

भारतीय मानक
फ्लोरिंग के लिए बिटुमेन-मास्टिक — विशिष्टि
(तीसरा पुनरीक्षण)

Indian Standard
BITUMEN-MASTIC FOR
FLOORING — SPECIFICATION
(*Third Revision*)

ICS 91.100.50

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

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Flooring, Wall Finishing and Roofing Sectional Committee had been approved by the Civil Engineering Division Council.

Bitumen-mastic has been considered very suitable for use in the flooring of industrial buildings, warehouses, grain storage structures and surfacing of bridge decks, roads, foot-paths, etc, because of its resiliency, imperviousness, wearing quality and ease of maintenance. Bitumen-mastic may also be used as a base coat to receive floor coverings, such as linoleum, flexible PVC sheets and rubber. This standard was first published in 1958 and was revised in 1968. In the second revision a number of changes have been made on account of the experience gained on the uses of bitumen-mastic since 1968. A number of grades of mastic suitable to various types of flooring have been incorporated. Recommendations with respect to thicknesses of bitumen-mastic of various grades to various types of floor covering have also been added for guidance.

In this third revision besides updating the referred Indian Standards, the details of materials and the values given in Table 1 have been modified.

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. This has been met by referring to the following publications:

BS 598 (Parts 1 and 2) : 1974 Sampling and examination of bituminous mixtures for roads and buildings.
British Standards Institution

BS 6925 : 1988 Specification for mastic asphalt for building and civil engineering (limestone aggregate). British Standards Institution

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

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 '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

BITUMEN-MASTIC FOR FLOORING — SPECIFICATION (Third Revision)

1 SCOPE

1.1 This standard covers the requirements for four grades of bitumen-mastic for buildings, composed of ground limestone or any other rocks, coarse aggregate, limestone dust filler and pigments if required, incorporated with asphaltic bitumen.

1.2 Bitumen-mastic flooring are graded according to usage as follows:

Grade I	Special flooring
Grade II	Light duty flooring
Grade III	Medium duty flooring
Grade IV	Industrial factory flooring

1.2.1 Grades I and II may be used as polished flooring for light traffic or as an underlay to other floor coverings.

1.3 This standard does not cover special grades of bitumen-mastic flooring such as chemical resistant, oil resistant or spark free flooring; for these purposes special bitumen-mastics are available.

1.4 A guide to the selection of the appropriate grade is given in Annex A.

2 REFERENCES

The Indian Standards given at Annex B 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.

3 TERMINOLOGY

3.1 For the purpose of this standard the following definitions and those given in IS 334 shall apply.

3.1.1 *Asphaltic Bitumen* — Refinery bitumen, lake asphalt, asphaltite or blends of these with one another having binding properties suitable for the manufacture of bitumen-mastic.

3.1.2 *Limestone* — A naturally occurring consolidated stratified calcareous rock.

NOTE — The term is interpreted in a restricted geological sense.

3.1.3 *Pigment* — Finely ground metallic oxide like ferric oxide (Fe_2O_3) (see IS 44) and chromium oxide (see IS 54).

4 MATERIALS**4.1 Bitumen**

The physical properties of bitumen used in the manufacture of mastic-bitumen shall conform to the requirements laid down in Table 1 when tested in accordance with the method of tests specified in Table 1. The bitumen grades specified in IS 702 generally meet the requirements of Table 1.

Table 1 Physical Properties of Bitumen
(Clause 4.1)

Sl No.	Characteristic	Requirements for Grade I		Requirements for Grades II, III and IV		Method of Test, Ref to IS No.
		Mastic Asphalt for Flooring	Coloured Mastic Asphalt for Flooring	Mastic Asphalt for Flooring	Coloured Mastic Asphalt for Flooring	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Penetration at 25°C	10 - 25	10 - 25	5 - 20	5 - 20	1203
ii)	Softening point (ring and ball)	60 - 90	60 - 90	85 - 135	85 - 135	1205
iii)	Solubility in trichloroethylene, percent, <i>Min</i>	99	99	99	99	1216
iv)	Ash content (mineral matter), percent by mass, <i>Max</i>	0.5	0.5	0.5	0.5	1217
v)	Loss on heating for 5 h at 163°C, percent by mass, <i>Max</i>	0.5	0.5	0.5	0.5	1212

4.2 Aggregates

The aggregates shall consist of coarse aggregate, fine aggregate and filler complying with 4.2.1, 4.2.2 and 4.2.3.

