or a block with hard rubber facing at least 150 mm × 150 mm in cross-section. The wood block shall be free of knots and shall be straight and true from end to end. It shall be fastened to a steel or wood faced steel beam

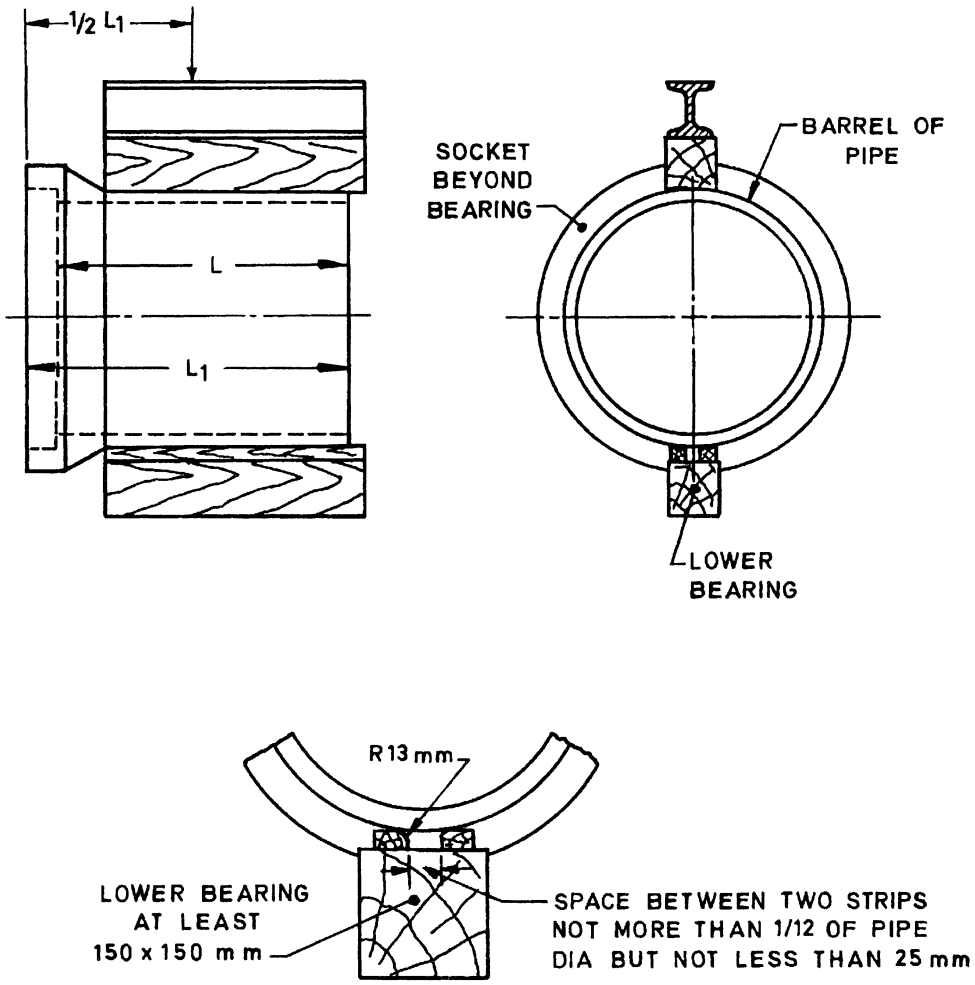


FIG. 1 THREE-EDGE BEARING METHOD

of such dimensions that deflections under maximum load will not be appreciable. The bearing face of the upper bearing block shall not deviate from a straight line by more than 1 mm in 375 mm of length under load.

5.2.1.4 The equipment shall be so designed that the load will be distributed about the center of the overall length of the pipe (*see* Fig. 1). The load may be applied either at a single point or at multiple points dependent on the length of the pipe being tested and the rigidity of the test frame.

NOTE — Multiple points of load applicable to the top bearing will permit use of lighter beams without appreciable deflection.

5.2.1.5 *Crack measuring gauge*

The crack measuring gauge shall be made from 0.25 mm thick strip and shall be of a shape as shown in Fig. 2.

5.2.2 *Procedure*

5.2.2.1 The specimen shall be placed on the two bottom bearing strips in such a manner that the pipe tests firmly and with the most uniform possible bearing on each strip for the full length of the pipes less the socket portion, if any.

If mutually agreed upon by the manufacturer and the purchaser prior to the test, a fillet of plaster of Paris not exceeding 25 mm in thickness may be cast on the surface of the upper and lower bearing before the pipe is placed. The width of the fillet cap, top or bottom, shall be not more than 25 mm per 300 mm diameter, but in no case less than 25 mm.

