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Indian Standard

GEO-SYNTHETICS FOR HIGHWAYS — SPECIFICATION

ICS 59.080.30

B U R E A U O F I N D I A N S T A N D A R D S
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Geo-synthetics Sectional Committee, TXD 30

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Geo-synthetics Sectional Committee had been approved by the Textile Division Council.

Geo-synthetics perform four major functions of separation, reinforcement, filtration and drainage. In this standard following sub-sections are covered:

a) Subsurface drainage;
b) Separation;
c) Sub-grade stabilization; and
d) Erosion control.

Explanatory note on selection and use of a geo-textiles for various end use applications is given in Annex A for information only.

The composition of the Committee responsible for the formulation of this standard is given in Annex E.

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

GEO-SYNTHETICS FOR HIGHWAYS — SPECIFICATION

1 SCOPE

This standard specifies requirements for geo-synthetics made from polyolefin or polyester material.

2 REFERENCES

The following standards 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 indicated below:

IS No.	*Title*
1966 : 1975	Methods for determination of bursting strength and bursting distention of fabrics — Diaphragm method (*first revision*)
6359 : 1971	Method for conditioning of textiles
13162	Geo-textiles — Methods of test:
(Part 2) : 1991	Determination of resistance to exposure of ultra-violet light and water (Xenon arc type apparatus)
(Part 4) : 1992	Determination of puncture resistance by falling cone method
(Part 5) : 1992	Determination of tensile properties using a wide width strip
14293 : 1995	Geo-textiles — Method of test for trapezoid tearing strength
14294 : 1995	Geo-textiles — Method for determination of apparent opening size by dry sieving technique
14324 : 1995	Geo-textiles — Methods of test for determination of water permeability-permittivity
14706 : 1999	Geo-textiles — Sampling and preparation of test specimens
14716 : 1999/ ISO 9864 : 1990	Geo-textiles — Determination of mass per unit area

3 GRADES

Geo-synthetic material shall be of following three grades depending upon the survivability conditions:

a) *Grade I* — For severe or harsh survivability conditions where there is a greater potential for geo-textile damage.

b) *Grade II* — For typical survivability conditions; this is the default classification to be used in the absence of site specific information.

c) *Grade III* — For mild survivability conditions.

4 STRENGTH REQUIREMENTS

The geo-textiles shall meet the strength requirements as given in Table 1.

5 OTHER REQUIREMENTS

5.1 Sub-surface Drainage Requirements

The geo-textile for subsurface drainage shall meet the requirements of Table 1 and Table 2.

NOTE — Woven slit film geo-textile (that is geo-textile made from yarns of a flat, tape-like character) shall not be allowed.

5.2 Separation Requirements

The geo-textile meant for separation shall meet the requirements of Table 1 and Table 3.

5.3 Stabilization Requirements

The geo-textile for the purpose of stabilization shall meet the requirements of Table 1 and Table 4.

5.4 Permanent Erosion Control

The geo-textile for permanent soil erosion shall meet the requirements of Table 1 and Table 5.

NOTE — Woven slit film geo-textile (that is geo-textile made from yarns of a flat, tape-like character) shall not be allowed.

5.5 Temporary Silt Fence Requirements

The geo-textiles for temporary silt fence shall meet the requirements of Table 1 and Table 6.

5.6 Paving Requirements

The paving geo-textile material shall meet the requirements of Table 7.

6 SAMPLING AND CRITERION FOR CONFORMITY

6.1 Sampling shall be done in accordance with IS 14706.

6.2 Criteria for Conformity

6.2.1 The lot shall be considered as conforming to the

requirements of the standard, if the following conditions are satisfied:

a) The average machine direction and cross machine direction breaking load values are not less than the corresponding specified requirements.
b) The average mass per square metre (on roll mass basis) and the average ends and picks per dm are in accordance with the requirements specified.
c) The average width of the rolls under test is in accordance with the requirements specified.

7 PACKING, STORAGE AND HANDLING

Each geo-textile roll shall be wrapped with a material that will protect the geo-textile from damage due to shipment, water, sunlight, and contaminants. The protective wrapping shall be maintained during periods of shipment and storage.

During storage, geo-textile rolls shall be elevated off the ground and adequately covered to protect from the following site construction damage, precipitation, extended ultra-violet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 71°C, and any other environmental condition that may damage the physical property values of the geo-textile.

8 MARKING

8.1 Geo-textiles rolls shall be marked with the following information:

a) Manufacturer or supplier name;
b) Roll number;
c) Grade;
d) Length
e) Date of manufacture; and
f) Product identification details.

Table 1 Strength Requirement
(*Clauses* 4, 5.1, 5.2, 5.3, 5.4 *and* 5.5)

Sl No.	Property	Geo-textile						Method of Test, Ref to
		Grade I		Grade II		Grade III		
		Strain < 50%	Strain > 50%	Strain < 50%	Strain > 50%	Strain < 50%	Strain > 50%	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	Tensile strength, N	1 400	900	1 100	700	800	500	IS 13162 (Part 5)
ii)	Tear strength, N	500	350	400[1)]	250	300	180	IS 14293
iii)	Puncture strength, N	500	350	400	250	300	180	IS 13162 (Part 4)
iv)	Burst strength, kPa	3 500	1 700	2 700	1 300	2 100	950	IS 1966

[1)] Woven geo-textiles fail at elongations (strains) < 50 per cent, while non-woven fail at elongation (strains) > 50 per cent. The required minimum average roll value of tear strength for woven filament geo-textiles is 250 N.

