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IS 2645 (2003): Integral Waterproofing Compounds for Cement Mortar and Concrete -Specification [CED 2: Cement and Concrete]



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(दूसरा पुनरीक्षण)

Indian Standard

INTEGRAL WATERPROOFING COMPOUNDS FOR
CEMENT MORTAR AND CONCRETE—
SPECIFICATION
(*Second Revision*)

ICS 91.100.10;91.100.30

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

FOREWORD

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

A number of proprietary integral waterproofing compounds for mortar and concrete exist in the market which according to the manufacturers' recommendations, may be added to cement to render the mortar or concrete waterproof. Earlier recommendations were not available to test these products for their efficacy as waterproof or their effects on other properties of cement. This standard was, therefore, published in 1964 and was subsequently revised in 1975.

It is necessary that all constituent materials in concrete including integral waterproofing compounds for mortar and concrete should, as far as possible, be free from chlorides and sulphates. Sometimes, waterproofing compounds are likely to contain water soluble chlorides and sulphates which may cause corrosion of steel reinforcement in reinforced concrete and also produce other harmful effects in concrete. IS 456 : 2000 'Code of practice for plain and reinforced concrete (*fourth revision*)' specifies the permissible limit of chlorides and sulphates in the concrete. The Committee, while reviewing the standard in 1984 felt that the dosage of sulphates in waterproofing compounds was so small that contribution of these compounds to the total soluble sulphates in concrete would be insignificant when compared to the limit of sulphates specified in IS 456 and that the adverse effects of chlorides in concrete and its control through limiting the chlorides from the concrete materials and admixtures were most significant. The Committee, therefore, issued an Amendment to this standard through which it was provided that the chloride content in the waterproofing compound would be declared by the manufacturer so that different samples of waterproofing compounds could be compared and Engineer-in-Charge was in knowledge of the amount of chlorides entering into concrete through waterproofing compound.

This revision has been brought out to incorporate modifications found necessary based on the experience gained with the use of this standard and specially in the context of recent developments in this field in the country.

The significant modifications included are as follows :

- a) Use of 43 and 53 Grades of ordinary Portland cement has also been permitted for testing the waterproofing compounds.
- b) Requirement for setting time has been modified.
- c) Requirement for compressive strength has been modified.
- d) A limit for maximum chloride content has been introduced.
- e) Sampling plan has been incorporated.

The composition of the Committee responsible for formulation of this standard is given at Annex C.

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, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

INTEGRAL WATERPROOFING COMPOUNDS FOR CEMENT MORTAR AND CONCRETE— SPECIFICATION

(*Second Revision*)

1 SCOPE

This standard covers the requirements for integral waterproofing compounds for cement mortar and concrete which shall be assessed by :

- a) The permeability to water of the specimen made from cement sand mortars, with and without addition of waterproofing compound under test, by measuring the percolation of water through standard specimen cylinders.
- b) The physical tests of setting time and compressive strength of cement by admixing the recommended proportions of the mortar/concrete waterproofing compound and comparing the results of similar tests on the same cement without addition of the compound.

NOTES

1 Integral waterproofing compounds for mortar and concrete shall be used in such proportions as recommended by manufacturer but not exceeding 3 percent by weight of cement.

2 For the purpose of all the requirements in this standard, cement shall mean ordinary Portland cement 33 Grade, 43 Grade or 53 Grade conforming to IS 269, IS 8112 and IS 12269 respectively. By agreement between the purchaser and the supplier, testing of waterproofing compounds may be done with Portland slag cement conforming to IS 455 or Portland pozzolana cement—Fly ash based conforming to IS 1489 (Part 1) or Portland pozzolana cement—Calcined clay based conforming to IS 1489 (Part 2).

2 REFERENCES

The standards given in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 REQUIREMENTS

3.1 Permeability to Water

The permeability to water of the standard cylindrical specimen prepared with the recommended proportions of waterproofing compound shall be less than half of the permeability of similar specimen prepared without

the addition of the compound when tested in accordance with the method given in Annex B.

3.2 Setting Time

The setting time of the cement admixed with the recommended proportion of the waterproofing compound when tested according to IS 4031 (Part 5), keeping time of gauging not less than 5 min nor more than 6 min shall conform to the following requirements :

- a) *Initial setting time*—Not less than 30 min nor the reduction in the initial setting time shall be more than 25 percent of the actual initial setting time of cement used for testing.
- b) *Final setting time*—Not more than 600 min nor the increase in the final setting time shall be more than 25 percent of the actual final setting time of cement used for testing.

