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IS : 9510 - 1980

*Indian Standard*

SPECIFICATION FOR  
BITUMEN MASTIC, ACID-RESISTING GRADE

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# Indian Standard

## SPECIFICATION FOR BITUMEN MASTIC, ACID-RESISTING GRADE

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# *Indian Standard*

## SPECIFICATION FOR BITUMEN MASTIC, ACID-RESISTING GRADE

### 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 16 May 1980, after the draft finalized by the Flooring and Plastering Sectional Committee had been approved by the Civil Engineering Division Council.

**0.2** Bitumen mastic of acid-resisting grade has been considered very effective as covering of floors for electroplating shops, processing departments, chemical liquor wash sections, gutters, and in fertilizer, rayon, diestuff or water treatment plants, and other chemical factories, where continuous or frequent contact with dilute effluents is expected. These mastics are being utilized as an underlay to acid-proof tiles, bricks or stones used to protect RCC, plain concrete or ordinary clay brick flooring. This standard has been prepared with a view to provide guidance for the manufacture and use of such mastics of acceptable quality.

**0.2.1** This standard contains clauses **6.1** and **6.2**, which call for agreement between the user and the supplier.

**0.3** 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.

**0.4** 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.

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### 1. SCOPE

**1.1** This standard specifies requirement for bitumen mastic of acid-resisting grade used as an underlay to acid-proof bricks, tiles or stones.

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

## 2. TERMINOLOGY

**2.1** For the purpose of this standard, definitions given in IS : 334-1965\* shall apply.

## 3. MATERIALS

**3.1 Bitumen** — The physical properties of bitumen used shall conform to those specified in Table 1, when tested in accordance with the method specified in col 4.

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**TABLE 1 PHYSICAL PROPERTIES OF BITUMEN**

SL No.	CHARACTERISTICS	REQUIREMENT	METHOD OF TEST (REF TO INDIAN STANDARD)
(1)	(2)	(3)	(4)
i)	Softening point, °C	65 to 140	IS : 1205 - 1958*
ii)	Penetration at 25°C in 0.01 cm	5 to 20	IS : 1203 - 1958†
iii)	Loss on heating, percent by mass, <i>Max</i>	0.3	IS : 1212 - 1958‡
iv)	Solubility in carbon disulphide, percent by mass, <i>Min</i>	99	IS : 1216 - 1958§

NOTE — Industrial bitumen of grades 90/15, 75/15, 135/10 conforming to IS : 702 - 1961|| are typical examples of binder which will satisfy the requirements of this table.

\*Methods for testing tar and bitumen: Determination of softening point.

†Methods for testing tar and bitumen: Determination of penetration.

‡Methods for testing tar and bitumen: Determination of loss on heating.

§Methods for testing tar and bitumen: Determination of solubility in carbon disulphide.

||Specification for industrial bitumen (*first revision*).

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**3.2 Aggregates** — The aggregates shall be of the following types:

- a) Filler,
- b) Fine aggregates, and
- c) Coarse aggregates.

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\*Glossary of terms relating to bitumen and tar (*revised*).



**3.2.1 Filler** — The filler shall be the portion passing through 75-micron IS Sieve.

**3.2.2 Fine Aggregates** — The aggregates shall be siliceous in nature and shall have the grading as specified in Table 2.

**3.3.3 Coarse Aggregates** — Coarse aggregates when used shall conform to IS : 383-1970\* and shall consist of either crushed siliceous stones or any approved aggregates free from foreign material. These shall not be affected by acids. The size of coarse aggregates for various thicknesses of bitumen mastic shall be as specified in Table 3.

**3.3.4** The coarse aggregates, fine aggregates and filler shall not contain matter soluble in hydrochloric acid more than 5 percent by mass when tested as per the method specified in Appendix D.

