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IS 15868-1 to 6 (2008): Natural fibre geotextiles (jute geotextile and coir bhoovasthra) - Methods of test [TXD 30: Geotextiles and Industrial Fabrics]



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जटा के भूवस्त्र) — जाँच की पद्धतियाँ

*Indian Standard*

NATURAL FIBRE GEOTEXTILES (JUTE GEOTEXTILE  
AND COIR *BHOOVA*STRA) — METHODS OF TEST

ICS 59.080.30

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**BUREAU OF INDIAN STANDARDS**  
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## FOREWORD

This Indian Standard (Parts 1 to 6) was adopted by the Bureau of Indian Standards, after the draft finalized by the Geosynthetics Sectional Committee had been approved by the Textile Division Council.

The use of natural fibre geotextiles has been recognized in erosion control in embankment construction for roads and railways, dam engineering, canals, etc, and in road pavements. Their increasing importance is due to their versatility based on their specific properties.

For applications, it is desired that the geotextiles maintain integrity during the course of its life and do not tear, split and deteriorate under constructional or post-constructional stresses.

From the view point of applications of geotextiles made of natural fibres, the mass per unit area, thickness, swell, water absorption, resistance to smouldering and mesh size of natural fibre geotextiles assume great significance. Accordingly this standard is divided in six parts as under:

Part 1 Determination of mass per unit area

Part 2 Determination of thickness

Part 3 Determination of percentage of swell

Part 4 Determination of water absorption capacity

Part 5 Determination of smouldering resistance

Part 6 Determination of mesh size of coir geotextiles by overhead projector method

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*

# NATURAL FIBRE GEOTEXTILES (JUTE GEOTEXTILE AND COIR *BHOOVA*STRA) — METHODS OF TEST

## PART 1 DETERMINATION OF MASS PER UNIT AREA

### 1 SCOPE

1.1 This standard (Part 1) specifies a method for the determination of the mass per unit area of all natural fibre geotextiles for identification purposes and for use in technical data sheets.

1.2 The method is applicable to all natural fibre geotextiles, all coir *bhoov*astra, jute geotextiles and erosion control blankets (ECBs).

### 2 PRINCIPLE

The mass per unit area is calculated by weighing small square or circular specimens of known dimensions. The mass per unit area of an ECB is determined by weighing test specimens of known dimensions cut from various locations over the full width of the laboratory sample.

The measured weight is then used to calculate the mass per unit area of the specimen, and these values are averaged to obtain the mean mass per unit area of the laboratory sample.

### 3 SPECIMENS

The specimens shall be cut in such a way that they are representative of the material to be tested.

Cut not less than ten specimens and to a nominal size of 100 cm<sup>2</sup>, unless the structure of the geotextile is such that a 100 cm<sup>2</sup> specimen is not representative, in which case a larger specimen size shall be used.

### 4 PROCEDURE

Determine the area of each specimen to an accuracy of

0.5 percent. Weigh each specimen to an accuracy of 0.1 percent.

### 5 EXPRESSION OF RESULTS

Calculate the mass per unit area of each specimen, expressed, in g/m<sup>2</sup>, using the equation:

$$p = (m \times 10^6)/A$$

where

$p$  = mass per unit area, in g/m<sup>2</sup>;

$m$  = mass of the specimen, in g; and

$A$  = the area of the specimen, in mm<sup>2</sup>.

Calculate the average mass per unit area, rounding the result to the nearest g/cm<sup>2</sup>, and the coefficient of variation.

### 6 TEST REPORT

The test report shall include the following particulars:

- a) A statement that the test was performed in accordance with this standard;
- b) Number of specimens tested;
- c) Conditioning atmosphere used;
- d) In the case of a specimen size larger than 100 cm<sup>2</sup>, give the size used, and a description (words or sketch) of the structure;
- e) Results of the test;
- f) Details of any deviation from the specified test procedure; and
- g) Date of the test.

*Indian Standard*

# NATURAL FIBRE GEOTEXTILES (JUTE GEOTEXTILE AND COIR *BHOOVASTRA*) — METHODS OF TEST

## PART 2 DETERMINATION OF THICKNESS

### 1 SCOPE

1.1 This standard (Part 2) prescribes method for determination of the thickness of geotextiles at specified pressures and defines at which pressure the nominal thickness is determined.

1.2 The method is applicable to all types of natural fibre geotextiles.

NOTE — Normally the thickness of geotextiles is determined by measuring one layer of the geotextile. In cases when two or more layers are used on top of the each other in a design, a test may be made in accordance with this standard with the agreed number of layers instead of one. In such case when testing structured geotextiles consideration should be paid to the relevance of such findings.