5.2.2.2 Each end of the pipe at a point mid-way between the lower bearing strips shall be marked and then diametrically opposite points thereof shall be established. The top bearing block shall be so placed that it contacts the two ends of the pipe at these marks. After placing the specimen in the machine on the bottom strips, the top bearing shall be symmetrically aligned in the testing machine. Load shall be applied at the rate indicated in **5.2.1.1** until either the formation of a 0.25 mm wide crack

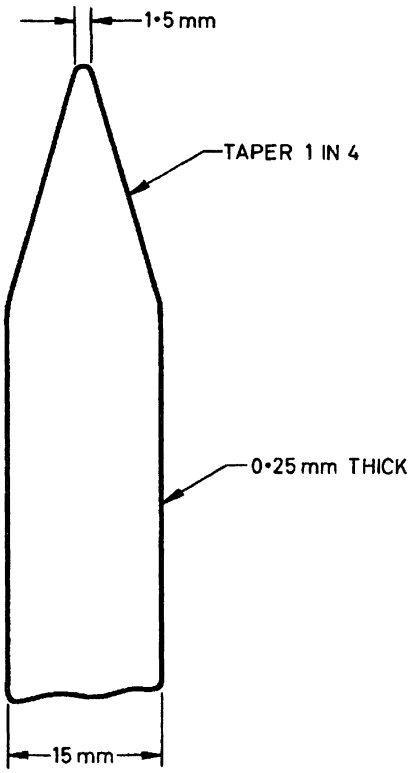


FIG. 2 GAUGE LEAF FOR MEASURING CRACKS

or ultimate strength load, as may be specified, has been reached. If both the 0.25 mm crack and ultimate load are required, the specified rate of loading need not be maintained after the load at 0.25 mm crack has been determined.

5.2.2.3 The 0.25 mm crack load is the maximum load applied to the pipe before a crack having a width of 0.25 mm measured at close intervals, occurs throughout a length of 300 mm or more. The crack shall be considered 0.25 mm in width when the point of the measuring gauge described in **5.2.1.5** penetrates 1.5 mm at close intervals throughout the specified distance of 300 mm. The ultimate load will be reached when the pipe will sustain no greater load.

5.2.3 *Calculation*

The crushing strength in Newton per linear metre of pipe shall be calculated by dividing the total load on the specimen by the nominal laying length. Effective length of the pipe shall be taken as the nominal laying length of the specimen. In case of spigot and socket ended pipes, the effective length shall be equal to the overall length minus the depth of socket (*see* Fig. 3) and in case of collar and flush jointed pipes, the effective length shall be equal to the overall length.

NOTE — In most machines the total load will include the dead weight of the top bearing plus the load applied by the loading apparatus.

6 ABSORPTION TEST

6.1 Test Specimen

Each specimen selected at random shall have a square area of 100 $cm^2 \pm 10$ percent of the length of the pipe as measured on surface of the pipe, and a thickness equal to the full depth of the pipe thickness and shall be free from visible cracks.

6.2 Procedure

6.2.1 *Drying Specimens*

Specimens shall be dried in a mechanical convection oven at a temperature of 105°C to 115°C until two successive weighings at intervals of not less than 8 h show an increment of loss not greater than 0.1 percent of the mass of the specimen. The drying time shall be not less than 36 h. The dry mass of the specimen shall be the mass after the final drying determined at ambient temperature.

6.2.2 After drying and weighing as specified in **6.2.1**, the specimens shall be immersed in clean water at room temperature for the specified period. The specimens shall then be removed from the water and allowed to drain for not more than one minute. The superficial water shall then be removed by absorbent cloth or paper and the specimens weighed immediately.

6.2.3 The least count/accuracy of the weighing balance shall be 0.1 g which the test specimen shall be weighed.

6.2.4 *Calculation and Report*

The increase in mass of the specimen over its dry mass shall be taken as the absorption of the specimen and shall be expressed as a percentage of the dry mass. The results shall be reported separately for each specimen.

7 HYDROSTATIC TEST

7.1 Test Specimen

The specimens for determination of leakage under internal hydrostatic pressure shall be sound and full-size pipe. If the pipes are tested after storing in adverse weather condition presoaking shall be permitted. For presoaking pipes shall be submerged in water or sprayed with water for a period not less than 6 hours prior to testing and excess water removed.

7.2 Procedure

7.2.1 The pipe shall be supported in such a way so that the longitudinal axis is approximately horizontal and the exterior surface excepting the supports can be examined readily.

