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IS 15652 (2006): Insulating mats for electrical purposes
[ETD 2: Solid Electrical Insulating Materials and
Insulation Systems]



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भारतीय मानक
विद्युत प्रयोजनों के लिए विद्युतरोधी मैट — विशिष्टि

Indian Standard

INSULATING MATS FOR ELECTRICAL PURPOSES —
SPECIFICATION

ICS 13.260; 29.260.99

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NEW DELHI 110002

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Solid Electrical Insulating Materials and Insulation Systems Sectional Committee had been approved by the Electrotechnical Division Council.

The objective of this standard is to take care of the technological advances and developing consumer need in the field of insulating mats for electrical purposes. While incorporating the practices and experience of Indian industry, the standard is on the lines of relevant IEC 61111-2002-06 'Matting of insulating materials for electrical purposes' and sampling plans have been adapted from therein. This standard supersedes IS 5424 : 1969 'Specification for rubber mats for electrical purposes'.

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

INSULATING MATS FOR ELECTRICAL PURPOSES — SPECIFICATION

1 SCOPE

1.1 The standard is applicable to insulating mats made of Elastomer (a generic term that includes rubbers, latex and elastomeric compounds that may be natural or synthetic or a mixture or a combination of both) for use as floor covering for the protection of workers on ac and dc installations with the system voltages upto 66 kV ac and 240 V dc.

1.2 It prescribes the requirements for the performance of the product, method of samplings, testing and acceptance.

1.3 While the human safety is the prime concern while developing this standard, it is clear that final safety of the worker is only obtained by considering also work methods, training of personnel and their safety issues which are not in the scope of this Committee.

1.3.1 The spread of the mat to be used for a certain work, the working methods, the care to be taken of the mat during use, periodic checks are some of the elements which will have influence on the final performance of the mat for the intended objective and shall be taken care of by the users. Hence, the Annex A 'In-service Recommendations' is not the mandatory part of the standard and is informative in nature to get the optimum results from the mat procured as per the standard.

2 REFERENCES

The standards listed in 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 listed in Annex B.

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Type Test — A test on one or more devices made to a certain design to show that the design meets certain specifications.

3.2 Routine Test — A test to which individual device is subjected during or after manufacture to ascertain whether it complies with certain criteria.

3.3 Sampling Test — A test performed on a number of devices taken at random from a batch.

3.4 Acceptance Test — A contractual test to prove to the customer that the device meets certain conditions of its specification.

3.5 Proof Test Voltage — A specified voltage that is applied to a device for the time defined under specified conditions to assure that the electrical strength of the insulation is above a specified value.

3.6 Flashover — An arc by-passing an insulating body and occurring between electrodes and over or around, but not through, the equipment being tested.

3.7 Nominal Voltage — A suitable approximate value of voltage used to identify a system.

4 CLASSIFICATION AND DESIGNATION

4.1 Four classes of mats, covered under this standard and differing in electrical characteristics for different use voltages are designated as given in Table 1.

Table 1 Classes and Maximum Use Voltages

SI No.	Class	ac (rms) kV	dc V
(1)	(2)	(3)	(4)
i)	A	3.3	240
ii)	B	11	¹⁾
iii)	C	33	¹⁾
iv)	D	66	¹⁾

NOTE — The maximum use voltage is the voltage rating of protective equipment that designates the maximum nominal voltage of the energized system that may be safely worked. On multiphase circuits, the nominal voltage is equal to phase-to-phase voltage.

¹⁾ Not standardized. However in general it is safe to use up to 1.4 times the corresponding ac voltage uses.

4.2 Mats of all classes shall be resistant to acid and oil and low temperature and shall be identified by the respective class symbol. However a category with special property of resistance to extreme low temperature will be identified by a subscript 'c' to the respective class symbol.

5 COMPOSITION

5.1 The insulating mats shall be made from the material — Elastomer, free from any insertions leading to deterioration of insulating properties.

5.2 Upper surface of the insulating mats shall have small aberration (rough surface without edges) to avoid slippery effects while the lower surface shall be plane or could be finished slip resistant without affecting adversely the dielectric property of the mat.

6 REQUIREMENTS

6.1 Shape

Insulating mats may be either of specific shape or in rolls to be cut for individual requirements.