3.3 Compressive Strength

The average compressive strength of 3 mortar cubes, prepared, stored and tested in accordance with the method described in IS 4031 (Part 6), using the recommended proportion of integral waterproofing compound as admixture to the cement shall be as follows:

- a) *Compressive strength at 3 days (72 ± 1 h)*—Not less than the minimum specified 3 days compressive strength of the grade of ordinary Portland cement used nor less than 90 percent of the 3 days compressive strength of mortar cubes prepared with same cement and sand only.
- b) *Compressive strength at 7 days (168 ± 2 h)*—Not less than the minimum specified 7 days compressive strength of the grade of ordinary Portland cement used nor less than 90 percent of the 7 days compressive strength of mortar cubes prepared with same cement and sand only.

3.4 Chloride Content

The chloride content determined in accordance with IS 6925 in the product shall be declared by the manufacturer. Further, it should not exceed 2.0 percent by mass of the product.

4 SAMPLING

4.1 Lot

Waterproofing compound upto 500 kg/500 litre or part manufactured at a time with same raw material shall constitute a lot.

4.2 Samples

Representative samples of waterproofing compound shall be selected in the manner specified in 4.2.1.

4.2.1 The number of containers/bags of a particular lot shall be selected for sampling in such a manner that complete representation is assured. The number of containers/bags to be sample shall be in accordance with Table 1.

4.2.2 Each sample for testing requirements as per 3.1 to 3.4 shall be the composite sample of the individual samples taken from the lot as per Table 1.

Table 1 Sampling of Water-Proofing Compound
(Clauses 4.2.1 and 4.2.2)

Sl No.	No. of Containers/ Bags in the Lot	No. of Containers/ Bags to be Sampled
(1)	(2)	(3)
i)	Up to 25	2
ii)	26 to 50	3
iii)	51 to 100	5
iv)	101 to 300	7
v)	301 to 500	10

4.3 Criteria for Conformity

A lot shall be considered as conforming to the

requirements of this standard if the composite sample meet the requirements mentioned in 3.1 to 3.4.

5 PACKAGING

The integral waterproofing compound for cement mortar and concrete shall be packed in suitable containers/bags.

6 MARKING

6.1 Each container/bag shall be legibly and indelibly marked with the following :

- a) Name of the material;
- b) Name and address of the manufacturer and/or his trade-mark, if any;
- c) Net mass;
- d) Brand name, if any;
- e) Date, month and year of manufacture;
- f) Batch No./Control unit No.
- g) Maximum chloride content;
- h) Manufacturer's recommended dosage;
- j) Instructions for use and safety precautions;
- k) Recommended storage conditions, and
- m) Date of expiry.

6.2 BIS Certification Marking

The integral waterproofing compound may also be marked with the Standard Mark.

6.2.1 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.

ANNEX A

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	Title	IS No.	Title
269 : 1989	Ordinary Portland cement, 33 Grade — Specification (<i>fourth revision</i>)	4031	Methods of physical tests for hydraulic cement:
455 : 1989	Portland slag cement — Specification (<i>fourth revision</i>)	(Part 5): 1988	Determination of initial and final setting times (<i>first revision</i>)
650 : 1991	Specification for standard sand for testing of cement (<i>second revision</i>)	(Part 6): 1988	Determination of compressive strength of hydraulic cement (other than masonry cement) (<i>first revision</i>)
1489	Specification for Portland pozzolana cement:	6925 : 1973	Methods of test for determination of water soluble chlorides in concrete admixtures
(Part 1) : 1991	Fly ash based (<i>third revision</i>)	8112 : 1989	43 Grade ordinary Portland cement — Specification (<i>first revision</i>)
(Part 2) : 1991	Calcined clay based (<i>third revision</i>)	12269 : 1987	Specification for 53 Grade ordinary Portland cement
1727 : 1967	Methods of test for pozzolanic materials (<i>first revision</i>)		

ANNEX B

(Clause 3.1)

**TEST METHOD FOR DETERMINATION OF PERMEABILITY TO WATER OF
CEMENT MORTARS WITH AND WITHOUT ADDITION OF INTEGRAL
WATERPROOFING COMPOUND**

B-1 GENERAL

This method of test covers the procedure for determining the permeability to water of the cement sand mortar specimen, prepared with and without the addition of the waterproofing compound and cured under specified conditions, by measuring the percolation of water through standard cylindrical specimen.

