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SPECIFICATION FOR RUBBER MATS FOR ELECTRICAL PURPOSES

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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SPECIFICATION FOR RUBBER MATS FOR ELECTRICAL PURPOSES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 24 October 1969, after the draft finalized by the Rubber Products Sectional Committee had been approved by the Chemical Division Council.

0.2 The need for standard on rubber mats for electrical purposes has been felt for quite a long time. This standard is expected to furnish the rubber industry with properties, test methods and sampling of rubber mats used as a floor covering around electrical apparatus whose voltage rating is 3 300 volts. It is not intended to imply that rubber mats should afford the sole means of protection for those working on electrical circuits. Wherever possible, further adequate precautions should be taken against the risk of shock and short circuit.

0.3 This standard is based on the following standards:

B.S. 921 : 1952 Rubber mats for electrical purposes. British Standards Institution.

ASTM Designation : D178-24 Rubber matting for use around electrical apparatus. American Society for Testing and Materials.

ZZ-M-8la : 1961 Matting: Rubber and plastics (for use around electrical apparatus or circuits not exceeding 3 000 volts to ground). General Service Administration, US Federal Supply Service.

0.4 This standard contains clauses **2.2.2** and **3.2** which call for agreement between the purchaser and the supplier.

0.5 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 prescribes the requirements, methods of sampling and test for solid rubber insulating mats for use as floor covering around electrical apparatus, not exceeding 3 300 volts to ground.

1.1.1 This standard does not cover perforated matting.

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

2. REQUIREMENTS

2.1 Materials and Manufacture — The mats shall be made from vulcanized rubber compound free from fabric insertions and fibrous materials.

2.1.1 The upper surface may have a ribbed, fluted, or other suitable pattern or may be plain. The lower surface may be finished in cloth imprints. The outside edges, except the butt edges, where a mat consists of two or more sections, may be bevelled.

2.2 Dimensions

2.2.1 *Thickness* — Unless otherwise specified, the thickness of the plain mats shall be not less than 6·5 mm. Patterned mats shall be not less than 6·5 mm thick at the root of the pattern.

2.2.2 *Length and Width* — The length and width of the mats shall be as agreed to between the purchaser and the supplier.

2.3 Colour — The colour of the mats shall be black unless otherwise specified.

2.4 Workmanship and Finish — The material shall be free from blisters, pin holes, cracks, embedded foreign matters and other defects which may impair its serviceability, when visually examined.

2.5 Physical Properties

2.5.1 *Tensile Strength and Elongation at Break* — The tensile strength and the elongation at break of the rubber shall be as follows:

Tensile strength, kgf/cm², *Min*	50
Elongation at break, percent, *Min*	250

2.5.2 *Compression Set* — Compression set of the rubber shall not exceed 10 percent.

2.5.3 *Ageing Properties* — The tensile strength and elongation at break of the test samples, when subjected to ageing for 7 days at 70° ± 1°C shall not exceed the following limits of the corresponding values (*see* **2.5.1**) obtained before ageing:

Characteristic	*Percent Change from the Original Value* Permissible
Tensile strength	$\begin{cases} +10 \\ -25 \end{cases}$
Elongation at break	$\begin{cases} +10 \\ -25 \end{cases}$

2.6 Electrical Properties

2.6.1 *Voltage Test* — The mats shall withstand 15 000 volts for 1 minute when tested according to the method prescribed in IS : 2584-1963*. The mats shall not puncture, become appreciably warm at any spot or show any other evidence of weakness. The leakage current shall not exceed 160 mA/m^2 (calculated on the area of the smaller electrode) for any position of the electrodes.

2.6.2 *Breakdown Strength* — The mats shall not fail at less than 40 000 volts when tested in air between electrodes, the voltage being applied to failure at the rate specified and tested according to IS : 2584-1963*.

2.7 Water Absorption — The mat shall not absorb water more than 4 mg/cm^2 when tested according to the method prescribed in **B-3**.

3. MARKING AND PACKING

3.1 Marking — Unless otherwise specified, the mats shall be marked with the following information:

a) Size and surface of matting (that is, plain or patterned);
b) Rated potential followed by the word 'Working' in brackets;
c) Manufacturer's name or trade-mark, if any; and
d) Month and year of manufacture.

3.1.1 The mats may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act, and the Rules and Regulations made thereunder. Presence of this mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard, under a well-defined system of inspection, testing and quality control during production. This system, which is devised and supervised by ISI and operated by the producer, has the further safeguard that the products as actually marketed are continuously checked by ISI for conformity to the standard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

3.2 Packing — The mats shall be packed as agreed to between the purchaser and the supplier.

4. SAMPLING

4.1 Scale of Sampling and Criteria for Conformity — For the purpose of ascertaining the conformity of the material to this specification, the scale of sampling and criteria for conformity shall be as prescribed in Appendix A.