6.2 Dimensions — Length and Width

Rolls of mat in multiple lengths of 5 000 mm and in width of 1 000 mm are preferred in order to minimize the joints. However, the insulating mats of specific shapes in lengths of 1 000, 2 000, 3 000 mm and in width to be agreed to between the purchaser and the supplier could be ordered.

The dimensions shall be verified with the mat in flattened condition.

6.2.1 Tolerances

On length and width shall be attended to the extent of ± 15 mm on size up to 600 mm and ± 20 mm for higher.

6.3 Thickness

Unless otherwise specified, the thickness of the mats of the different classes, when measured as described in C-1, shall be as given in Table 2.

Table 2 Thickness of Mats for Different Classes

Sl No.	Class of Mat	Thickness mm	Tolerance Percent
(1)	(2)	(3)	(4)
i)	A	2.00	± 10
ii)	B	2.50	± 10
iii)	C	3.00	± 10
iv)	D	3.50	± 10

NOTE — Wherever, higher clearance is available in front and rear portion of the electrical installation, mats with higher thickness and passing the tests defined in this standard can be used on agreement between the supplier and the purchaser.

6.4 Colour

Colour shall be as agreed to between the purchaser and the supplier. However no colour with metallic derivatives shall be used.

7 WORKMANSHIP AND FINISH

7.1 Mats shall be free on both surfaces from harmful physical irregularities that can be detected by thorough test and inspection.

Harmful physical irregularities shall be defined as any feature that disrupts the uniform, smooth surface contour, such as pinholes, cracks, blisters, cuts, conductive embedded foreign matter, creases, pinch marks, voids (entrapped air), prominent ripples.

8 PHYSICAL PROPERTIES

8.1 Tensile Strength and Elongation at Break

The minimum tensile strength and elongation of mats of all classes at break, measured, as described in C-2 shall be as given in Table 3.

Table 3 Mechanical Properties of Mats for Different Ambient Temperature Use

Sl No.	Ambient Temperature Range °C	Tensile Strength N/mm ²	Elongation Percent
	(2)	(3)	(4)
i)	- 10 to 55	15	250
ii)	- 40 to 27	12	350

8.2 Di-electric Properties

8.2.1 Insulation Resistance with Water

Minimum insulation resistance for all classes of mats with tap water (that is, wet condition) will be 100 000 M Ω , when measured with 5 000 V Megger or 1 000 000 M Ω with 500 V Megger, as described in C-3.1.

8.2.2 Leakage Current

To meet the requirements of 3.2, 3.3 and 4.2 of IS 8437 (Part 1), the maximum value of the leakage current for all classes of mats when measured as described in C-3.2 shall not be more than 10 μ A.

8.2.3 ac Di-electric Strength

Minimum di-electric strength of the mats for different classes, measured as described in C-3.3 and 5.1.1, 7.2.1 and 8 of IS 2584 shall be as given in Table 4.

Table 4 Di-electric Strength of Mats for Different Classes
(Clause 8.2.3)

Sl No.	Class	Di-electric Strength ac (rms) kV
(1)	(2)	(3)
i)	A	30
ii)	B	45
iii)	C	65
iv)	D	110

8.2.4 ac Proof Voltage

Mats of different classes will withstand proof voltage as given in Table 5, when using electrodes and applying the voltage as described in C-3.4. The test is deemed successful, if the specified test voltage is reached and maintained for 3 min for the type and sampling test and 1 min for the routine test without becoming appreciably warm at any spot.

Table 5 ac Proof Voltages of Mats for Different Classes

Sl No.	Class	Proof Voltage ac (rms) kV
(1)	(2)	(3)
i)	A	10
ii)	B	22
iii)	C	36
iv)	D	70

8.3 Ageing Properties

Tensile strength and elongation at break, when measured after subjecting the mat to ageing for 168 h at $70 \pm 1^\circ\text{C}$ as described in C-4 shall not be less than 75 percent of the corresponding values obtained for unaged test pieces from the same lot.

8.4 Thermal Properties

8.4.1 Flame Retardance

Fire should extinguish within 5 s after removal of blue flame, when tested as described in C-5.1.

8.4.2 Low Temperature Resistance

Mats of all classes will not show any visible break or crack when folded after placing for one hour

at a temperature of $-10 \pm 3^\circ\text{C}$ as described in C-5.2. These shall also pass ac proof voltage test as per 8.2.4.