### 2 REFERENCE

The following standard is a necessary adjunct to this standard:

<i>IS No.</i>	<i>Title</i>
6359 : 1971	Method for conditioning of textiles

### 3 DEFINITIONS

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

3.1 **Thickness (of Geotextiles)** — The distance between a reference plate on which the specimen rests and a parallel presser-foot applying a given pressure to the specimen.

3.2 **Nominal Thickness (of Geotextiles)** — The thickness determined when applying a pressure of  $2 \pm 0.01$  kPa to the specimen.

### 4 PRINCIPLE

4.1 The thickness of a number of specimens of geotextiles are measured as the distance between the reference plate on which the specimen rests and a parallel circular presser-foot exerting pressures on an area of defined size within a larger area of geotextile.

4.2 The result of the test is given as the average of the results obtained at each specified pressure.

### 5 APPARATUS

5.1 **Thickness Tester** — Incorporating the following elements.

5.1.1 **Interchangeable Presser-Foot** — Having a circular and plane surface with an area of  $25 \text{ cm}^2$  for testing materials of uniform thickness. For determination of the overall thickness of materials of non-uniform thickness or other parts of such materials, the size of the presser-foot shall be agreed upon and the size shall be given in the test report.

The presser-foot shall be capable of exerting a pressure of 2 kPa within a tolerance of 0.5 percent normal to the plane of the specimen.

NOTE — To assure the parallelity between the presser-foot surface and the reference plate when determining the overall thickness of geotextiles of non-uniform thickness, the presser-foot should be supported in at least three points evenly distributed over the presser-foot surface, which normally will require that a presser-foot with an area of more than  $25 \text{ cm}^2$  is chosen.

5.1.2 **Reference Plate** — With a plane surface of minimum dimension greater than twice the diameter of the presser-foot surface for testing material of uniform thickness. When testing thinner areas in material of non-uniform thickness, the reference plate or a substituting supporting device can be chosen as small as the area of the presser-foot agreed upon to assure contact with the lower surface.

5.1.3 **Gauge** — For registering the distance between the reference plate and the presser-foot to an accuracy of 1 percent.

### 5.2 Suitable Timing Device

## 6 PREPARATION OF TEST SPECIMENS

6.1 Cut from each roll selected over its full width perpendicular to roll length direction, a suitable sample of length necessary for obtaining the required number of test specimens. Cut from all such samples, required number of test specimens of minimum dimension greater than twice the diameter of the presser-foot surface.

6.2 The number of specimens shall be not less than 10.

6.2.1 Specimens from a roll shall be cut from positions evenly distributed over the full width and length of the sample, but not closer than 100 mm to the selvages.

6.2.2 Specimens shall not contain dirt, irregular spots, creases, holes or other visible faults.

6.2.3 Any two specimens shall not contain the same longitudinal or transversal position. If it is not possible, it shall be reported.

6.3 Before cutting structured geotextiles, exact instructions for cutting shall be laid down, and those shall be followed with great care.

6.4 If the cutting causes fragments of geotextile to loosen and if this cannot be avoided causing influence on test results, this fact shall be reported.

6.5 The specimens shall be kept free from dust, dry, at ambient temperature, in dark and protected against chemical and physical damage until the test is performed.

## 7 PROCEDURE

### 7.1 Conditioning of Test Specimens

7.1.1 Condition the specimens in the standard atmosphere of  $65 \pm 2$  percent relative humidity and  $27 \pm 2^\circ\text{C}$  temperature to moisture equilibrium from the dry side (*see also* IS 6359). When the specimens have been left in such an atmosphere so that both the faces are exposed to the standard atmosphere as far as possible for 24 h, they shall be deemed to have reached the state of moisture equilibrium.

### 7.2 Measurement of Thickness

7.2.1 When determining the thickness of material of non-uniform thickness, for example, material in which strands or similar features are present, the part of the material to be tested shall be a matter of prior agreement between the buyer and the seller. The part tested shall be specified in the test report.

7.2.2 The thickness is determined by using the procedure specified in 7.3 applying pressures of 2 kPa to an accuracy of 0.5 percent.

## 7.3 Procedure

7.3.1 Place a specimen between the clean surfaces of the reference plate and presser-foot specified in 4. Lower gently the presser-foot applying a pressure of  $2 \pm 0.01$  kPa to the specimen and note the gauge reading after 30s, unless some other time is specified.

7.3.2 Remove the pressure and the specimen.

7.3.3 Repeat the procedure specified in 7.3.1 and 7.3.2 until at least 10 specimens are tested.

## 8 TEST REPORT

8.1 The test report shall include the following particulars:

- a) Roll number, roll width, roll length and colour of roll;
- b) Number of specimens tested at each pressure given in 7.3;
- c) Conditioning atmosphere and the time of relaxation (*see* 7.3.1);
- d) Presser-foot size. If applicable the reason for not using the 25 cm<sup>2</sup> presser-foot size; and
- e) Average value of the thickness given in 7.3 expressed in mm to an accuracy of 1 percent for geotextile thickness over 0.05 mm and to the nearest 0.001 mm for thickness not exceeding 0.05 mm.