4.2.1 Coarse Aggregate

The coarse aggregate shall consist of clean igneous or calcareous or siliceous rock obtained from natural deposits either directly or by crushing screening or other mechanical process. It shall be free from dust as far as possible/practicable.

4.2.2 Fine Aggregate

The fine aggregate shall consist of naturally occurring lime stone or any other rock ground to a grading as given in Table 2.

4.2.3 Filler

The filler shall consist of limestone rock crushed to fine powder with at least 85 percent passing 75-micron IS Sieve. The calcium-carbonate contents of filler material shall not be less than 80 percent by mass when determined in accordance with the method specified in Annex C.

Table 2 Grading of Fine Aggregate
(Clause 4.2.2)

Sl No.	Grading	Percent by Weight	
		Min	Max
(1)	(2)	(3)	(4)
i)	Passing 75-micron IS Sieve	45	55
ii)	Passing 212-micron IS Sieve and retained on 75-micron IS Sieve	10	30
iii)	Passing 600-micron IS Sieve and retained on 212-micron IS Sieve	10	30
iv)	Passing 2.36-micron IS Sieve and retained on 600-micron IS Sieve	5	20
v)	Retained on 2.36-micron IS Sieve	-	-

4.2.3.1 The percentage and size of coarse aggregate incorporated in the bitumen-mastic will be dependent primarily upon the thickness of the finished work. The size shall be within the limits specified in Table 3. The percentage shall be such that the total percentage of material retained on a 600-micron IS Sieve, on analysis of the bitumen-mastic as laid, including the material derived from the fine aggregate, shall fall within the appropriate limits specified in Table 3.

5 COMPOSITION

5.1 On analysis of the bitumen-mastic as laid (or the block material as dispatched from the factory), the proportions of coarse aggregate retained on a 600-micron IS Sieve shall be in accordance with Table 3, depending on the thickness of the finished

floor. The composition of the remaining material shall then be calculated as a percentage by mass of the bitumen-mastic excluding the material retained on a 600-micron IS Sieve and shall fall within the limits specified in Table 4.

Table 3 Percentage and Size of Coarse aggregate for Bitumen-Mastic for Flooring and Coloured Bitumen-Mastic for Flooring
(Clauses 4.2.3.1 and 5.1)

Sl No.	Grade	Size and Type of Coarse Aggregate	Percentage, Thickness	
			Min	Max
(1)	(2)	(3)	(4)	(5)
i)	I and II	Retained on 600-micron IS Sieve 85 percent Min, passing 4.75 mm IS Sieve 100 percent	15-25	15-20
ii)	III	Retained on 600-micron IS Sieve 85 percent Min, passing 4.75 mm IS Sieve 100 percent	25-35	20-30
iii)	IV	Retained on 600-micron IS Sieve 95 percent Min, passing 9.5 mm IS Sieve 90 percent	30-50	30-50

Table 4 Composition of Bitumen-Mastic Excluding Coarse Aggregate
(Clause 5.1)

Sl No.	Requirements	Percentage by Mass	
		Min	Max
(1)	(2)	(3)	(4)
i)	Soluble bitumen	12.0	18.0
ii)	Passing 75-micron IS Sieve	40.0	56.0
iii)	Passing 212-micron IS Sieve and retained on 75-micron IS Sieve	8.0	25.0
iv)	Passing 600-micron and retained on 212-micron IS Sieve	8.0	32.0

5.2 The analysis of bitumen-mastic shall be done in accordance with the method specified in Annex D.

6 MANUFACTURE AND COMPOSITION

6.1 The fine aggregate, as specified in 4.2.1 and pigment if required shall be thoroughly incorporated at a temperature between 175°C and 205°C with the requisite proportion of bitumen. The requisite proportion of coarse aggregate shall be incorporated either during manufacture of the bitumen-mastic or during remelting on site of work. Where the total percentage of coarse aggregate does not exceed 35 percent and/or 4.75 mm in size, wherever possible the whole of this shall be incorporated during manufacture. In cases where the material is not required for immediate use, it shall be cast into blocks.

6.2 Remelting on Site

The bitumen-mastic blocks shall be broken into pieces

of convenient size not exceeding 60 mm cube and then carefully remelted, preferably in mechanical mixers.