8.5 Acid/Alkalis and Oil Resistance

Following the conditioning in acids/alkalis and oil as described in C-6, the resulting mechanical deterioration and chemical damage on the mats of all classes shall be determined by measuring tensile strength and elongation. The values obtained for these shall not be less than 80 percent of the corresponding values obtained in tests carried out on samples from same batch without conditioning.

8.6 Extreme Low Temperature

Mats of all classes for usage in extreme low ambient conditions will not show any visible tear, break or crack when folded under force of 100 N for 30 s after conditioning in a chamber for $24 \text{ h} \pm 0.5 \text{ h}$ at a temperature of $-40 \pm 3^\circ\text{C}$ as described in C-7. These shall in addition pass the proof voltage test as per 8.2.4.

9 MARKING

9.1 Every roll/flat will be marked with following:

- Class,
- Lot No.,
- Roll No., and
- Manufacturer's identity.

9.2 BIS Certification Marking

The product 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 the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian standards.

10 PACKING

The mats shall be packed either in rolls or flats and shall not be distorted mechanically. In case of rolls material should be rolled smoothly on hollow mandrel made of either hard cardboard or waste plastic, of diameter 50 mm or higher. The material shall be wound tightly and the edges of top most layer should not shift from the edge of 1st bottom layer by more than 75 mm. The roll should be clamped at 2 places with the help of plastic unidirectional tape and clamps. Gunny/jute material should be used, if material has to be transported over long distances or has to be dispatched through local transportation to avoid any

kind of damage to the material. Over the gunny/jute material, proper plastic bag having lining of suitable fabrics should be used.

11 TESTS ON MATS

11.1 General

11.1.1 Unless otherwise specified, the mat shall be pre-conditioned for a period of 2 ± 0.5 h at a temperature of 27 ± 2 °C and relative humidity of 50 ± 5 percent.

11.1.2 The classification of tests-type, routine and sampling to be carried out for different requirements/properties of the mats, the number of mats required for type tests and the allotment of the mats in various testing lots are given in Annex D and Annex E.

11.1.3 In case of mats in rolls, the minimum size of each unit shall be 1 m × 1 m. For rolls/sheets with width of less than 1 m, the manufacturer shall provide test pieces of 1 m × 1 m.

11.1.4 Test methods are described in Annex C.

11.2 Acceptance Testing/Conformity to Standard

11.2.1 In order to assure the delivery of the mats that meet this standard, the manufacturer shall employ an approved quality assurance plan. This quality assurance plan shall ascertain that the mats meet the requirement contained in the standard. Acceptance testing consisting of routine tests, to be carried out on each unit and/or on sampling of units (sampling tests) and the sampling size must be agreed to between the supplier and the purchaser.

11.2.2 In the absence of an accepted quality assurance plan, for the purpose of ascertaining the conformity of mats to this standard, the acceptance tests are those (both routine and sampling) specified in the standard and must be carried out as per sampling plans given in Annex E.

ANNEX A

(Clause 1.3.1)

A-1 IN-SERVICE RECOMMENDATIONS

The following is for guidance only for the use, maintenance, inspection and retest of insulating mat during service after purchase to ensure highest level of safety:

- a) *Storage* — Mats should be stored in its container or package. Care should be taken to ensure that the mats are not compressed, folded or stored in proximity to steam pipes, radiators or other sources of artificial heat or exposed to direct sunlight, artificial light or other sources of ozone. It is desirable that the ambient temperature is between 10 and 21°C.
- b) *Examination Before Use* — Before use, each mat should be visually inspected: both top and bottom surfaces along with type test report from accredited lab. If, the mat is apparently unsafe, it shall not be used and should be returned for testing.
- c) *Recommendations for Use of Mats* —
 - 1) For obtaining maximum practical safety in adverse working conditions, the mat should be permanently pasted with the help of suitable adhesive/resin, which does not energize between -40 and $+55$ °C. All joints and corners shall be filled/covered with insulating material of matching colour. Matching colour and matching designed tapes should be used to maintain an aesthetic look of the installation over the joints and corners. Wherever the floor is porous in nature and attracts moisture, waterproofing compound is recommended to be used to protect insulating and electrical properties.
 - 2) Alternatively butt joints may be welded by thermo-fusion method by making a 'V' groove cut at the joint as per IS 8002.
 - 3) Mats should be washed with soap and water periodically at temperature not exceeding recommended temperature of use. Contact with petrol/paraffin or white spirit and strong acid/alkalis should be avoided. In case of any drop out these be removed immediately for longer life. Dust of any kind, especially coal/cement must be removed regularly. Any paint mark should be removed immediately without excessive use of thinner.
 - d) *Recommended Areas of Use* — All kinds of electric sub-stations, transformers rooms, lift machine rooms, switch rooms, electrical panels, ac plant rooms, X-ray plant rooms, LT/HT Labs, around bus bars, generator rooms, etc.
 - e) *Periodic Inspections* — Mats as per this standard will normally have a life span of around 10-15 years under normal indoor working conditions, unless it is damaged visually under abnormal use. Thus an only yearly visual inspection is recommended.