#### 4. PREPARATION OF BITUMEN MASTIC

**4.1** The fine aggregates shall be heated to a temperature of 170 to 205°C and then the required amount of bitumen (heated to 170 to 180°C) shall be added to it. They shall be mixed and cooked in a mechanically agitated mixer called mastic cooker for about 3 hours until the materials are thoroughly mixed. During mixing, care shall be taken to ensure that the contents in the cooker at no time are heated to a temperature exceeding 205°C. After the mastic has been prepared the requisite percentage of coarse aggregates shall be added either during manufacture of the mastic or during remelting at the site of work. Where the material is not required for immediate use, it shall be cast into blocks weighing about 25 kg.

**4.2 Remelting at Site** — The blocks shall be broken to convenient size of not more than 150 mm cube and loaded into the mastic cooker at the site of work. The material shall then be carefully remelted. At this stage coarse aggregates, preferably preheated, shall be fed in successive portions until the complete charge is thoroughly incorporated. After all the coarse aggregates has been incorporated, the material shall be mixed continuously for a period of not less than 1 hour before laying is begun, and mixing shall be continued until laying operation is completed, so as to maintain the coarse aggregates in suspension. At no stage during the remelting and mixing process the temperature shall exceed 205°C.

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

TABLE 2 GRADING OF FINE AGGREGATES

( Clause 3.2.2 )

SL No.	GRADING	PERCENTAGE BY MASS
(1)	(2)	(3)
i)	Passing 75-micron IS Sieve	45 to 55 ( filler )
ii)	Passing 212-micron IS Sieve and retained on 75-micron IS Sieve	10 to 30
iii)	Passing 600-micron IS Sieve and retained on 212-micron IS Sieve	10 to 30
iv)	Passing 2.36-mm IS Sieve and retained on 600-micron IS Sieve	5 to 20
v)	Retained on 2.36-mm IS Sieve	Nil

TABLE 3 SIZE OF COARSE AGGREGATES FOR USE IN BITUMEN MASTIC

( Clause 3.2.3 )

THICKNESS OF EACH LAYER OF THE MASTIC	SIZE OF AGGREGATES	PERCENTAGE BY MASS
(1)	(2)	(3)
10 mm	No coarse aggregates may be incorporated	—
15 mm	Passing 4.75-mm IS Sieve Retained on 600-micron IS Sieve	100 85 <i>Min</i>
20 mm	Passing 4.75-mm IS Sieve Retained on 600-micron IS Sieve	100 95 <i>Min</i>
25 mm	Passing 10-mm IS Sieve Retained on 2.36-mm IS Sieve	100 95 <i>Min</i>

## 5. COMPOSITION

**5.1** On analysis of the bitumen mastic as laid, the proportion of coarse aggregate retained on 2.36-mm IS Sieve shall be in accordance with those specified in Table 4, depending on the thickness of each layer of the mastic. The composition of the remaining material shall then be calculated as a percentage by mass of the bitumen mastic excluding the material retained on 2.36-mm IS Sieve and shall fall within the limits set out in Table 5.

**5.2** The analysis of the bitumen mastic shall be done in accordance with the method specified in Appendix A.

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**TABLE 4 PERCENTAGE OF COARSE AGGREGATES**

Sl. No.	THICKNESS OF EACH LAYER OF THE MASTIC	PERCENTAGE OF COARSE AGGREGATES BY MASS OF TOTAL MASTIC
(1)	(2)	(3)
i)	15 mm	15 to 30
ii)	20 to 25 mm	20 to 35
iii)	25 to 30 mm	30 to 45

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**TABLE 5 COMPOSITION OF BITUMEN MASTIC**

Sl. No.	REQUIREMENT	PERCENTAGE BY MASS OF BITUMEN MASTIC EXCLUDING THE COARSE AGGREGATES
(1)	(2)	(3)
i)	Soluble bitumen	13 to 18
ii)	Grading of aggregate:	
	Passing 75-micron IS Sieve	45 to 55
	Passing 212-micron IS Sieve and retained on 75-micron IS Sieve	8 to 32
	Passing 600-micron IS Sieve and retained on 212-micron IS Sieve	8 to 30

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## 6. PROPERTIES OF BITUMEN MASTIC

**6.1 Hardness Number** — Unless otherwise agreed between the purchaser and the user, the hardness number of bitumen mastic as laid shall be 4 to 12 at 35°C when tested in accordance with the method specified in Appendix B.