B-2 TESTING EQUIPMENT**B-2.1 Permeability Unit**

The permeability unit shall consist of a specimen container ring of 100 mm diameter and 50 mm height held between a bottom plate and a water cell. The hydraulic head for testing shall be obtained by connecting the unit to a compressor through a water pressure vessel. A pressure regulator and a pressure gauge shall be included between the compressor and water pressure vessel to indicate the test pressure. Water percolating through the specimen shall be collected in a container Fig. 1 and Fig. 2 give the details of an individual unit.

The water cell shall be a 100 mm diameter brass cylinder and the top and bottom plates shall be either of brass or any other non-corroding metal. The connecting pipeline from the water cell to the water pressure vessel shall also be of non-corroding metal or of hard polythene. This requirement is necessary since the tests last over a number of days in which mild steel or allied materials will corrode and the rust formed will coat the top of the specimen and affect the permeability. The connection of units to the compressor shall be done by means of armoured heavy duty rubber hose.

The water pressure vessel shall be made of galvanized steel and capable of withstanding the applied pressure with an adequate margin of safety.

B-2.2 Rammer

A standard rammer of the type shown in Fig. 3 shall be used to compact the mortar. The rammer shall consist of a plunger weighing 500 ± 5 g which shall fall freely through a height of 150 ± 1 mm in a tubular guide. The base of the plunger shall have a diameter of 50 ± 1 mm.

B-3 STANDARD SAND**B-3.1 Regraded Sand**

The standard sand to be used in the preparation of the mortar shall be natural, preferably rounded siliceous sand with a maximum amount of quartz grains. The sand should preferably be the same as standard and conforming to IS 650 but clean, separated and recombined to yield the following gradation:

<i>IS Sieve Designation</i>	<i>Cumulative Retained Percent</i>
2.00 mm	0
1.70 mm	5 ± 5
1.00 mm	33 ± 5
500 microns	67 ± 5
150 microns	88 ± 5
75 microns	98 ± 2

B-4 PREPARATION OF MORTAR

B-4.1 Clean appliances shall be used for mixing and the temperature of the water and that of the test room at the time when the above operations are being performed shall be $27 \pm 2^\circ\text{C}$.

B-4.2 The quantities of cement and standard sand required for each specimen shall be as follows :

- a) Cement : 140 g
- b) Waterproofing compound : As recommended by manufacturer
- c) Standard sand : 700 g

The amount of water used for gauging shall be equal to produce a flow of 75 ± 5 percent as determined in accordance with the procedure given in 9.5.3 of IS 1727.

The mixture of cement and standard sand shall be placed on a non-porous plate. It shall be mixed dry with a trowel for 1 min and then with water until the mixture is of uniform colour. The quantity of water to be used shall be as specified in 4.2. The time of mixing shall be not less than 3 min and should the time taken to obtain a uniform colour exceed 4 min, the mixture shall be rejected and the operation repeated with a fresh quantity of cement, sand and water.

NOTE — Wherever possible, mixing with Hobart type mortar mixer is recommended. In such cases, it is desirable to take a batch of 300 g cement and 1 500 g regraded sand since in the Hobart mixer efficiency is better with a 1 800 g - 2 000 g batch. The material used for the flow test can be collected back into the bowl, mixed again for 15 s at medium speed and used for casting. In case where flow test is omitted after completion of mixing, allow the mortar to stand for 90 s, remix for 15 s at medium speed and later mould two test specimen.

B-5 PREPARATION OF SPECIMEN

The container ring shall be given a thin coating of neat cement slurry and the mortar shall be placed in

it in two layers. Each layer shall be compacted with 10 blows of the standard rammer. During compaction the guide of the rammer shall remain in contact with the wall of the container ring. It shall be moved through a uniform distance after each blow so as to cover the entire periphery container ring after 10 blows. After compaction the top specimen shall be levelled off with a 12 mm diameter rod slowly and firmly moved over the surface. No trowelling of other type of the finish shall be allowed.

B-6 CURING AND STORAGE OF SPECIMEN

Keep the container ring with the specimen at a temperature of $27 \pm 2^\circ\text{C}$ in an atmosphere of at least 90 percent relative humidity for 24 h. At the end of that period submerge the specimen in clean fresh water and keep there for 20 days, and take it out just prior to testing. The water in which the specimens are submerged shall be changed every 7 days and shall be maintained at a temperature of $27 \pm 2^\circ\text{C}$.

B-7 PROCEDURE OF TEST

The specimen shall be lightly wire brushed on either faces to remove laitance, surface fines, etc and washed. Later each of the specimen shall be fitted into the permeability cell as shown in Fig. 2.