ANNEX B

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	Title	IS No.	Title
2076 : 1981	Specification for unsupported flexible polyvinyl chloride sheeting (<i>first revision</i>)		Part 1 General aspects (<i>first revision</i>)
2500 (Part 1) : 2000	Sampling procedure for inspection by attributes: Part 1 Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection	3400 (Part 1) : 1987	Methods of test for vulcanized rubbers: Part 1 Tensile stress-strain properties (<i>second revision</i>)
2584 : 1963	Method of test for electric strength of solid insulating materials at power frequencies	8002 : 1976	Recommended procedure for welding of flexible PVC
8437 (Part 1) : 1993	Guide on effects of current passing through human body:	10810 (Part 7) : 1984	Methods of test for cables: Part 7 Tensile strength and elongation at break of thermoplastic and elastomeric insulation and sheath

ANNEX C

(Clauses 6.3, 8.1, 8.2.1, 8.2.2, 8.2.3, 8.2.4, 8.3, 8.4.1, 8.4.2, 8.6 and 11.1.4)

TEST METHODS

C-1 THICKNESS

Thickness shall be measured with help of vernier caliper/screw gauge or alternative instrument, giving substantially same results. Thickness measurements shall be made at five or more points approximately uniformly distributed over the total area of the mat. The instrument should be graduated within 0.02 mm and during measurement sufficient support shall be given to mat so that it will present an unstressed flat surface between the two faces of the measuring instrument.

C-2 TENSILE STRENGTH AND ELONGATION AT BREAK

Four dumb-bell test pieces shall be prepared in accordance with IS 10810 (Part 7). Before the tensile test, the gauge length of 10 mm shall be marked by the two lines centrally on each specimen. The rate of separation of jaws (grips) shall be 250 ± 50 mm/min. The tensile strength and elongation at break shall be determined simultaneously on the same test pieces. During the test the distance between the marker lines shall be closely followed and the elongation shall be determined by measuring the distance between the two marker lines at the instant of the break that is the separation of the gauge marks at break. This distance is used to calculate the percentage elongation at break, based on the original gauge length. The breaking load at which the test piece breaks is also recorded for each piece.

C-2.1 Calculation

For individual specimen

$$A = w \times t$$

where

w = width of the test piece within gauge length, in mm; and

t = thickness of test piece, in mm.

NOTE — In case of taper cutting w of both side should be measured and average of it should be taken as w .

C-2.2 Tensile Strength (N/mm²)

$$= F/A$$

C-2.3 Elongation at Break (in Percent)

$$= [G_2 - G_1]/G_1 \times 100$$

where

G_1 = original gauge length, in mm; and

G_2 = separation of gauge marks at break, in mm.

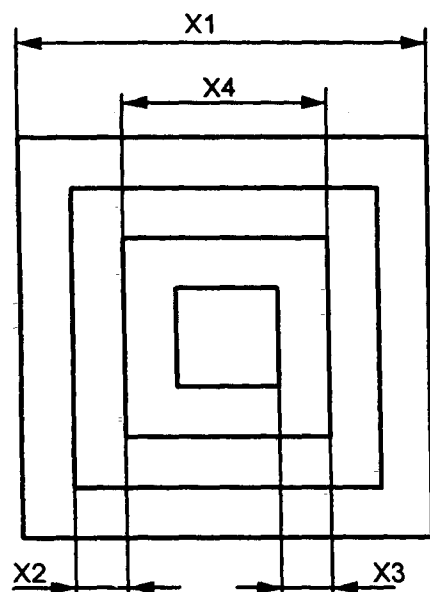
At least five test pieces shall be taken, result shall be processed as per IS 2076 or IS 3400 (Part 1) or other relevant Indian Standard depending upon the chemical nature of the material of the mat.