**6.2 Acid-Resistance** — The test specimens shall be subjected to acid-resistance test as described in Appendix C. The test specimen shall be observed for change of mass, surface cracks, loss of gloss, etching, pitting, and softening. The concentration of acid solutions to which the specimens to be are tested shall be as specified by the user.

**6.2.1** The immersion medium shall be observed for discolouration and the formation of sediments.

**NOTE 1** — It has been observed that immersion in concentrated nitric and sulphuric acids generally results in loss of mass. In other cases a slight gain in mass is usually observed. Therefore, it is the rate of change of mass of the specimen which is more significant than the actual value at any one time. The result will indicate whether a particular material will approach a constant mass in time or will continue change in mass as the test progresses.

**NOTE 2** — An initial discolouration of the immersion medium coupled with a high loss in mass of the specimen is indicative of the extraction of soluble compounds. Continuation of the test with fresh solutions will indicate whether the attack is progressive or not.

**6.2.2** A guideline of performance and recommendations for use of bitumen mastic are indicated in Table 6.

## 7. SAMPLING AND CRITERIA FOR CONFORMITY

**7.1 Lot** — The entire quantity of bitumen mastic prepared in a single charge of the mastic cooker shall constitute a lot. In cases 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.

**7.2 Sampling from Mastic Cooker** — When bitumen mastic 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 of one-quarter, half, and three-quarters of the bitumen mastic. Each increment shall be at least of 2 kg.

**7.2.1** All the five increments from a lot shall be thoroughly mixed together at a temperature of 150 to 250°C. The mixture shall be floated out 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 7.5.

**TABLE 6 GUIDELINES OF PERFORMANCE AND RECOMMENDATIONS FOR USE OF ACID RESISTANT BITUMEN MASTIC WHEN EXPOSED TO ACIDS OF DIFFERENT CONCENTRATIONS**

( Clause 6.2.2 )

SL No.	TEST SOLUTION	VISUAL OBSERVATION	MAXIMUM PERMISSIBLE MASS CHANGE AT THE END OF THE TEST	RESISTANCE RATING	RECOMMENDATIONS
(1)	(2)	(3)	(4)	(5)	(6)
1.	Hydrochloric acid 10% Nitric acid 10% Acetic acid 10% Sulphuric acid 10% Phosphoric acid 10%	No change in the test pieces or in the immersion medium	$\pm 1\%$	VG	R
2.	Hydrochloric acid 20% Nitric acid 20% Sulphuric acid 20% Acetic acid 20% Phosphoric acid 20% Chromic acid 20%	No change in the test pieces or in the immersion medium	$\pm 1\%$	VG	R
3.	Nitric acid 40% Sulphuric acid 40%	Slight disintegration of the test pieces	$\pm 1\%$	P	NR
4.	Hydrochloric acid 50% & above Glacial acetic acid 50% & above	Slight discolouration of the immersion medium in concentrated acids	$\pm 1\%$	F	RL
5.	Nitric acid ( conc ) Sulphuric acid ( conc )	Disintegration of the test pieces	$\pm 1\%$	VP	NR
6.	Lactic acid Benzene	Specimens dis-solves	$\pm 1\%$	VP	NR
7.	Saturated solution of either:  Sodium chloride Ammonium chloride Ammonium carbonate Ammonium sulphate Ammonium phosphate Chromium sulphate Glycerine Urea	No change in the test specimens or the immersion medium	$\pm 1\%$	VG	R
	R = Recommended RL = Recommended for limited use NR = Not recommended VG = Very good F = Fair P = Poor VP = Very poor				

## IS : 9510 - 1980

**7.3 Sampling from Blocks** — From each lot of 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 portions of the blocks to represent the block adequately. Ten kilogrammes of the material thus collected from all the five blocks shall constitute the sample and shall be sent to the laboratory with full particulars as given in 7.5.