6.2.1 At this stage any coarse aggregate remaining to be added shall be fed in successive portions until the complete charge is thoroughly incorporated. The coarse aggregate should, as far as practicable, be added in a dry state.

6.2.2 Whether the material is transported to the site in a molten condition or remelted on site the total duration of heating and the type of plant used shall be such that the properties of the bitumen-mastic shall not be impaired.

7 HARDNESS NUMBER

The hardness number of the bitumen-mastic when determined in accordance with Annex E, shall be as follows:

a) *At the time of manufacture:*

Grade I	Not more than 15 at 45°C (after addition of specified coarse aggregates)
Grades II and III	Not more than 12 at 35°C (after addition of specified coarse aggregates)
Grade IV	Not more than 40 at 35°C (before addition of specified coarse aggregates)

b) *At the time of laying:*

Grade I	Neither less than 2 nor more than 12 at 45°C
Grades II and III	Neither less than 2 nor more than 12 at 35°C
Grade IV	To be agreed, depending on the size and percentage of aggregate coarse

8 SAMPLING AND CRITERIA FOR CONFORMITY

8.1 Lot

The entire quantity of bitumen-mastic prepared in a single charge of the mastic cooker shall constitute a lot. In case where the practice of returning the first and the last portions to the cooker is followed, portions thus returned should be excluded from the lot.

8.2 Sampling from Mastic Cooker

When mastic asphalt is to be used directly from the cooker, a sample composed of five increments taken at equal intervals shall be withdrawn from each lot during discharge from the mastic cooker. The increments shall be taken at the beginning, the end, and soon after discharge on one quarter, half, and three

quarters of the mastic asphalt. Each increment shall be at least 2 kg in weight.

8.2.1 All the five increments from a lot shall be thoroughly mixed together at a temperature of 175 to 205°C. The mixture shall be floated on an iron plate with the aid of a wooden float to a thickness not less than 25 mm. While still warm the specimen shall be loosened from the plate and a representative portion weighing not less than 10 kg shall be forwarded to the laboratory for examination with full particulars as given in 8.5.

8.3 Sampling from Blocks

From each lot cast in blocks, five blocks shall be picked up at random. Each block shall be broken and a number of pieces weighing about 2 kg shall be taken from different positions in the blocks so as to represent the block adequately. Ten kilograms of material thus collected from all the five blocks shall constitute the laboratory sample and shall be sent to the laboratory with full particulars as given in 8.5.

8.4 Criteria for Conformity

The laboratory sample representing the lot shall be tested for all requirements. The lot shall be considered to conform to the requirements of this standard if the laboratory sample passes tests for all the requirements.

8.5 Labelling

The specimen shall be adequately identified and the identification shall be provided for reference to schedule which shall be sent giving the appropriate items for the following:

- a) Name and address of authority giving instructions for the examination to be carried out;
- b) Sample number;
- c) Type of material;
- d) Type of binder;
- e) Type of aggregates;
- f) Specification with which the material is intended to comply;
- g) Name and location of mixing plant;
- h) Sample taken before or after laying;
- j) Date of mixing, if known;
- k) Date of laying, if known;
- m) Date of sampling;
- n) Site where laid;
- p) Position from which sample was taken;
- q) Number and nominal thickness of course;
- r) Nature of foundation;

- s) Nature of surface treatment, if any; and
- t) Tests to be made, or information sought.

To facilitate the testing procedure and interpretation of test results, it is essential that as much information as possible should be given to the laboratory.

9 MARKING

9.1 Bitumen-mastic manufactured in compliance with the standard shall be legibly marked with the following:

- a) Registered name or trade-mark of the manufacturer, and
- b) Number of the Indian Standard.

Marking shall be by a suitable labelling system or by the application of suitable paint or by branding. Marking systems shall not impair the efficiency of the bitumen-mastic when laid.

9.2 BIS Certification Marking

Each block may also be marked with the Standard Mark.