C-3 DI-ELECTRIC MEASUREMENTS

C-3.1 Insulation Resistance with Water

Two test pieces measuring 150 mm × 150 mm shall be cut out of mat. A layer of 5 mm (width) of same material shall be pasted upon all corners with suitable adhesives to avoid seepage of water. A further layer of similar width shall be formed at the interval of 20-25 mm from first layer to strictly avoid any leakage. The inner cavity of the sample shall be filled with the water and it shall remain there for 24 h at room temperature. After 24 h, water be removed and electrodes of 25 mm diameter and 75 mm diameter shall be placed in the inner cavity area to measure the insulation resistance after 1 min of application of voltage as per 5.1.1 of IS 2584. Direct reading shall be noted.

Various dimensions of the sample as shown in Fig. 1 shall be as under:



X1	150
X2	20-25
X3	5
X4	85

All dimensions in millimetres.

FIG. 1 SAMPLE FOR INSULATION RESISTANCE WITH WATER

C-3.2 Leakage Current

Two test pieces in size of 150 mm × 150 mm shall be placed in insulating oil and electrodes as prescribed in 5.1.1 of IS 2584 shall be used to measure the leakage current by application of maximum use voltage for the mat under testing. Direct reading shall be noted.

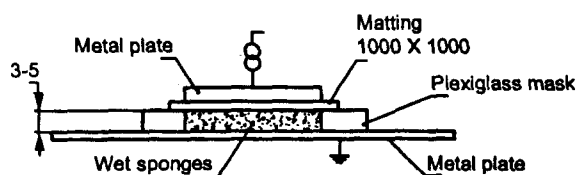
C-3.3 ac Di-electric Strength

Five test pieces in size of 150 mm × 150 mm shall be immersed in insulating oil at ambient temperature. Di-electric strength shall be measured in oil with the help of electrodes as per 5.1.1, 7.2.1 and 8.0 of IS 2584.

C-3.4 ac Proof Voltage

A 1 270 mm × 1 270 mm sheet of insulating material 3 mm to 5 mm thick which has a 762 mm × 762 mm opening in the centre, shall be placed on a grounded metal plate. This mask which has a picture frame appearance shall have the opening filled with a conductive material of such thickness so as to bring the ground electrode to approximately the same level as the mask in order to maintain direct contact with the mat to be tested.

The mat is placed over the ground electrode and a wet pad of approximately the same size as the ground electrode is placed on top of the mat. The wet pad is energized with the test voltage as shown in Fig. 2.



All dimensions in millimetres.

FIG. 2 TEST ELECTRODE FOR MATTING

Mat shall be given a voltage test as specified in Table 5 (see 8.2.4) using electrodes as described above. The ac voltage shall be initially applied at a low value and gradually increased at a constant rate-of-rise of approximately 1 000 V/s until the specified test voltage level is reached. The test period shall be considered to start at the instant the specified voltage is reached. The test is deemed successful if the specified test voltage is reached and maintained for 3 min for the type and sampling tests and 1 min for the routine test. For type and sampling the mats shall be conditioned for moisture absorption by immersion in water for a period of 16 ± 0.5 h at ambient temperature. For routine tests such conditioning is not required.

NOTES

1 This method will test a 762 mm × 762 mm area of a 1 000 mm × 1 000 mm mat at 40 kV ac r.m.s. as the mask prevents flashover.

2 At the end of the test period the applied voltage should be reduced to approximately half value before opening the test circuit unless an electrical failure has already occurred.

C-4 AGEING

Ageing test shall be carried out as per IS 3400 (Part 1).

C-5 THERMAL PROPERTIES

C-5.1 Flame Retardance

The test shall be carried out in a draught-free room or chamber.

A test piece of 150 mm × 150 mm shall be cut from the mat and mounted horizontally and centrally, 40 mm above a gas burner and held by suitable clips.

The gas supply shall be technical grade methane gas with a suitable regulator and meter to produce a uniform gas flow.

The nozzle of the burner shall have a diameter of 9.5 ± 0.5 mm to produce a 20 ± 2 mm high blue flame.