**7.4 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 specification if the laboratory sample passes tests for all the requirements.

**7.5 Labelling** — The specimen shall be adequately identified, and the identification shall provide for reference to a schedule which shall be sent, giving the appropriate items from the following:

- a) Name and address of authority giving instructions for the examination;
- b) Sample number;
- c) Type of material;
- d) Type of binder;
- e) Type of aggregate;
- f) Specification to 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 coarses;
- r) Nature of foundation;
- s) Nature of surface treatment ( if any ); and
- t) Tests to be made, or information sought.

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

## 8. MARKING

**8.1** If cast into blocks for storage, the date of manufacture and name of the manufacturers shall be indicated suitably.

**8.2** Each block 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 manufacturer or processors, may be obtained from the Indian Standards Institution.

## APPENDIX A

( Clause 5.2 )

### METHOD FOR DETERMINING BINDER CONTENT AND FINE AGGREGATES IN BITUMEN MASTIC

#### A-1. APPARATUS

**A-1.1** The apparatus shall consist of a simple hot extractor and shall comprise the following.

**A-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.

**A-1.1.2** *A Reflux Condenser* — There should be sufficient flow of cold water to condense the solvent.

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

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

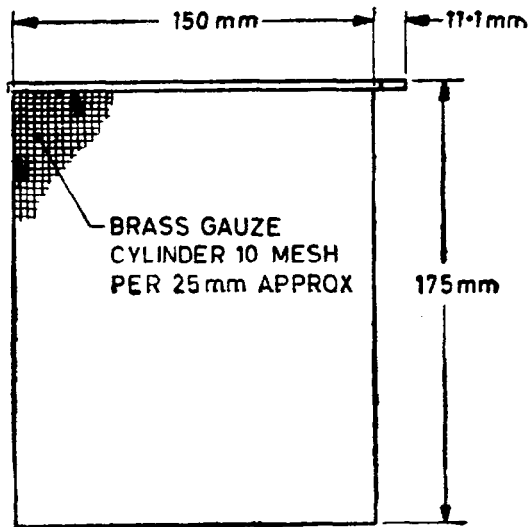