9.2.1 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 a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(Clause 1.4)

GRADES AND RECOMMENDED THICKNESS OF BITUMEN-MASTIC FLOORING FOR TYPICAL SITUATIONS

Situation	Grade			
	I	II	III	IV
	Recommended Thickness, mm			
	15-20	15-20	20-30	30-50
Underlays for other floor covering	x	x	—	—
Hospital wards	x	—	—	—
Hospital corridors (foot traffic)	—	x	—	—
Schools	x	—	—	—
Shops (floors to take movable racks)	x	—	—	—
Shops (floor to take fixed racks)	—	x	—	—
Offices	x	—	—	—
Factory floors — light	—	x	—	—
Factory floors — medium	—	—	x	—
Factory floors — heavy	—	—	—	x
Loading sheds	—	—	—	x
Breweries	—	—	—	x
Railway platforms	—	—	—	x
Domestic floors (either as a finished or as an underlay)	x	—	—	—
Heavy foot-trafficked floors or passageways	—	x	—	—

NOTES

1 'x' indicates applicability.

2 This list is by no means comprehensive and is intended to give only an approximate guide to the selection of the appropriate grade for specific purposes.

3 For special requirements, such as suspended floors where wet processes are used, two coats are normally necessary, the bottom coat to be as a waterproof membrane, the wearing surface to be in accordance with the table above. Bitumen-mastic as an underlay to receive other flooring, such as rubber, linoleum, thermo-plastic tiles and wood blocks; not less than 15 mm in one coat.

4 As varying conditions of humidity frequently affect cork, close collaboration between the cork supplier and the bitumen-mastic contractor should be established when cork is used as the floor covering.

ANNEX B

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
44 : 1991	Iron oxide pigments for paints	1212 : 1978	Determination of loss on heating (<i>first revision</i>)
54 : 1988	Green oxide of chromium for paints	1216 : 1978	Determination of solubility in carbon disulphide trichloroethylene (<i>first revision</i>)
245 : 1983	Trichloroethylene, technical (<i>third revision</i>)	1217:1978	Determination of mineral matter (ASH) (<i>first revision</i>)
334 : 1982	Glossary of terms relating to bitumen and tar (<i>second revision</i>)	1840 : 1961	Benzene, reagent grade
702 : 1992	Industrial bitumen (<i>second revision</i>)	2386 (Part 1) :	Method of test for aggregates for concrete : Part 1 Particle size and shape
1203 : 1978	Determination of penetration (<i>first revision</i>)	1963	
1205 : 1978	Determination of softening point (<i>first revision</i>)		

ANNEX C

(Clause 4.2.3)

DETERMINATION OF CALCIUM CARBONATE CONTENT

C-1 Approximately 1 g of the sample shall be weighed into a 250-ml beaker and approximately 15 to 20 ml of concentrated hydrochloric acid diluted with three times its volume of distilled water shall be added. The whole shall be boiled for a few minutes and approximately 100 ml of distilled water added. The solution shall then be filtered through a filter paper (Whatman No. 42 or the equivalent) and thoroughly washed with distilled water.

C-2 After the addition of 2 or 3 drops of methyl orange indicator solution, the filtrate shall be brought to the boil and ammonium hydroxide solution added until the solution is alkaline. It shall then be filtered and washed and the filtrate neutralized by the gradual addition of dilute hydrochloric acid. The solution shall then be made acidic by the addition of 1 ml of

concentrated hydrochloric acid. It shall be again brought to the boil and a 4 percent solution of ammonium oxalate added slowly to excess, followed by 1:10 ammonia solution until neutral or faintly alkaline. A few drops of oxalate solution shall then be added to check that precipitation is complete. The contents of the beaker shall again be filtered and washed. The filter paper and its contents shall be placed in a tared platinum crucible, dried and ignited to constant weight. The weight of the residue shall be multiplied by 1.784 7 calculated as a percentage of the sample tested and reported as the calcium carbonate content of the material.

C-3 A recognized alternative method, such as volumetric determination by potassium permanganate, may be used on agreement between the purchaser and the vendor.

ANNEX D

(Clause 5.2)

METHOD FOR DETERMINATION OF BINDER CONTENT AND
FINE AGGREGATES IN BITUMEN-MASTIC

D-1 APPARATUS

D-1.1 The apparatus shall consist of a simple hot extractor consisting of the following :

D-1.1.1 A cylindrical container as shown in Fig. 1 shall be made from brass gauze of about 1.70 mm aperture width which is rested on, or suspended from, three pegs inside a brass or welded iron pot as shown in Fig. 2. Alternatively, the brass gauze container may rest on a suitable stool standing in the bottom of the pot. The pot is flanged and fitted with a cover and suitable jointing gasket. The cover is held in position by swivelling bolts fitted with wing nuts. The essential features of construction are indicated in Fig. 1, 2 and 3, it is advantageous to have containers and pots of more than one size, the size employed being appropriate to the quantity of material taken for analysis.