7.2.2 The equipment for making the test shall be such that the specimen under test can be filled with water to

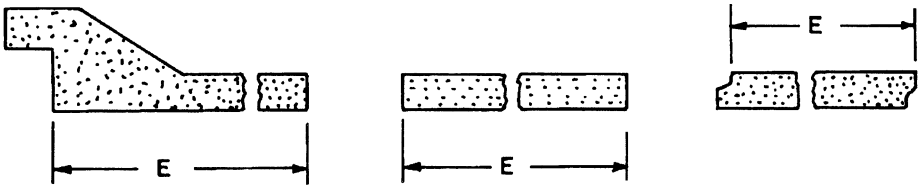


FIG. 3 ILLUSTRATING EFFECTIVE LENGTH 'E' OF PIPES

the exclusion of air and subjected to the required hydrostatic pressure. Apply hydrostatic pressure to the whole pipe including the portion of socket and rebated joints, that is, subjected to pressure in the 'as laid' condition.

7.2.3 The specimen shall be filled with water and the air expelled. Pressure shall be applied at a gradual rate until the specified test pressure is reached, or beads of water on the pipe surface is seen, whichever occurs first.

7.2.4 Pressure shall be maintained for 1 min + 30 s for each 10 mm of wall thickness (for precast concrete pipes wall thickness shall be full barrel wall thickness, whereas it shall be core thickness, in case of prestressed concrete pipe) or for twice that entire period if the application of pressure resulted in the formation of beads of water on the pipe surface.

7.2.5 At the end of the holding period, the pressure shall be released immediately if the test pressure has been maintained. If the beads of the water have not grown or run the pressure shall be increased slowly until the test pressure is reached or the beads of water grow or run (whichever occurs first).

7.2.6 If the test pressure has been reached without the beads of water growing or running, the test pressure shall be maintained constant for 1 min + 30 s for each 10 mm of wall thickness (for precast concrete pipes wall thickness shall be full barrel wall thickness, whereas it shall be core thickness, in case of prestressed concrete pipe). At the end of the holding period the pressure shall be released immediately.

After releasing the pressure, the test pipe shall be drained completely.

8 PERMEABILITY TEST

8.1 Prestressed Concrete Pipes and Precast Concrete Pipes

This test shall be done on outside surface of the pipe. No additional treatment of any type shall be done on the pipe before permeability test is carried out. For Prestressed Concrete Pipe, the test shall be conducted at 3 places on coating and for Precast Concrete Pipe at 2 places simultaneously, immediately after curing is completed (*see* Fig. 4). In case this is done later, the pipe shall be kept wet for 48 hours prior to test. For plain/flush ended precast pipes, it shall be carried out about 300 mm away from both ends.

8.1.1 *Procedure*

The dry surface of the pipe shall be scrapped by wire brush and loose particles, if any, removed. Sealant shall then be applied to the lower portion of the cup and cup shall be pressed on the pipe. After hardening of sealant, water shall be filled in the cup with wash bottle. The glass tube with rubber cork shall then be fixed in the cup as shown in Fig. 4. Water in the tube shall then be filled using wash bottle and air shall be allowed to escape during filling. Precaution shall be taken, so that water does not leak either from cup ends or from the rubber stopper.

8.1.2 *Initial Absorption*

Water shall be filled up to zero mark and reading shall be taken at every half hour interval up to two hours. The drop in water level in the stand pipe at the end of two hours in the initial absorption.

8.1.3 *Final Permeability*

Fill the water in the stand pipe again up to zero mark and take the reading at one hour interval up to 4 h. The absorption in the fourth hour, that is, difference between fourth and third hour readings is the final permeability. The average of tests conducted at three places for prestressed concrete pipe and two places for precast concrete pipe shall be expressed in cm^3 as final permeability.

Criteria for acceptance is the final permeability.