FIG. 1 TYPICAL BRASS GAUZE CONTAINER

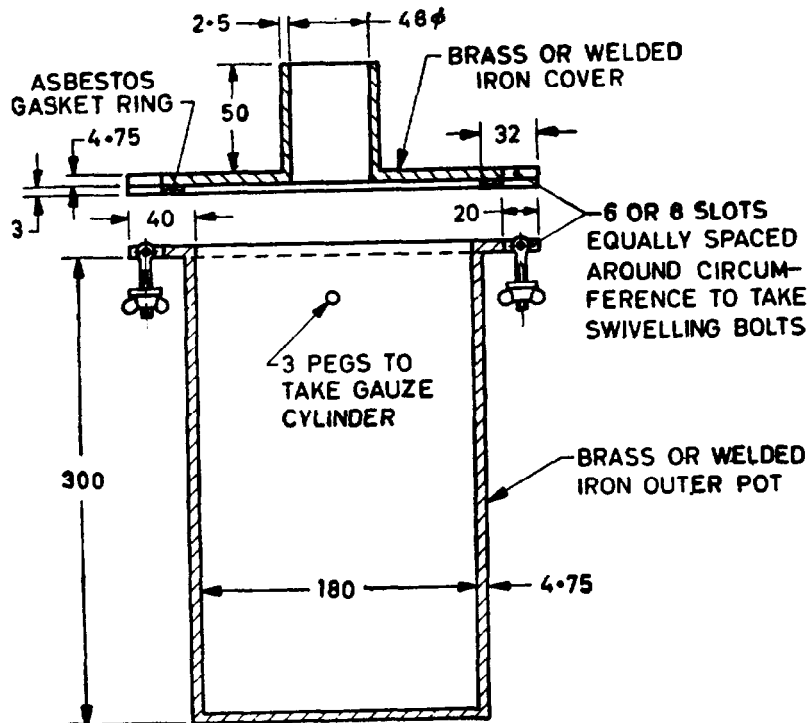


FIG. 2 TYPICAL HARD-SOLDERED BRASS OR WELDED IRON POT



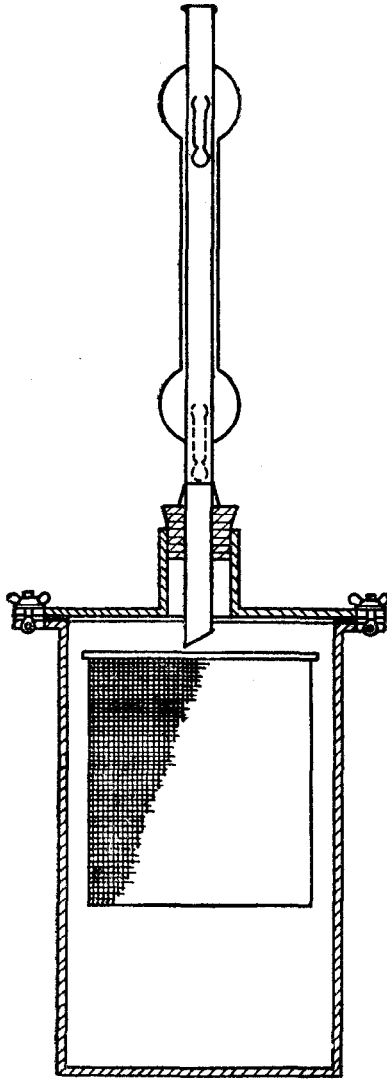


FIG. 3 TYPICAL ASSEMBLED APPARATUS

## **A-2. SOLVENT**

**A-2.1** The solvent shall be benzene (*see* IS : 1840-1961\* ) or trichloroethylene (*see* IS : 245-1970† ).

**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.

## **A-3. SIZE OF THE SAMPLE**

**A-3.1** About 6 kg of the bittumen mastic shall be taken for the test.

## **A-4. PROCEDURE**

**A-4.1** 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 in 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 the mass 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.

**A-4.2** The washed mineral aggregate, with its container, shall then be removed and dried to constant mass at 100 to 120°C such that successive weighings at half-hourly intervals do not exceed 0.05 percent. The cylinder and the 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 I )-1963‡.

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\*Specification for benzene, reagent grade.

†Specification for trichloroethylene, technical (*second revision* ).

‡Methods of test for aggregates for Concrete: Part I Particle size.

**A-4.2.1** The binder content  $B$  shall be calculated on the dry sample by means of the following formula:

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

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 in evaporating the solvent  
in g.

## A-5. REPORTING OF RESULTS

**A-5.1** 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.

# APPENDIX B

( Clause 6.1 )