D-1.1.2 Reflex Condenser

There should be sufficient flow of cold water to condense the solvent.

D-1.1.3 A suitable heater, such as an electric hot-plate or a gas ring.

D-1.1.4 A suitable filter paper which shall not allow any filler material to pass through.

D-2 SOLVENT

D-2.1 The solvent shall be benzene (*see* IS 1840) or trichloroethylene (*see* IS 245).

NOTE — When chlorinated solvents are recovered by distillation for further use, care should be taken to ensure that the solvent satisfies the requirements of the appropriate standard. In particular, acidity may develop, and a useful precaution is to store the solvent over quick lime in coloured glass or metal containers.

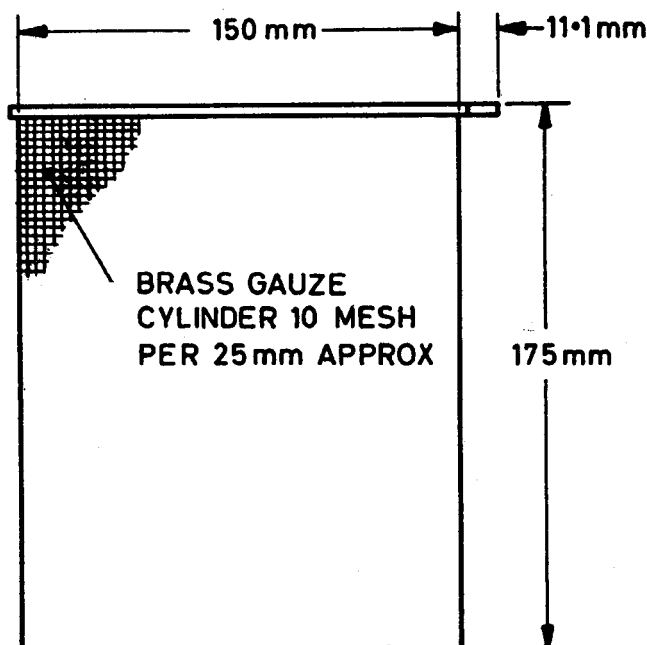
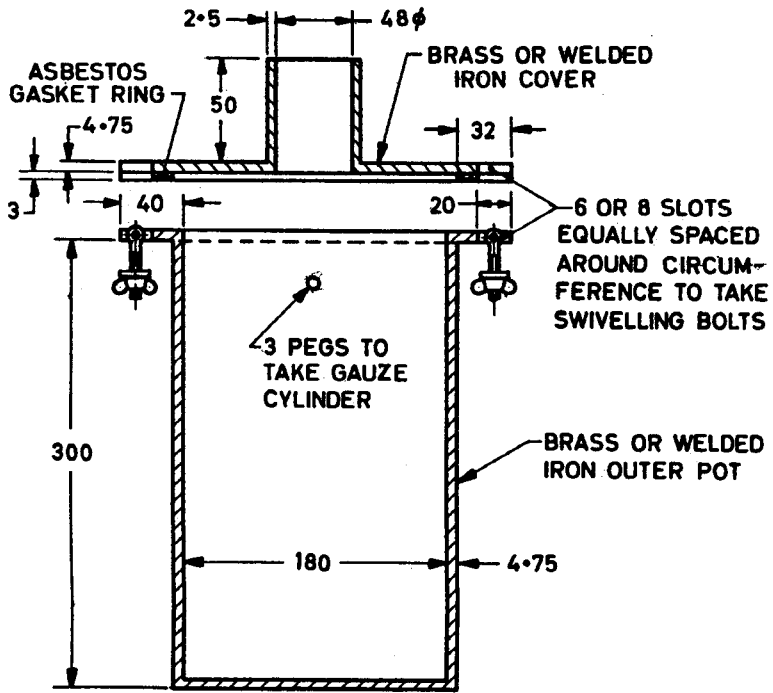


FIG. 1 TYPICAL BRASS GAUZE CONTAINER



All dimensions in millimetres.

