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PROJECT CLOSING REPORT

DRAFT COPY OF INDIAN STANDARDS AND SPECIFICATION FOR NATURAL FIBRE NONWOVEN COIR GEO TEXTILE FABRICS AND COMPOSITES METHOD OF TEST (PART1-PART 5)

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Pioneering Innovations in Eco-friendly Materials and Products

Indian Standard

NATURAL FIBER NON WOVEN COIR GEO TEXTILE FABRICS AND COMPOSITES- METHOD 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 non-woven geo textile fabrics and composites for identification and purposes and for use in technical data sheets.

1.2 The method is applicable to all natural non-woven coir geo-textiles (NWCG)

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 NWCG 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 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 then ten specimens and to nominal size of 100cm², unless the structure of the geotextile is such that a 100 cm² 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/m², using the equation;

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

where

p = mass per unit area, in g/m²,
m = mass of specimen, in g: and
A = the area of the specimen, in mm².
Calculate the average mass per unit area, rounding the result to the nearest g/cm², 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 specimen size larger than 100cm², 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 FIBER NON WOVEN COIR GEO TEXTILE FABRICS AND COMPOSITES- METHOD OF TEST

PART 2 DETERMINATION OF THICKNESS

1. SCOPE

1.1 This standard (Part 2) prescribes method for determination of the thickness of non woven coir geotextile 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 geo-textiles.

Note – Normally the thickness of geo-textiles is determined by measuring one layer of the geotextile. In case 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 geo-textiles consideration should be paid to the relevance of such findings.

2. REFERENCE

The following standard is a necessary adjunct to this standard:

IS NO.
1515868 (Part 1 to 6): 2008
Title
Method for conditioning of textiles
Natural Fibre Geo-Textile (Jute Geo-textile and Coir Bhoovastra) method of -----

3. DEFINITIONS

For the purpose of this standard. The following definitions shall be 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±0.01 kPa to the specimen.

4. PRINCIPLE

4.1 The thickness of a number of specimens of geo-textiles are measured as the distance between the reference plate on which the specimen rests and a parallel circular pressure –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 25cm² for testing materials of uniform thickness for determination of the overall thickness of material of non

uniform thickness or other parts of such material of the size of the pressure –foot shall be agreed upon the size shall be given in the test report.

The pressure 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 pressure –foot surface and the reference plate when determining the overall thickness of geo-textiles of non uniform thickness, the pressure-foot should be supported in at least three points even distributed over the presser-foot surface ,which normally will y require that pressure foot, with an area of more than 25cm².

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

5.1.3 *Gauge* - For registering the distance between the reference plate and the pressure –foot to 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, suitable samples 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 25 cm².

6.2 1. Specimens from a roll shall be cut from position evenly distributed over the width and length of the sample, but not closer than 100mm to the sleeved.

6.2.2. Specimens shall not contain dirt, irregular 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 geo-textiles, exact instructions for cutting shall be laid down and those shall be followed with great care.

6.4 If the cutting causes fragments of geo-textile 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± 2 2 percent

relative humidity and 27 ± 2º 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 stands or similar features are present, the part of the material to be tested shall be a matter of prior agreement between the buyer and 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 surface of the reference plate and presser-foot specified in 4 lower gently the presser-foot applying a pressure of 2± 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^2 presser –foot
e) Average value of the thickness given in 7.3 expressed in mm to an accuracy of 0.1 percent for non-woven coir geo-textile thickness over 0.05 mm and to nearest 0.001 mm for thickness not exceeding 0.05mm

NOTES

1. Upon request the single results of each individual test can be given.
2. Upon request a graph showing; the cure of the mean value 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 FIBER NON WOVEN COIR GEO TEXTILE FABRICS AND COMPOSITES- METHOD 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 geo-textiles.

1.2 The method is applicable to all types of natural non woven coir geo-textiles.

2. PRINCIPLE

This test is used to calculate the percentage of swell of all natural non woven coir geo-textiles in water. This method determines the percentage of swell in thickness of the sample after it has been immersed in water for 24 hrs.

3. APPARATUS

3.1 Two pieces of non–corrosive household window screen measuring 127 mm x 127 mm.

3.2 A shallow pan measuring 305 mm x 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 x100mm 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, T1 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 serene corners loosely to hold the test specimen in place without compressing the specimen material.