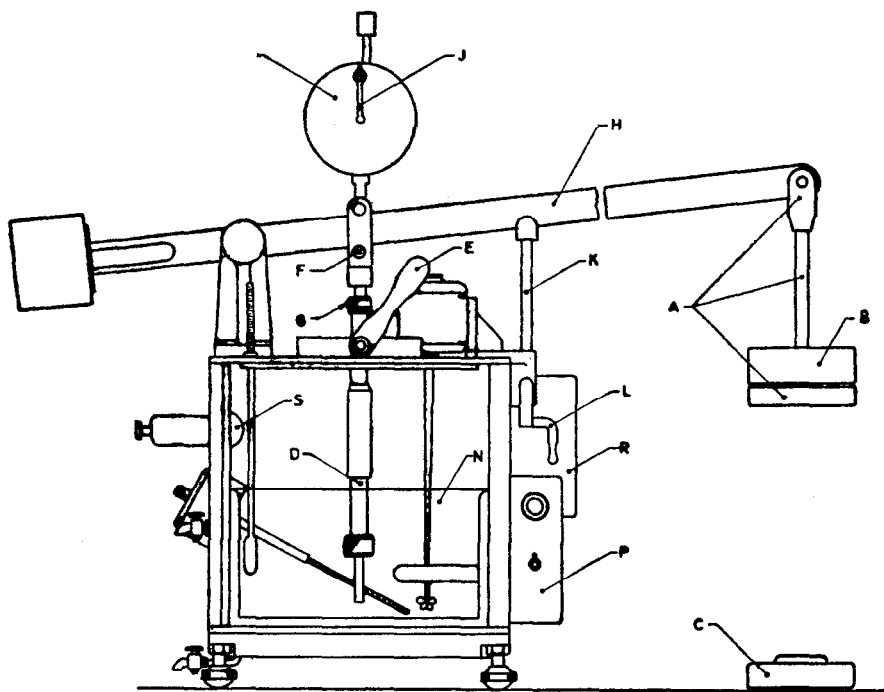
## METHOD FOR DETERMINING HARDNESS NUMBER

### B-1. DEFINITION

**B-1.1** The hardness number is the figure denoting the depth, in hundredths of a centimetre ( 0.01 cm ), 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 317 N ( 31.7 kgf ) applied for 1 minute, the temperature being maintained at  $35 \pm 0.5^\circ\text{C}$ . This load is equivalent to  $10 \text{ N/mm}^2$  (  $100 \text{ kgf/cm}^2$  ) and is conveniently applied by means of a lever giving a suitable mechanical advantage.

### B-2. APPARATUS

**B-2.1** The apparatus employed should be capable of fulfilling the above requirements accurately. One convenient form of apparatus is shown in Fig. 4.



- |                         |  |
|-------------------------|--|
| 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                         |

All dimensions in millimetres.

FIG. 4 A TYPE OF APPARATUS FOR HARDNESS TESTING

### B-3. METHOD

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

**B-3.1.1 Samples** — In preparing samples for test, the mastic 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<sup>2</sup> and float finished. The

samples, shall be taken in duplicate, and 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 samples should not be remelted.

**B-3.1.2 Test Temperature** — For the purpose of this standard, the sample shall be cooled for not less than 3 hours in air or not less than 1 hour in cold running water. It shall then be immersed in water at a temperature of  $35 \pm 0.5^\circ\text{C}$  for at least 1 hour immediately prior to testing and shall be maintained at that temperature during the test.

**B-3.1.3 Adjustment of Pin** — Before the load is applied, the indentation pin shall be adjusted lightly but firmly in contact with the surface. The pressure should be not greater than is necessary to prevent lateral movement of the specimen.

**B-3.1.4 Testing** — The requisite load shall then be applied for exactly 1 minute and the depth of indentation recorded in hundredths of a centimetre (0.01 cm).

**B-3.1.5 Test Results** — 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.

## APPENDIX C

(Clause 6.2)

### METHOD FOR DETERMINING ACID RESISTANCE

#### C-1. GENERAL

**C-1.1** This method is intended for use as a relatively rapid test to evaluate the chemical resistance of the mastic under anticipated service conditions. The method provides for the determination of changes in the following properties of test specimens and test reagents after exposure of the specimens to the reagent:

- a) Mass of specimen,
- b) Appearance of specimen, and
- c) Appearance of medium.

## **C-2. TEST SPECIMENS**

**C-2.1** The size of the specimen shall be  $25 \times 25 \times 25$  mm. In preparing the specimens for test the mastic as laid shall be filled directly from the mixer into moulds and float finished. No release agent shall be used in the mould.

**C-2.2** Where it is necessary to perform the test on a floor already laid, samples shall be cut from the floor. These samples shall be machined to give the required size of the specimen. The specimen may be sanded or ground to obtain flat smooth faces.