FIG. 2 TYPICAL HARD-SOLDERED BRASS OR WELDED IRON POT

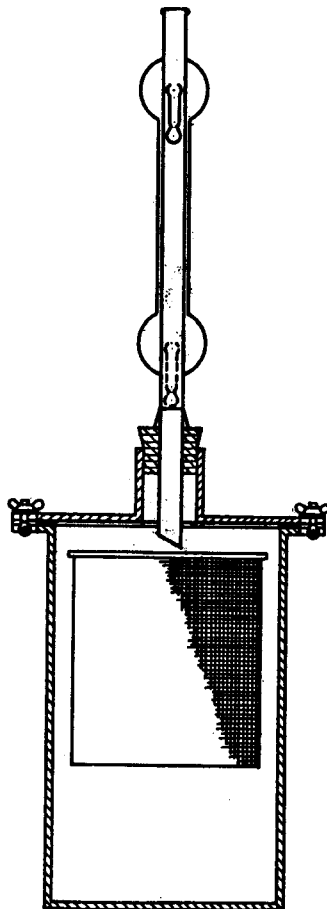


FIG. 3 TYPICAL ASSEMBLED APPARATUS

D-3 SIZE OF SAMPLE

About 6 kg of the bitumen-mastic shall be taken for the test.

D-4 PROCEDURE

The determination shall be made in duplicate. The filter paper shall be dried at 100° to 120°C, placed in a large weighing bottle or jar, cooled in a desiccator and weighed. The filter paper shall then be fitted into the gauze cylinder to form a complete lining. The sample shall be warmed just sufficiently to facilitate breaking up, and a representative portion, obtained if possible by quartering, shall be weighed to the nearest 0.05 percent of weight taken and transferred without loss to the filter paper and placed inside the gauze cylinder. Alternatively, the cylinder and its paper lining may be placed on the balance and the material weighed into it. The gauze cylinder shall then be placed inside the pot and 800 to 1 500 ml of the solvent, according to the size of the extractor, shall be poured over the sample. The cover shall be bolted on with the dried gasket in position. After fixing the reflux condenser, heat shall be applied to the pot and so adjusted as to avoid intense local heating, but at the same time to ensure a steady reflux action of 2 to 5 drops per second falling from the end of the condenser.

Heating shall be continued until extraction is complete.

The washed mineral aggregate, with its container, shall then be removed and dried to constant weight at 100° to 120°C such that successive weighings at half-

hourly intervals do not exceed 0.05 percent. The cylinder and contents shall be cooled in a desiccator before weighing. In order to correct for any fine material present in the solution at the end of the test, the solvent shall be evaporated off, the residue weighed, and a representative portion of it (between 2 to 3 g) treated with the solvent and filtered through a sintered silica filtering crucible or filter paper. In the case of materials containing high filler content the whole of the solution at the end of the test should be filtered or centrifuged. The aggregate shall then be graded according to the procedure laid down in IS 2386 (Part 1).

The binder content *B* shall be calculated on the dry sample by means of the following formula:

$$B = 100 \frac{W_1 - (W_2 + W_3)}{W_1} \text{ percent by mass}$$

where

W_1 = mass of sample in g,

W_2 = mass of recovered aggregate in gauge cylinder in g, and

W_3 = mass of residue obtained on evaporating the solvent in g.

D-5 REPORTING OF RESULTS

If the difference between the results obtained by the duplicate determinations exceeds 0.4, they shall be discarded and the test repeated. If the difference does not exceed 0.4, the individual values and the mean value shall be reported.

ANNEX E

(Clause 7)