Immerse the test specimen in the screen assembly de –ionized water for 24 ± 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 the thickness,

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

6. CALCULATION

Calculate the percent thickness change as follows;

Percent thickness change = 100 *(T1-T2)1T*
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 FIBER NON WOVEN COIR GEO TEXTILE FABRICS AND COMPOSITES- METHOD 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 geo-textiles.

1.2 The method is applicable to all types of natural non woven coir geo-textiles

2. PRINCIPLE

This test is used to calculate the water absorption capacity of all natural non-woven Coir geo-textiles.

3. APPARATUS

3.1 Galvanized screen, tared, measured 230 mm x 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 200mm x 200mm 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 ± 2ºC and about 64 mm deep.

Allow the specimen to soak in the water for 24 ± 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± 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

NON-WOVEN COIR GEO TEXTILES – METHOD OF TEST

PART 5 DETERMINATION OF TENSILE PROPERTIES USING A WIDE WIDTH STRIP

1 SCOPE

1.1 This standard (Part 5) prescribes index test method for determination of the tensile test properties of non woven coir geo textiles and related products using a wide width strip. The method is applicable to most geo-textiles including non-woven Fabrics, woven fabrics, Non Woven Composites, layered fabrics, Knitted fabrics and felts. The method is applicable to geo-grids but the specimen dimensions may need to be altered.

1.2 This method covers the measurement of load elongation charac6teristics and includes procedures for calculation of wide with tensile strength, strain at maximum load and equivalent strain at maximum load.

1.3 Procedure for measuring the tensile properties of both dry and wet (after 24 hrs. cold Water Immersion) specimens are included.

1.4 The measuring device can be either mechanical, optical or infra-red. In any case it shall not damage the sample.

2. REFERENCES the following Indian standards are necessary adjuncts to this standard:

3. DEFINITION

3.0 For the purpose of this standard, the following deficit ions shall apply

3.1 Extension at Preload

The extension corresponding to an applied load equal to 1 percent of the maximum load or 350 N which is less.

3.2 Maximum load

The maximum tensile force (in kN) obtained during a test

3.3 Increase in gauge length

The measured extension minus the extension at the preload.

3.6 Strain

The increase in gauge length of a specimen during a tensile test expressed as a percentage of the initial nominal gauge length.

3.7 Strain at maximum load the percentage strain corresponding to the maximum load.

3.8 Tensile Strength (kN/m)

The maximum resistance to deformation per unit width developed for a specific material when subjected to tension by one external force.

3.9 Strain Rate

Strain rate of Testing is defined as the speed of the jaw expressed as a percentage of the initial jaw separation. The initial jaw separation shall be as defined in 8.1.1.

When testing with caption grips, the strain rate shall be defined on the basis of the increase in gauge length at maximum load divided by the duration of the test.

4. PRINCIPLE

A test specimen is held across its entire width in the jaws of a tensile testing machine operated at a given rate of strain, applying a longitudinal force of the test specimen ruptures. The tensile properties of the test specimen are calculated from machine scales, dials, autographic recording charts, or an interfaced computer. The rate of strain ids fixed at 20 ± 5 percent per minute for all geo-textiles and related products, if constant rate of extension tensile testing machine is used. In case of constant rate of traverse tensile testing machine, the rate of traverse shall be 20 ± 45 mm per minute.

5. APPARATUS AND REAGENTS

5.1 Tensile testing Machines

A constant rate of extension (CRE) or a constant-rate-of traverse (CRT) tensile testing machine as specified in IS 1969:1985 shall be used.

5.2 Jaws which are sufficiently wide to hold the entire width of the specimen and with appropriate means to limit slippage or damage.

5.2.1 Compressive grips will be used for most materials. For materials where the use of compressive grips gives rise to excessive jaw breaks or slippage caption grips may be used.

5.2.2. When caption grips are used, the reason for their use and the separation between the tests should be kept to a minimum. The use of caption shall be specified in the report.

NOTE – It is stressed that it is essential to choose jaw faces that limits the slippage of the geo-textile that may occur especially for stronger geo-textiles. Examples of number of jaw faces that have been other grips which limits slippage may also be acceptable. Examples of jaw designs suitable for testing geo-grids are given.