**C-2.3** The number of test specimens is dependent on the number of test solutions and the number of different temperatures (the test shall normally be carried out at  $30 \pm 1^\circ\text{C}$ . Other temperatures could also be employed if agreed between the consumer and the supplier depending on the service conditions), and the frequency of each test interval. The test specimens shall consist of sets of a minimum of three specimens for one solution at a single temperature and for each test interval. In addition one set of at least three specimens shall be available for test immediately following the conditioning period and the other sets of at least three specimens each equivalent to the number of test temperatures for test after ageing in air at test temperature for the total period. The total number of specimens required shall be calculated as follows:

$$N = n (S \times T \times I) + nT + n$$

where

$N$  = total number of specimens,

$n$  = number of specimens for a single test,

$S$  = number of solutions,

$T$  = number of test temperatures, and

$I$  = number of test intervals.

## **C-3. PROCEDURE**

**C-3.1** Prepare the test solutions in distilled water using pure chemicals. The acid solution shall be on volume basis and the solutions of salts on mass to volume basis.

**C-3.2** Weigh all the specimens to the nearest 0.0001 g on an analytical balance and record the values. Prior to immersion record a brief description of the colour and surface appearance of the specimens and the colour and clarity of the test solutions.

**C-3.3** Place the weighed specimens to be immersed in a suitable container or containers, care being taken to prevent the specimens from coming in contact with each other. The total number of specimens per container is not limited except by ability of the container to hold the specimens plus the requisite amount of test solution per specimen.

**C-3.4** Add approximately 150 ml of test solution for each specimen and place the container in a constant temperature oven adjusted to the required temperature or in a suitably adjusted liquid bath.

**C-3.5** Examine the specimens after 1, 7, 14, 28, 56 and 84 days of immersion.

NOTE—Other inspection periods may be employed and the test may be terminated before 84 days if agreed between the purchaser and the supplier.

**C-3.6** Clean the specimens by three quick rinses in running cold tap water and quick drying by blotting with a filter paper between each immersion. After the final blotting allow the specimen to dry in air for half an hour. Weigh to the nearest milligram.

**C-3.7** Note any indication of surface attack on the specimen, any discolouration on the test solution and formation of any sediment.

**C-3.8 Changing of Immersion Medium**—Discard and replace the test solution with fresh material after each test period.

### **C-3.9 Interpretation of Results**

**C-3.9.1 Mass Change**—Calculate to the nearest 0.01 percent the percentage loss or gain in mass of the specimen during immersion for each examination period, taking the conditioned mass as 100 percent, as follows:

$$\text{Mass change, percent} = \frac{(C - W)}{C} \times 100$$

where

$C$  = conditioned mass of specimen in g, and

$W$  = Mass of specimen after immersion in g.

**C-3.9.2 Appearance of Specimens**—Note the specimens for surface cracks, loss of gloss, etching, pitting, softening, etc.

**C-3.9.3 Appearance of Immersion Medium**—Note the discolouration of test solution and the formation of sediment.

## APPENDIX D

( Clause 3.3.4 )

### METHOD FOR DETERMINING SOLUBILITY OF AGGREGATES IN HYDROCHLORIC ACID

#### D-1. METHOD

**D-1.1** Dry to constant mass at 160°C about 2.5 g of the dust of the coarser material, or of stone or fine aggregate or filler that has been previously pulverized in a mortar. The loss will represent any moisture that may have been retained in the material as well as any absorbed solvent that may not have been expelled while drying the sample after extraction. Place 1 g of the dried sample in a 250-ml beaker, cover with a watch-glass and add 10 ml of hydrochloric acid (sp gr 1.19) diluted with 50 ml of distilled water. Break up any lumps by means of a glass stirring rod. Note any effervescence that may occur. If considerable effervescence takes place, the sample may be said to be carbonate. If practically all the sample dissolve, the determination need not be carried further. If apparently insoluble, heat it carefully and boil for 15 minutes, filter through a tared Gooch filter, and wash the insoluble residue with hot water. Ignite and weigh, and report the loss as the percentage soluble in hydrochloric acid.