### NOTES

1 Upon request the single results of each individual test can be given.

2 Upon request a graph showing; the curve of the mean values of thickness corresponding to the applied pressure can be given. The X-axis should be logarithmical for applied pressures. The Y-axis should be linear for the thickness.

*Indian Standard***NATURAL FIBRE GEOTEXTILES (JUTE GEOTEXTILE AND COIR *BHOOVA*STRA) — METHODS OF TEST****PART 3 DETERMINATION OF PERCENTAGE OF SWELL****1 SCOPE**

1.1 This standard (Part 3) prescribes method for determination of the percentage of swell in water of geotextiles.

1.2 The method is applicable to all types of natural fibre geotextiles.

**2 PRINCIPLE**

This test is used to calculate the percentage of swell of all natural fibre geotextiles in water. This method determines the percentage swell in thickness of the sample after it has been immersed in water for 24 h.

**3 APPARATUS**

3.1 Two pieces of non-corrosive household window screen measuring 127 mm × 127 mm.

3.2 A shallow pan measuring 305 mm × 305 mm and containing two 76 mm high rigid blocks.

3.3 A balance accurate to 0.01 g.

3.4 Thickness device consistent to measure 0.01 mm.

**4 TEST SPECIMEN**

4.1 Ten, 100 mm × 100 mm specimens handled in a manner to avoid loss of loose filler and weaving components.

**5 PROCEDURE**

For each specimen, raise the presser-foot on the thickness device and place the specimen flat between

the presser-foot and the anvil. Gently release the presser-foot and allow it to rest on the specimen for 5s. Record the initial thickness,  $T_i$ , to the nearest 0.01 mm.

Place the specimen between the two No. 17 gauge wire mesh screens that have been soaked in water for a minimum of 1 h. Connect the screen corners loosely to hold the test specimen in place without compressing the specimen material.

Immerse the test specimen in the screen assembly in de-ionized water for  $24 \pm 0.25$  h.

After the soaking period, remove the assembly from the water, rest it upon the blocks and allow it to drip-drain in a horizontal position for 10 min.

Remove the specimen from the screen and measure its thickness,  $T_f$ .

NOTE — Care should be exercised to maintain specimen integrity and preserve all material components during removal from screen supports. Lost specimen fibres, threads or other components may significantly impact final results.

**6 CALCULATION**

Calculate the percent thickness change as follows:

$$\text{Percent thickness change} = 100 (T_f - T_i) / T_i$$

Repeat the procedure for all 10 test specimens.

**7 REPORT**

The percent change in thickness for each specimen along with the average and standard deviation of the test set.

## *Indian Standard*

# NATURAL FIBRE GEOTEXTILES (JUTE GEOTEXTILE AND COIR *BHOOVA*STRA) — METHODS OF TEST

## PART 4 DETERMINATION OF WATER ABSORPTION CAPACITY

### 1 SCOPE

1.1 This standard (Part 4) prescribes method for determination of the water absorption capacity of geotextiles.

1.2 The method is applicable to all types of natural fibre geotextiles.

### 2 PRINCIPLE

This test is used to calculate the water absorption capacity of all natural fibre geotextiles.

### 3 APPARATUS

3.1 Galvanized screen, tared, measured 230 mm × 230 mm and constructed of No. 17 gauge wire.

3.2 Pan, 76 mm deep by 254 mm wide by 254 mm long.

3.3 Pan, tared, shallow, lightweight, and large enough to hold the galvanized screen.

### 4 TEST SPECIMEN

Prepare three specimens measuring 200 mm × 200 mm cut at approximately equally spaced intervals across the sample.

### 5 PROCEDURE

Weigh each test specimen to the nearest 0.1 g and place it on a tared 230 mm by 230 mm galvanized wire screen.

Place the specimen on the screen in such a way as to preserve specimen integrity and avoid the loss of specimen components.

Place another tared screen having the same dimensions on top of the specimen and place both screens and specimen in the 76 mm deep pan containing water at  $21 \pm 2^\circ\text{C}$  and about 64 mm deep.

Allow the specimen to soak in the water for  $24 \pm 0.25$  h.

After the soaking period, remove the specimen by removing the screens with the specimen between them and placing above the water on supports placed at the edge of the screens.

Allow the specimen and screens to drip-drain in a horizontal position for  $10 \pm 0.1$  min.

After drip-draining, place the screens and the wet specimen in the tared pan and weight the pan and its contents to the nearest 0.1 g.