5.3 Extensiometer

5.3.1 Extensiometer may also be used for testing in place of CRE or CRT tensile testing machines. The extensiometer shall be able to follow two reference points on the sample without any damage or slippage. Examples of extensiometers include mechanical, optical, infra- red or electrical devices.

5.3.2 Care should be taken to ensure that the measurement represents the true movement of the reference points.

5.3.3 If any irregularity of the stress-strain curve due to the extensiometer is remarked, this result shall be discarded and another specimen shall be tested.

5.4 Distilled Water

For wet specimen only (*see* IS 1070:1977)

5.5 Non –Ionic wetting Agent

For wet specimens only

6. TEST SPECIMENS

6.1. Number of Specimens

6.1.1 Cut a minimum of five test specimens in the machine direction and the cross direction.

6.2. Selection of Test Specimen

6.2.1. The specimens shall be selected as specified in IS 13162 (Part 3):1991.

6.3 Dimension of the test specimens

6.3.1 prepare each finished test specimen 200mm wide (excluding fringes when applicable, see 6.3.2) and of sufficient length to ensure 100mm between the jaws with the length dimension being designated and parallel to the direction for which the breaking load is being measured. Where appropriate and for slippage control, draw two lines running the full width of the test specimen, perpendicular to the length dimension and separated by 100 mm (except for caption grips)

6.3.2 For non-woven geo-textiles cut each specimen 220 mm wide and then remove an equal number of threads from each side to obtain the 200 mm, nominal specimen width.

6.3.2.1. This helps to maintain the specimen Integrity during the test. When specimen integrity is not affected, the specimen can be initially cut the finished width.

6.3.3 For geogrids the specimen shall be of at least 200 mm width and sufficiently long to ensure a length of at least 100mm. The test specimen shall contain at least 5 complete tensile elements with the width and at least one row of nodes or cross- members by which the test specimen is held in the jaws.

6.3.3.1 The reference points shall be marked on a central row of tensile elements that are subjected to test and shall be at least 60mm apart. The reference points shall be mounted at the central point of a rib and shall be separated by at least one node or cross member. If necessary, in order to achieve the minimum separation of 60 mm, the two reference points can be separated by more than one row of nodes or cross-members. In this case, the requirement to mount the reference points at mid –rib shall be maintained and the gouge length shall then be an integral number of pitches of the grid measure the gauge length within ±3mm.

6.3.4 When both the wet maximum load and the dry maximum load are required, cut each test specimen at least twice the required length. Number each test specimen and then cut cross wise into two parts, one for determining the dry maximum load, and the other for determining the wet maximum load , each portion shall bear the specimen number. In this manner each paired break is performed on test specimens containing the same threads.

NOTE – For geo-textiles which shrink excessively when wet, the tensile strength is determined from the maximum load in wet conditions the initial width before wetting.

7. CONDITIONING ATMOSPHERE

7.1 The test specimen shall be conditioned and the test conducted in the

standard atmosphere for testing textiles as prescribed in IS 6359:1971

NOTES

1. The test specimen may be considered to have been conditioned when the change in mass of the test specimen in any two successive weighing made at intervals of not less than 2 h does not exceed 0.25 percent of the original mass of the test specimen.
2. Conditioning and or testing at a specified relative humidity may be omitted if it can be shown that the results are not affected.

7.2 Test specimen to be tested in the wet condition shall be immersed in water, maintained at a temperature of 27 ±2º C. The time of immersion shall be sufficient to wet out the test specimens thoroughly, as indicated by no significant change in maximum load or stain following a longer period of immersion, and at least 24 hours. To obtain through wetting it may be necessary to add not more than 0.05 percent of a nonionic natural wetting agent (see 5.5) to the water.

8. PROCEDURE

8.1 Setting up of machine

8.1.1 Adjust the distance between the jaws at the start of the test to give a length of 100 ±3mm except for geo-grids and for geo-textiles when using capstan grips. Select the force range of the testing machine such that the break occurs between 30 percent and 90 percent of the full scale force. Set the machine to a rate of strain or rate of traverse as given in 4.1. Test the conditioned specimens in the atmosphere specified in 7.