4.1.1 Unless otherwise specified carry out all the tests within three months from the date of supply of the material.

*Method of test for electric strength of solid insulating materials at power frequencies.

5. TEST METHODS

5.1 Physical Tests

5.1.1 *Tensile Strength and Elongation at Break* — Test the material in accordance with the method prescribed in IS : 3400 (Part I)-1965*.

5.1.2 *Ageing* — Age the samples in an air oven at 70° ± 1°C in accordance with the method specified in IS : 3400 (Part IV)-1965†.

5.1.3 *Compression Set* — Carry out the test as prescribed in IS : 3400 (Part X)-1969‡ at 27° ± 2°C.

5.1.4 *Electrical Tests* — Carry out electrical tests as prescribed in IS : 2584-1963§.

5.1.5 *Water Absorption Test* — Weigh a test piece, 2 cm square, with clean cut edges and immerse in distilled water (*see* IS : 1070-1960¶) at a temperature of 27° ± 2°C (*see* IS : 1961-1966‖) for 168 hours. Remove and superficially dry with blotting paper and immediately weigh in a stoppered weighing bottle. Express the increase in weight (water absorbed) as mg/cm² of the total surface (top, bottom and edges) of the test piece.

NOTE — In the case of patterned sampled buff off the pattern of the test piece to give a smooth surface before carrying out the test.

APPENDIX A

(*Clause* 4.1)

SAMPLING AND CRITERIA FOR CONFORMITY OF RUBBER MATS FOR ELECTRICAL PURPOSES

A-1. PROCESS INSPECTION

A-1.1 Quality and reliability can be built into the product during the course of production by reducing the quality fluctuations to the minimum

*Methods of test for vulcanized rubbers: Part I Tensile stress-strain properties.

†Methods of test for vulcanized rubbers: Part IV Accelerated ageing.

‡Methods of test for vulcanized rubbers: Part X Compression set.

§Method of test for electric strength of solid insulating materials at power frequencies.

¶Specification for water, distilled quality (*revised*).

‖Atmospheric conditions for testing (*revised*).

through application of statistical quality control techniques (*see* IS : 397-1952*) at all stages of manufacture including the control of raw materials. When adequate process control is maintained by the manufacturer, the product will have little chance of rejection during lot inspection.

A-1.2 The requirements like thickness, tensile strength, elongation at break and compression set are suitable for control by the use of control chart for averages and ranges. The surface defects can be controlled by the use of control chart for number of defects.

A-2. LOT INSPECTION

A-2.1 Lot — In a single consignment of rubber mats all the rolls of the same colour, size, thickness and rated potential belonging to the same batch of manufacture shall be grouped together to constitute a lot.

A-2.2 For judging conformity to this specification each lot shall be considered separately. For this purpose a number of rolls shall be taken at random from the lot in accordance with col 1 and 2 of Table 1.

TABLE 1 SCALE OF SAMPLING

No. of Rolls in the Lot	Sample Size for Visual and Dimensional Examination	Acceptance No.	Sub-Sample Size for Physical Characteristics and Water Absorption	Sub-Sample Size for Electrical Tests
N	n			
(1)	(2)	(3)	(4)	(5)
Up to 3	All	*	1	
4 to 8	3	0	1	
9 ,, 15	5	0	2	1
16 ,, 25	8	0	2	
26 ,, 50	13	0	2	
51 ,, 100	20	1	3	2
101 and over	32	2	5	3

*As agreed to between the purchaser and the supplier.

A-2.2.1 In order to ensure random† selection of rolls from the lot the random number tables shall be used. In case random number tables are not available the following procedure may be adopted:

Starting from any roll count all the rolls in the lot in one order as 1, 2, 3, ... , etc, up to r and so on where r is the integral part of N/n. Every rth roll thus counted shall be withdrawn to constitute the sample.

*Method for statistical quality control during production by the use of control chart (*tentative*).

†*See also* IS : 4905 - 1968 Methods for random sampling.

A-2.3 Number of Tests and Criteria for Conformity — Each of the rolls selected in **A-2.2** from the lot shall be inspected for visual and dimensional properties (*see* **2.1** to **2.4**). The number of defective mats shall not exceed the acceptance number given in col 3 of Table 1 if the lot is to be accepted under this clause.

A-2.3.1 The lot having satisfied the visual and dimensional requirements shall then be tested for physical requirements in **2.5** and **2.7**. For this purpose a sub-sample of rolls as in col 3 of Table 1 shall be taken from the sample already selected. Each of the rolls in the sub-sample shall be tested for all the physical requirements in **2.5** and **2.7**. The lot shall be declared to conform to the requirements of this specification if each of the rolls in the sub-sample satisfies all the requirements in **2.5** and **2.7**.

A-2.3.2 The number of mats to be tested for electrical properties is given under col 5 of Table 1. There shall be no failures if the lot is to be declared acceptable for these properties.