### 6 CALCULATION

Calculate the amount of water held by the specimen by subtracting the sum of the weights of the weighing pan, screens, and dry specimen from the total weight.

### 7 REPORT

Report the absorptive capacity as the ratio of water held by the specimen to the weight of the original dry specimen. Report the average of the three values found as the absorptive capacity.

## Indian Standard

# NATURAL FIBRE GEOTEXTILES (JUTE GEOTEXTILE AND COIR *BHOOVA*STRA) — METHODS OF TEST

## PART 5 DETERMINATION OF SMOULDERING RESISTANCE

### 1 SCOPE

1.1 This standard (Part 5) details a procedure for the determination of the smouldering resistance of degradable rolled erosion control products.

1.2 The method is applicable to all types of natural fibre geotextiles.

### 2 PRINCIPLE

The distance between an extinguished cigarette and maximum smoulder travel is measured to determine the smouldering resistance of the specimen.

### 3 SIGNIFICANCE AND USE

Degradable erosion control blanket materials may be susceptible to flammability caused by cigarettes. This is a concern during installation and use. This test method serves to provide an index reading of relative smoulder resistance.

### 4 APPARATUS

4.1 Fan capable of providing 50 ft/min air velocity when measured with air velocity or wind speed meter.

4.2 Fire resistant square box having one cubic foot volume and two holes, three inches in diameter, bored through opposing walls and centered 3.5 inches above the bottom edge.

4.3 Fan is installed in one hole. Hole opposite fan equipped with slotted cover plate attached flush against outer wall to act as a vent louver. Additional cover plate is provided over fan opening to act as a restricting baffle to control flow and reduce turbulence.

4.4 A 57 mm unfiltered cigarette.

4.5 Ruler accurate to 1.0 mm.

### 5 SAMPLING

Sample test specimens from across the roll width to ensure representative specimen of the test material.

### 6 TEST SPECIMEN

Cut three, 300 mm × 300 mm test specimens. Handle the test specimens in a manner to avoid loss of loose filler and weaving components.

### 7 CONDITIONING

Condition test specimens for 12 h in an air oven maintained at 45°C. Remove test specimens and equilibrate in laboratory test conditions for a minimum of 2 h.

### 8 PROCEDURE

Place test apparatus in hood or otherwise facilitate exhaust of generated smoke.

Place specimen flat on the base of the test box.

Set fan speed to facilitate an air velocity of 50 ft/min across the center of the sample. Verify velocity with air velocity or wind speed meter.

Place a freshly lit cigarette in the centre of the test specimen length-wise along the direction of air.

Allow the cigarette to burn completely and extinguish.

Upon extinguishment of the cigarette and sample, measure the maximum distance, in mm, of specimen smoulder from the cigarette ashes.

Clean test apparatus and repeat test for each of two additional test specimens.

### 9 REPORT

Report measurements developed for each test specimen as well as the average and standard deviation for the three specimen population.

*Indian Standard***NATURAL FIBRE GEOTEXTILES (JUTE GEOTEXTILE AND COIR *BHOOVA*STRA) — METHODS OF TEST****PART 6 DETERMINATION OF MESH SIZE OF COIR GEOTEXTILES BY OVERHEAD PROJECTOR METHOD****1 SCOPE**

This standard (Part 6) specifies method to determine the mesh size by projecting the geotextile through an overhead projector (OHP). This method is suitable for meshes having large opening sizes.

**2 PRINCIPLE**

A specimen of geotextile of known dimension (20 cm × 20 cm) is placed on the projector. The dimensions of the projected specimen are also noted. The projected mesh size is measured in both directions. By the ratio proportion method the mesh size of the specimen can be determined.

**3 APPARATUS**

An OHP is used to project the sample.

**4 PROCEDURE**

The sample is placed on the OHP. The image is made to project on a screen. Focusing is done till a clear image is obtained. The length and breadth of the projected image is measured with the help of a scale.

Now the dimensions of the meshes are noted. Five readings in each direction may be noted. The meshes may be chosen randomly so as to include all the mesh sizes.

**5 CALCULATION**

Length of the specimen	= $L_s$
Length of the projected sample	= $L_p$
Projected length of mesh	= $S_p$
Actual length of mesh, $L_a$	= $(L_s \times S_p)/L_p$
Width of the specimen	= $W_s$
Width of the projected sample	= $W_p$
Projected width of mesh	= $S_p$
Actual width of mesh, $W_a$	= $(W_s \times S_p)/W_p$
Mesh size	= $L_a \times W_a$

The mesh sizes are measured in mm.

**6 REPORT**

Calculate the average of the five readings and report the mesh size in mm.

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### Amendments Issued Since Publication

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