8.1.2. For wet test specimen perform the test within 3 minutes after removal from the water.

8.2 Insertion of Test Specimen in Jaws

8.2.1. Mount the test specimen centrally in the jaws. Take care that the specimen length in the machine direction and cross direction tests, respectively, is parallel to y=the direction of application of force. Where appropriate do this by having the two lines, which were previously drawn 100 mm apart across the with of the test specimen positioned as close as possible adjacent to the inside edges of the upper and lower jaws.

8.3 Installation of the Tensile testing Machine on the Extensometer

Place the reference points on the sample. Ensure that there will be no slippage of the points during the mounting of the specimens or during testing.

8.4 Measurement of Tensile Properties

8.4.1 Start the tensile testing machine and continue running the test until the specimen ruptures. Stop the machine and reset to the initial gauge position. Record and report the maximum load to an accuracy of 00.2 percent of the full scale and strain to the first decimal place.

8.4.2 The decision to discard a break shall be based on observation of the specimen during the test upon the provision of 5.4. In the absence of other criteria for rejecting a jaw break, any break occurring with in 5 mm of the

jaws which results in a value below 50 percent of the average of all other breaks shall be discarded. No other break shall be discarded unless the test is known to be faulty.

NOTES

1. It is difficult to determine the precise reason why certain specimens break near the edge of the jaws. If a jaws break is caused by damage to the test specimen by the jaws, due to randomly distributed weak place, it is a legitimate result. In some cases, it ma also be caused by a concentration of the stress in the area adjacent to the jaws width as the load is applied. In these cases, a break near the edge of the jaws is inevitable and should be accepted as a characteristic of the particular method of test.

2. Special procedures are required for the preparation of test specimen made from specific materials (glass fiber, carbon, Composite geo-textiles, etc.) to minimize damage in the jaws. If a test specimen slips in the jaws or if more than one quarter of the specimens break at a point within 5 mm of the edge of the jaw, then (a) the jaws may be padded (b) the test specimen may be coated under the jaw face area; or (C) the jaw face may be modified. If any of the modification listed above are used, state the method of modification in the test report.

8.5 measurement of Strain

Measure the increase in gauge length of the test specimen at any stated load by means of a suitable recording device.

9. CALCULATIONS

Calculation the tensile Strength (kN/m) directly from the information obtained from the tensile testing machine using formula;

$$af = Ft \times C \qquad \ldots.(1)$$

Where
af = the tensile strength in KN/m of width;
Ff = The observed maximum load (in kN);
C = Value obtained from formula (2) or (3) given below as appropriate.

For nonwovens or close woven fabrics or similar materials:

$$C = 1/B \qquad \ldots(2)$$

Where
B = Specimen width in meters, or for coarse woven fabrics, meshes, grids or similar materials:

$$C = Nm/Ns \qquad \ldots.(3)$$

Where
Nm = the minimum number of tensile elements within 1 m width of the product being tested; and
Ns = the number of tensile elements within the test specimen.

9.2 Strain at maximum Load

Record the strain percentage at the maximum load.

9.3 Secant Stiffness

To calculate the secant stiffness, determine load for a specified strain, and use the following formula:

$$Jsec = \frac{(F \times C \times 100)}{E}$$

Where
Jsec = the secant stiffness in (KN / m) at the specified strain E;

F = the determined load at strain E (in kN);
C = value obtained from formula (2) or (3) given in 9.1 as appropriate.

10. Test Report

The test report shall include the following information:

a) Identification of the sample tested:

b) The mean tensile strength in both the machine direction and cross direction (see 9.1);

c) If applicable, the mean strain at the maximum load in both the machine direction and cross direction(see 9.2)

d) The mean scant stiffness corresponding to the strain of 2, 5 and 10 percent, if required:

e) The standard deviation or coefficient of variation of the properties determine;

f) The condition of the test specimens, that is wet or dry;

g) The number of test specimens tested in each direction;

h) The make and model of testing machine;

i) The type of jaw including the dimensions of the jaws and the type of jaw faces used, type of deformation measuring system, and initial jaw separation;

j) A load-strain curve with the yield points;

k) Details of nay deviations from the specified procedure; and

l) Strain rate reported to 1 percent accuracy.