The burner is placed remote from the test piece, ignited and adjusted in the vertical position to produce a blue flame 20 ± 2 mm high. The flame is obtained by adjusting the gas supply and air influx of the burner until a 20 ± 2 mm yellow-tipped blue flame is produced and then the air supply is increased until the yellow tip dis-appears. The height of the flame is measured again and corrected, if necessary.

The burner shall then be placed centrally below the test piece for 10 s to cause the fire on the mat and then withdrawn. It should be ensured that no air draught interferes with the test.

NOTE — If natural gas is used as an alternative to methane/liquefied petroleum, its heat content should be approximately 37 MJ/m^3 , which has been found to provide similar results.

C-5.2 Low Temperature Resistance

For type tests three test pieces 200 mm × 500 mm shall be cut from the mat. For sampling tests, the numbers are given in Annex E. Each sample shall be placed in a chamber for 1 h at a temperature of

$-10 \pm 3^\circ\text{C}$. Two polyethylene plates 200 mm × 200 mm × 5 mm thick shall be conditioned at the same temperature and for the same time.

Within 1 min after removal from the chamber, each piece of mat shall be folded at the mid point and placed between the two polyethylene plates and subjected to a force of 100 N for 30 s as shown in Fig. 3.

The test is deemed successful if no tear, break or crack is visible. The test piece shall also pass the ac proof voltage test as per 8.2.4.

C-6 EFFECTS OF ACID, ALKALIS, DIESEL AND TRANSFORMER OIL

The test pieces shall be conditioned by immersion in each medium (30 percent concentrated acid, 30 percent concentrated alkalis, diesel and transformer oil) for 48 h at room temperature. After conditioning in the given agent, the test pieces shall be dried for 4 h at room temperature before subjecting to test. Tensile strength and elongation at break shall be measured as described in C-2.

C-7 EXTREME LOW TEMPERATURE

Three test pieces 200 mm × 500 mm shall be cut from the mat and placed in a chamber for $24 \text{ h} \pm 0.5 \text{ h}$ at a temperature of $-40 \pm 3^\circ\text{C}$. Two polyethylene plates 200 mm × 200 mm × 5 mm thick shall be conditioned at the same temperature and for the same time.

Within 1 min after removal from the chamber, the mat shall be folded at the mid-point, placed between the two polyethylene plates and subjected to a force of 100 N for 30 s as shown in Fig. 3.

The test is deemed successful if no tear, break or crack is visible. The test piece shall also pass the ac proof voltage test as per 8.2.4.

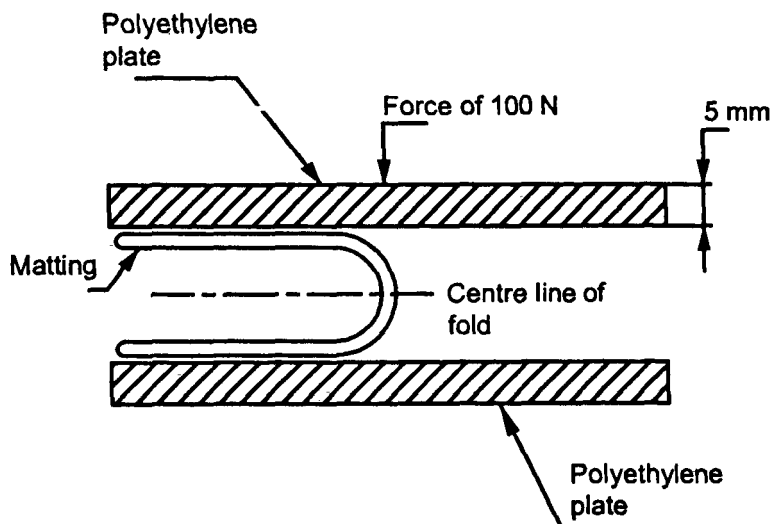


FIG. 3 POLYETHYLENE PLATES FOR EXTREME TEMPERATURES

ANNEX D

(Clause 11.1.2)