9 STRAIGHTNESS TEST

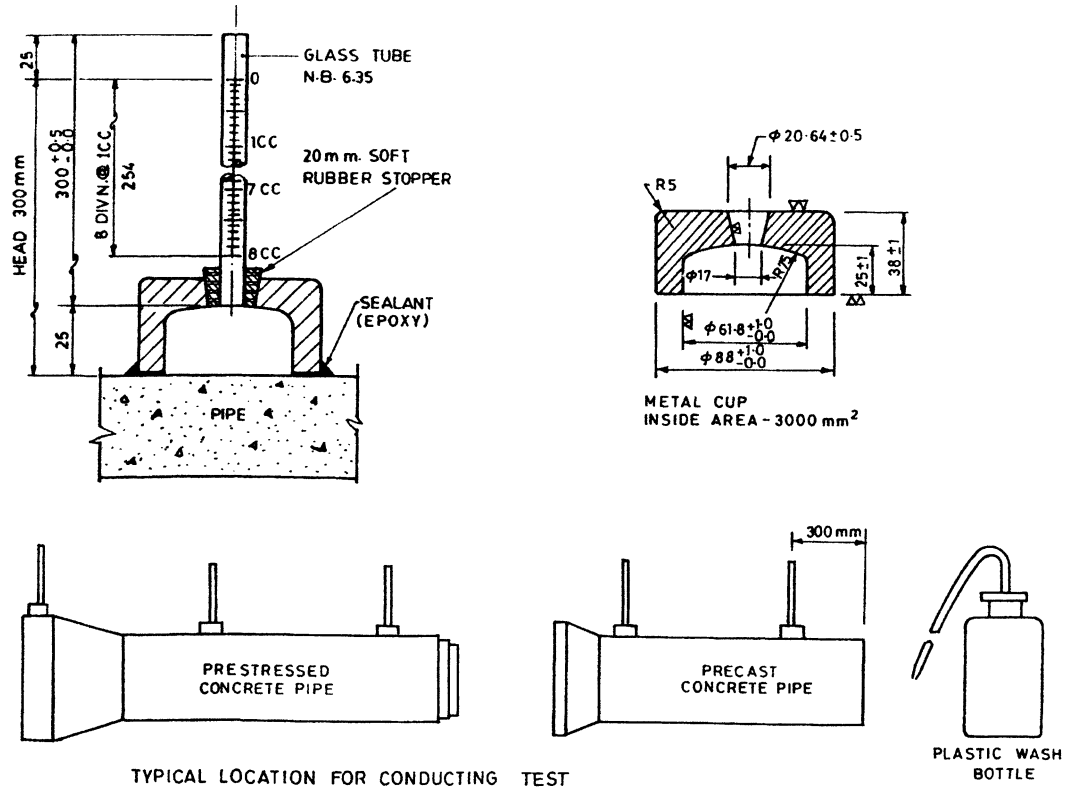
9.1 Procedure

9.1.1 A rigid straight edge, made into a gauge of the form and dimension shown in Fig. 5 shall be placed in the bore of the pipe with edge *X* in contact with the pipe internal surface and/or the line parallel to the pipe axis. Hold the plane of the gauge in a radial plane.

9.1.2 If both ends of the gauge, when so placed are in contact with the internal surface of the pipe, the deviation from straightness is excessive. If this condition occurs at any one of four different positions of the gauge, approximately equally spaced around the pipe circumference the pipe does not comply with the particular requirement.

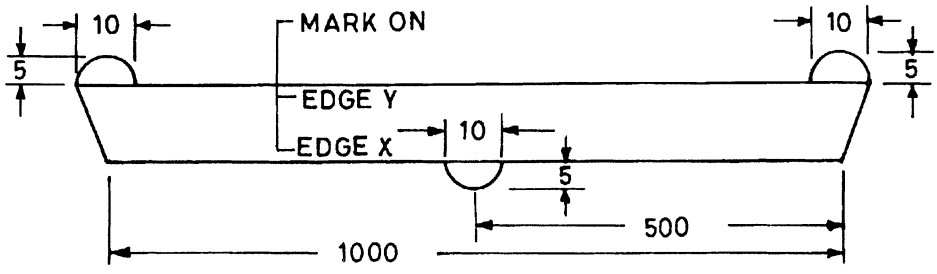
9.1.3 If both ends of the gauge, when used as described in **9.1.1**, are not in contact with the internal surface of the pipe at both ends, the gauge shall be reversed so that edge *Y*, placed as in **9.1.1**, is adjusted to the internal surface of the pipe. If the two studs in edge *Y* cannot be made to touch the surface of the pipe simultaneously, the deviation from the straightness is excessive.

If this condition occur at any four position of the gauge the pipe does not conform with this particular requirements.



All dimensions in millimetres.

FIG. 4 METHOD FOR PERMEABILITY TESTING OF CONCRETE PIPES



All dimensions in millimetres.

FIG. 5 STRAIGHTNESS TEST

ANNEX A

(*Foreword*)

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(*Continued on page* 7)

(*Continued from page* 6)

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A-5, Adinath Antophill, Mumbai 400037

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

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Amendments Issued Since Publication

Amend No.	Date of Issue
Amd. No. 1	March 2003

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002. Telegrams: Manaksanstha
Telephones: 323 01 31, 323 33 75, 323 94 02 (Common to all offices)

Regional Offices:		Telephone
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002	323 76 17, 323 38 41
Eastern	: 1/14 C. I. T. Scheme VII M, V. I. P. Road, Kankurgachi, KOLKATA 700054	337 84 99, 337 85 61, 337 86 26, 337 91 20
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