METHOD FOR DETERMINING HARDNESS NUMBER**E-1 DEFINITION OF HARDNESS NUMBER**

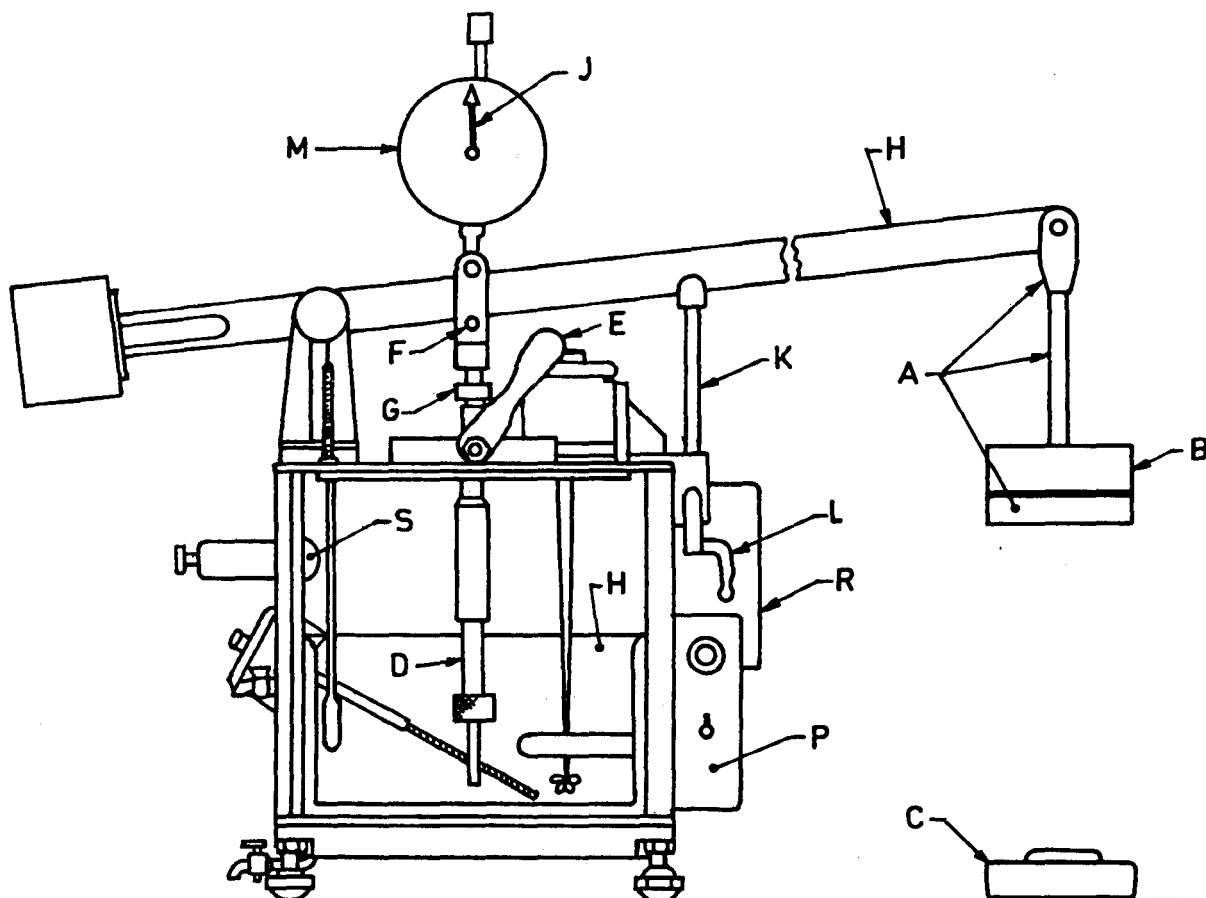
The hardness number is the figure denoting the depth, in hundredths of a centimetre, to which a flat-ended indentation pin in the form of a steel rod 6.35 mm in diameter will penetrate the mastic under a load of 31.7 kg, applied for one minute, the temperature being maintained at $35 \pm 0.5^\circ\text{C}$ or $45 \pm 0.5^\circ\text{C}$ as specified. The load is equivalent to 100 kg/cm^2 and is conveniently applied by means of a lever giving a suitable mechanical advantage.

E-2 APPARATUS

The apparatus employed should be capable of fulfilling the above requirements accurately. One convenient form of apparatus is shown in Fig. 4.

E-3 METHOD

E-3.1 In order to ensure that the test results are reproducible, particular attention is called to the following points.



- | | |
|--------------------------|---|
| A— Yoke, stalk and tray | J— Indicating needle |
| B— Weight (central hole) | K— Beam support yoke |
| C— Weight (slotted) | L— Support bracket |
| D— Indentor pin spindle | M— Calibrated dial |
| E— Lock lever | N— Water bath |
| F— Spindle head | P— Controls for water stirrer |
| G— Adjusting Nut | R— Controls for heater blade and thermostat |
| H— Beam | S— Bath illuminator |

FIG. 4 TYPICAL APPARATUS FOR HARDNESS TESTING

E-3.1.1 Sample

In preparing samples for test, the mastic as laid shall be filled directly from the mixer at the time of laying, into moulds which are not less than 100 mm in diameter or 100 mm square, and float finished. The samples, which shall be taken in duplicate shall be moulded to a thickness of 25 mm. Where it is necessary to make a test on samples cut from the floor, special precautions should be taken to ensure that the sample is of uniform thickness and that the base is level. The sample should not be remelted.