LIST AND CLASSIFICATION OF TESTS

Table 6 General Test Procedure

Description of Work	Sub-clause	Classification of Tests	Type Tests					Routine Tests
			Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	
Shape	6.1	Type, Sampling	1					
Dimensions	6.2	Type, Sampling	2					
Thickness	6.3	Type, Sampling	3					
Workmanship and finish	7.0	Type, Sampling	4	1	1	1	1	1
Marking	9.0	Type, Routine	5					
Packaging	10.0	Type, Sampling	6					
Tensile strength and elongation	8.1	Type, Sampling	7	2 ¹⁾				
Insulation resistance	8.2.1	Type, Sampling			2 ¹⁾			
Leakage current	8.2.2	Type, Sampling			2 ¹⁾			
ac di-electric strength	8.2.3	Type, Sampling			2 ¹⁾			
ac proof voltage	8.2.4	Type, Sampling and Routine			2 ¹⁾			2
Ageing	8.3	Type, Sampling		3 ¹⁾				
Flame retardance test	8.4.1	Type, Sampling						
Low temperature	8.4.2	Type, Sampling	8			2 ²⁾		
Acid and oil resistance	8.5	Type, Sampling					2 ¹⁾	
Special properties category C – Extreme low temperature	8.6	Type, Sampling				2 ²⁾		
Size of each lot (unit is the mat)			1	1	4	3	2	

¹⁾ Tests carried out on test pieces.²⁾ Either test 8.4.2 or test 8.6 shall be used, according to the special properties of the mat.

NOTES

- 1 The numbers given in the table indicate the order in which the tests are to be made.
- 2 The sampling tests are the same as those for type tests.
- 3 The size of each lot for sampling tests is given in Annex E.
- 4 Mat which has been subjected to type tests or sampling tests shall not be re-used.

ANNEX E

(Clauses 11.1.2 and 11.2.2)

SAMPLING PLANS AND PROCEDURES

E-1 GENERAL

The sampling procedure does not follow in its entirety the sampling procedure given in IS 2500 (Part 1). The characteristics of the product covered by this standard do not lend themselves to the application of the previously mentioned standard.

Every lot consists of mat of the same class and category.

E-2 CLASSIFICATION OF DEFECTS

E-2.1 Major Defect

Defect, other than critical, that is likely to result in failure, or to materially reduce the usability of the item or product for its intended purpose.

E-2.2 Minor Defect

Defect, that is not likely to materially reduce the usability of the item or product for its intended purpose, or is departure from established standards having little bearing on the effective use or operation of the item.

Table 7 gives the nature of defects in function of the tests retained for the sampling procedure.

E-3 GENERAL SAMPLING PLANS

E-3.1 Sampling Plan for Minor Defects

Samples are drawn and tested following the sampling plan of Table 8.

E-3.2 Sampling Plan for Major Defects

Samples are drawn and tested following the sampling plan of Table 9.

E-4 SAMPLING PROCEDURE FOR MAT WITH SPECIAL PROPERTIES

A first sample of mat with special properties shall be selected in accordance with the sampling plans given in E-2 and E-3.

In addition, a second sample shall be selected in accordance with Table 9 and submitted to test given in 8.6, for each respective special category.

Table 7 Classification of Defects

(Clause E-2.2)

Type of Test (1)	Subclause (2)	Type of Defect	
		Minor (3)	Major (4)
Shape	6.1	X	
Dimensions	6.2	X	
Thickness	6.3	X	
Packaging	10	X	
Tensile strength and elongation	8.1		X
Insulation resistance	8.2.1		X
Leakage current	8.2.2		X
ac di-electric strength	8.2.3		X
ac proof voltage	8.2.4		X
Ageing	8.3	X	
Thermal			
Flame retardance	8.4.1	X	
Low temperature	8.4.2	X	
Acid and oil resistance	8.5	X	

Table 8 Sampling Plan for Minor Defects
(Clause E-3.1)

Sl No.	Lot Size	Sample Size	Number of Defects for Acceptance	Number of Defects for Rejection
(1)	(2)	(3)	(4)	(5)
1	2 to 90	5	1	2
2	91 to 150	8	2	3
3	151 to 3 200	13	3	4
4	3 201 to 3 5000	20	5	6

Table 9 Sampling Plan for Major Defects
(Clause E-3.2)

Sl No.	Lot Size ¹⁾	Sample Size	Number of Defects ²⁾ for Acceptance	Number of Defects ²⁾ for Rejection
(1)	(2)	(3)	(4)	(5)
1	2 to 90	3	0	1
2	91 to 3 200	13	1	2
3	3 201 to 3 5000	20	2	3

NOTES

1 Square meter in case of rolls and number in case of sheet.

2 Number of defects for acceptance/number of defects for rejection is number of defective samples for declaring the specific test deemed to have passed or failed.