An initial pressure of about 0.05 N/mm^2 shall be applied to the water and from time to time the collecting container shall be taken out and weighed to determine the rate of percolation. The rate of percolation will be comparatively high in the initial stages and will then become stabilized. At this stage the pressure shall be increased again by 0.05 N/mm^2 and this procedure repeated until a final pressure of 0.2 N/mm^2 is reached. When a stable flow has been reached at this pressure, readings of the percolation shall be taken at fixed intervals of time for 8 h.

The test shall be carried out at a temperature of $27 \pm 2^\circ\text{C}$. For each test three specimen shall be tested without the use of waterproofing compound, and three with the use of the waterproofing compound in the recommended proportions. If the average percolation (measured in millilitres of water) for the specimen incorporating the waterproofing compound is less than 50 percent of the average percolation in the case of the specimen without the waterproofing compound; the integral waterproofing compound under test shall be considered satisfactory.

B-8 FAULTY SPECIMEN AND RETESTS

Specimen that are manifestly faulty or that give percolations (measured in millilitres of water) differing by more than 20 percent from the average shall not be considered. In such cases, the average of the remaining two specimen can be considered provided the two values agree within 10 percent of their average; otherwise a retest shall be made.

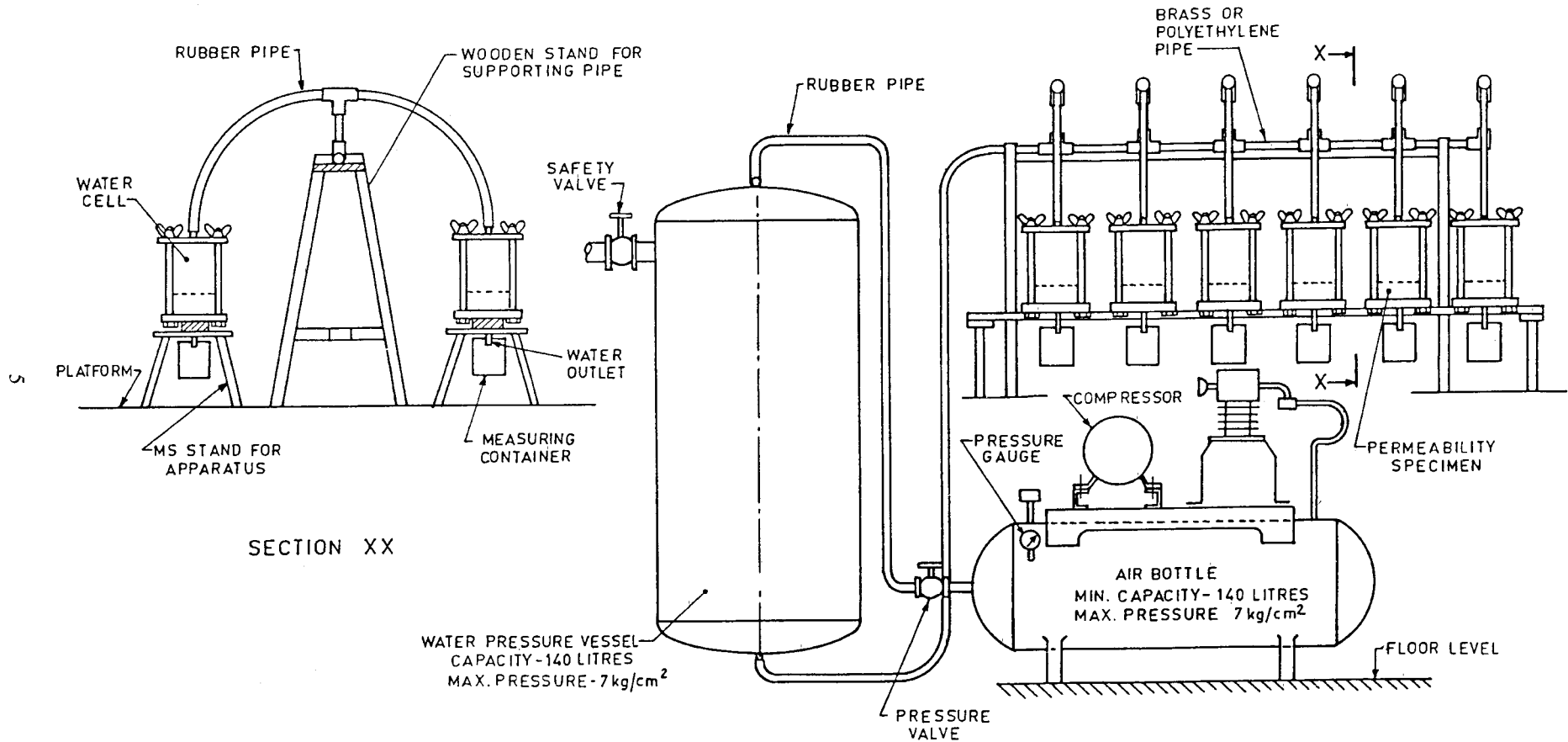
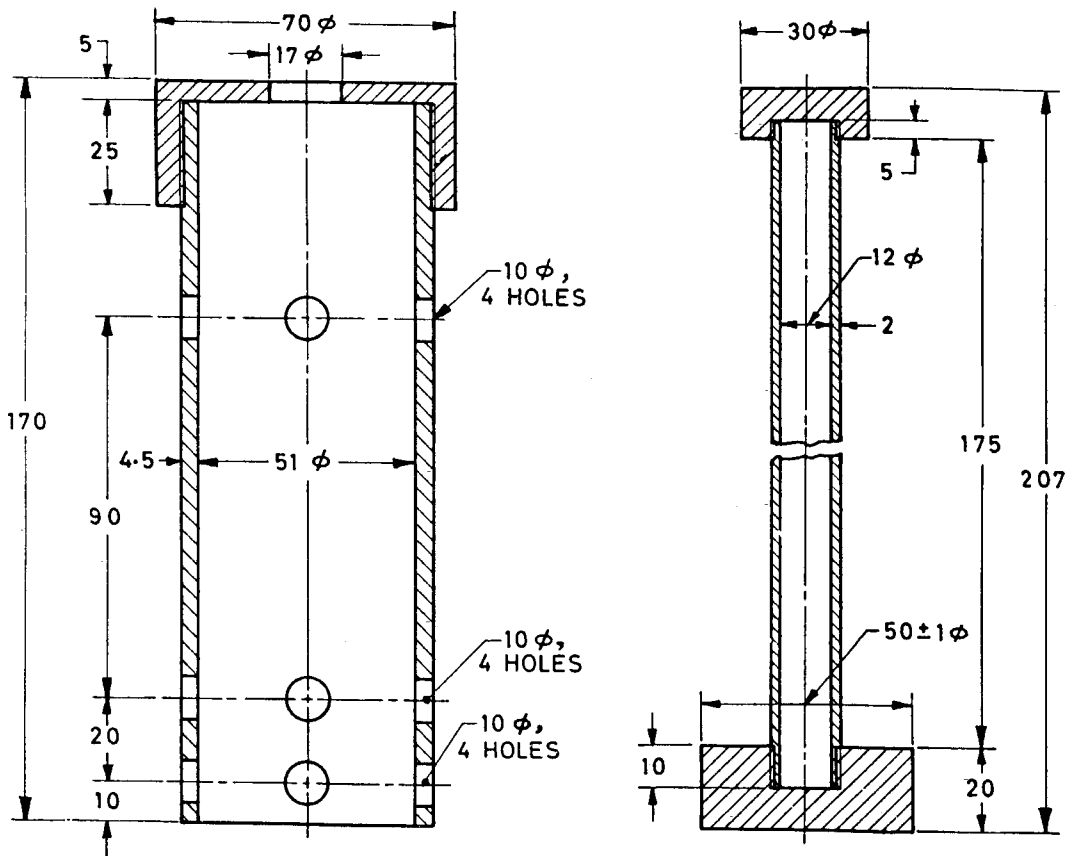


FIG. 1 GENERAL ARRANGEMENT OF PERMEABILITY TEST UNIT



3A GUIDE

3B RAMMER (WEIGHT 500 \pm 5g)

Guide length of travel of rammer 150 \pm 1 mm.

All dimensions in millimetres.

FIG. 3 SPECIMEN COMPACTING APPARATUS
(GUIDE AND RAMMER)

ANNEX C

(Foreword)

COMMITTEE COMPOSITION

Cement and Concrete Sectional Committee, CED 2

<i>Organization</i>	<i>Representative(s)</i>
In personal capacity ('Chandrika', at 15th Cross 63-64, East Park Road, Malleswaram, Bangalore 560003)	DR H. C. VISVESVARAYA (<i>Chairman</i>)
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Central Board of Irrigation and Power, New Delhi	SHRI MAHESH KUMAR
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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices:

	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	{ 2323 7617 2323 3841
Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi KOLKATA 700054	{ 2337 8499, 2337 8561 2337 8626, 2337 9120
Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022	{ 60 3843 60 9285
Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113	{ 2254 1216, 2254 1442 2254 2519, 2254 2315
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