E-3.1.2 Test Temperature

For the purpose of this standard, the sample shall be cooled for not less than 3 h in air or not less than 1 h

in cold running water. It shall then be immersed in water at the test temperature ($\pm 0.1^\circ\text{C}$) for at least 1 h immediately prior to testing. For test temperature (see 7).

E-3.1.3 Testing

The sample shall then be transferred to the test machine where it shall again be immersed in water maintained at the test temperature ($\pm 0.1^\circ\text{C}$) throughout the test. The indentor pin shall then be adjusted lightly but firmly in contact with the surface of the sample, the pressure being no greater than is necessary to prevent lateral movement in the specimen. The requisite load shall then be applied for exactly 60 s and the depth of indentation recorded in tenths of a millimetre.

E-3.1.4 Test Result

Test points shall be not less than 25 mm apart and not less than 25 mm from the edge. At least five readings shall be taken and the results averaged. If any result

differs from the mean by more than two hardness number units, it shall be rejected and the average of the remainder determined, except that if there are fewer than four results to be averaged the sample shall be discarded and the test made on another sample.

ANNEX F

(Foreword)

COMMITTEE COMPOSITION

Flooring, Wall Finishing and Roofing Sectional Committee, CED 5

<i>Organization</i>	<i>Representative(s)</i>
In personal capacity (A-39/8, DDA Flats, Munirka, New Delhi 110067)	SHRI P. B. VIJAY (<i>Chairman</i>)
All India Brick & Tile Manufacturers Federation, New Delhi	SHRI S. P. BANSAL
Bhor Industries Limited, Mumbai	SHRI K. L. SHAH SHRI R. K. PATEL (<i>Alternate</i>)
Builder's Association of India, Mumbai	SHRI W. R. TALWAR SHRI PAWAN TALWAR (<i>Alternate</i>)
Building Materials & Technology Promotion Council, New Delhi	SHRI J. SENGUPTA
CEAT Limited, Hyderabad	SHRI S. SUNDRAM SHRI RAJENDER PAL (<i>Alternate</i>)
Central Building Research Institute, Roorkee	SHRI LATHIKA JAISINGH SHRI S. K. MITTAL (<i>Alternate</i>)
Central Public Works Department, New Delhi Engineer-in-Chief's Branch, New Delhi	CHIEF ENGINEER (CSQ) SHRIMATI UPINDER KAUR SHRIMATI RIVOO MAHINDRU (<i>Alternate</i>)
Hindustan Zinc Limited, Udaipur	SHRI C. S. MEHTA
India Meteorological Department, New Delhi	SHRI A. V. R. K. RAO SHRI S. C. GOYAL (<i>Alternate</i>)
Indian Institute of Technology, Kharagpur	MS RAJNI AHUJA
Institution of Engineers (India) Limited, Kolkata	SHRI P. B. VIJAY
Maharashtra Engineering Research Institute, Nasik	CHIEF ENGINEER & DIRECTOR SCIENTIFIC RESEARCH OFFICER (<i>Alternate</i>)
Ministry of Railways (RDSO), Lucknow	EXECUTIVE ENGINEER (P&D-II) EXECUTIVE ENGINEER (P&D-I) (<i>Alternate</i>)
Modern Tiles & Marble, New Delhi	SHRI A. C. KAPOOR SHRI SUBHASH KAPOOR (<i>Alternate</i>)

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<i>Organization</i>	<i>Representatives(s)</i>
National Test House, Kolkata	SHRI D. K. KANUNGO SHRI R. KAPOOR (<i>Alternate</i>)
Prodorite Anti-Corrosives Limited, Chennai	SHRI M. ANNAMALAI DR P. SACHINDRAPAL (<i>Alternate</i>)
Projects & Development India Limited, Sindri	DR P. K. JAISWAL SHRI A. K. PAL (<i>Alternate</i>)
Public Works Department, Chennai	SUPERINTENDING ENGINEER (P&D) EXECUTIVE ENGINEER (<i>Alternate</i>)
Rashtriya Pariyojna Nirman Nigam Limited, New Delhi	SHRI R. C. KEHRAM SHRI B. B. KANWAR (<i>Alternate</i>)
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