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Amendments Issued Since Publication

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AMENDMENT NO. 1 NOVEMBER 2007
TO
IS 15652 : 2006 INSULATING MATS FOR ELECTRICAL
PURPOSES — SPECIFICATION

(Page 2, clause 8.2.2, last line) — Substitute '10 mA' for '10 μ A'.

(Page 7, Annex C, clause C-5.2, last para, second sentence) — Substitute the following for the existing:

'A mat conditioned simultaneously in the low temperature chamber shall also pass the ac proof voltage test as per 8.2.4 but without conditioning for moisture absorption as given in C-3.4.'

(Page 7, Annex C, clause C-6) — Add the following new paragraph at the end:

'Sulphuric acid, NaoH and HSD will be used for conditioning for determination of effects of acids/alkali and diesel.'

(Page 7, Annex C, clause C-7, last para, second sentence) — Substitute the following for the existing matter:

'A mat conditioned simultaneously in the low temperature chamber shall also pass the ac proof voltage test as per 8.2.4 but without conditioning for moisture absorption as given in C-3.4.'

(Page 8, Annex D, Table 6, row 7, col 4) — Substitute '7¹⁾' for '7'.

**AMENDMENT NO. 2 MARCH 2010
TO
IS 15652 : 2006 INSULATING MATS FOR ELECTRICAL
PURPOSES — SPECIFICATION**

(Page 1, clause 1.1, last line) — Substitute '33' for '66'.

(Page 1, clause 4.1, first line) — Substitute 'Three' for 'Four'.

[Page 1, Table 1, Sl No. (iv)] — Delete the entire row.

(Page 1, clause 4.2, first sentence) — Substitute 'acid/alkali and oil and low temperature' for 'acid and oil and low temperature'.

(Page 1, clause 4.2) — Add the following new para at the end:

'Mats resistant to acid and oil and low temperature (Category I) and mats resistant to alkali and oil and low temperature (Category II) shall be considered to be different product groups. Thus, mats resistant to acids, alkali & oil and low temperature (Category III) shall be considered to be conforming to both the product groups.'

(Page 2, clause 6.3) — Add the following new subclause at the end:

'**6.3.1** Mats of higher thickness than those specified in the Table 2 inclusive of tolerances are permissible subject to their passing the specified tests. Manufacturers of such mats shall declare that thickness and the tolerances of ± 10 percent shall be applicable on the declared thickness.'

[Page 2, Table 2, Sl No. (iv)] — Delete the entire row.

[Page 3, Table 4, Sl No. (iv)] — Delete the entire row.

[Page 3, Table 5, Sl No. (iv)] — Delete the entire row.

[Page 3, clause 9.1(a)] — Substitute the following for the existing:

'a) Class, Category and thickness,'

(Page 5, Annex C, clause C-2, first sentence) — Substitute the following for the existing:

'Five dumb-bell test pieces shall be prepared in accordance with IS 10810 (Part 7).'

Amend No. 2 to IS 15652 : 2006

(Page 6, Annex C, clause C-3.4, second para) — Substitute the following for the existing:

‘The matting or test piece shall be placed over the mask. A rectangular metal plate, 762 mm × 762 mm and approximately 5 mm thick, having smoothly rounded edges and corners, shall be placed on top of the matting or test piece. This top plate shall then be energized with the test voltage.’

(Page 6, Annex C, clause C-4) — Substitute the following for the existing:

‘Subsequent to subjecting the mat to ageing as described in 8.3, the tensile strength and elongation at break shall be measured as described in C-2.’

[Page 7, Annex C, clause C-6 (see also Amendment No.1)] — Substitute the following for the existing:

‘C-6 EFFECTS OF ACID/ALKALIS AND OIL

The test pieces shall be conditioned by immersion in each of the desired medium, namely, 30 percent concentrated sulphuric acid, 30 percent concentrated NaOH LR Grade, HSD and Transformer Oil conforming to IS 335, as per product classification in line with 4.2, for 48 h at room temperature. After conditioning in the given agent, the test pieces shall be dried for 4 h at room temperature before subjecting to test. Tensile strength and elongation at break shall be measured as described in C-2.’

(Page 9, Annex E, Table 7, col 1, row 7) — Substitute the following for the existing:

‘Acid/alkali & oil resistance’

(ET 02)