Table 2 Geo-textile Requirements for Sub-surface Drainage
(*Clause* 5.1)

Sl No.	Property	Requirements (Percent *in-situ* Soil Passing 0.075 mm)			Method of Test, Ref to
		<15	15-50%	>50%	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Geo-textile class[1)]	←	Grade II[2)]	→	
ii)	Permittivity[2)], l/s	0.5	0.2	0.1	IS 14324
iii)	AOS[2, 3)], mm	0.43	0.25	0.22 [4)]	IS 14294
iv)	UV stability (retained strength after exposure for 500 h), percent	←	50	→	IS 13162 (Part 2)

[1)] The engineer may specify a Grade III geo-textile, if conditions are less severe.

[2)] In addition to default permittivity value, the engineer may require geo-textile permeability and/or performance testing in problematic soil environments.

[3)] Site specific geo-textile design should be performed, if unstable or highly erodable soils such as non-cohesive silts; gap-graded soils; alternating sand/silt laminated soils; dispersive clays; and/or rock flour are encountered.

[4)] For cohesive soils with a plasticity index greater than 7, minimum average roll value shall be 0.30 mm.

8.2 BIS Certification Marking

The fabric roll (fabric roll or liner) may also be marked with the Standard Mark.

8.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Table 3 Geo-textile Requirements for Separation (Separation of Soil Sub-grades — Soaked CBR > 3 or Undrained Shear Strength > 90 kN/m^2)

(*Clause* 5.2)

Sl No.	Property	Requirements	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Geo-textile class	Grade II	—
ii)	Permitivity, l/s	0.02	IS 14324
iii)	AOS, mm	0.60 maximum average roll value	IS 14294
iv)	UV stability (retained strength after exposure for 500 h), percent	50	IS 13162 (Part 2)

NOTES

1 Grade III geo-textile may also be used, if conditions are less severe.

2 Permittivity of the geo-textile should be greater than that of the soil.

Table 4 Geo-textile Requirements for Stabilization (For Soil Sub-grades — 1 < CBR > 3; or Undrained Shear Strength between 30 kN/m^2 and 90 kN/m^2)

(*Clause* 5.3)

Sl No.	Property	Requirements	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Geo-textile class	Grade I	—
ii)	Permittivity, l/s	0.05	IS 14324
iii)	AOS, mm	0.43 maximum average roll value	IS 14294
iv)	UV stability (retained strength after exposure for 500 h), percent	50	IS 13162 (Part 2)

NOTES

1 Grade II or III geo-textiles may also be used, if conditions are less severe.

2 Permittivity of the geo-textile should be greater than that of the soil.

Table 5 Geo-textile Requirements for Permanent Erosion Control

(*Clause* 5.4)

Sl No.	Property	Requirements (Percent *in-situ* Soil Passing 0.075 mm)			Method of Test, Ref to
		<15	15-50%	>50%	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Geo-textile class	← Grade II[1)] (for filaments) →			—
		← Grade I[1)] (for others) →			—
ii)	Permittivity, l/s	0.7	0.2	0.1	IS 14324
iii)	AOS, mm	0.43	0.25	0.22[2)]	IS 14294
iv)	UV stability (retained strength after exposure for 500 h), percent	←	50	→	IS 13162 (Part 2)

[1)] Geo-textile selection is appropriate for stone weight not exceeding 100 kg and stone drop height less than 1 m and the geo-textile protected by a 150 mm thick bedding layer. More severe applications require an assessment of geo-textile survivability based on a field trial and may require a geo-textile with higher strength properties. Class 2 geo-textile may also be used, if conditions are less severe.

[2)] For cohesive soils with a plasticity index greater than 7, maximum average roll value for apparent opening size for geotextile material shall be 0.3 mm.

Table 6 Geo-textile Requirements for Temporary Silt Fencing
(*Clause* 5.5)

Sl No.	Property	Requirements			Method of Test, Ref to
		Supported Silt Fence[1)]	Unsupported Silt Fence		
			Geo-textile elongation greater than 50 percent	Geo-textile elongation less than 50 percent	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Maximum post spacing	1.2 m	1.2 m	2.0 m	—
ii)	Tensile strength, N:				
	a) Machine direction	400	550	550	IS 13162 (Part 5)
	b) Cross machine direction	400	450	450	
iii)	Permittivity, l/s	0.05	0.05	0.05	IS 14324
iv)	AOS[2)], mm	← 0.60 (Maximum average roll value) →			IS 14294
v)	UV stability (retained strength after exposure for 500 h), percent	← 70 →			IS 13162 (Part 2)

[1)] Silt fence support shall consist of 14 gauge steel wire with a mesh spacing of 150 mm × 150 mm or prefabricated polymeric mesh of equivalent strength.

[2)] These default filtration property values are based on empirical evidence with a variety of sediments. For environmentally sensitive areas, a review of previous experience and/or site or regionally specific geo-textile tests should be performed.

Table 7 Geo-textile Requirements for Prevention of Reflective Cracking (Paving Fabrics)
(*Clause* 5.6)

Sl No.	Property	Requirements	Method of Test, Ref to Annex of this Standard
(1)	(2)	(3)	(4)
i)	Tensile strength, N, *Min*	450	B
ii)	Ultimate elongation, percent, *Min*	> 50	B
iii)	Asphalt retention (*see* Note 1), kg/10 m^2, *Min*	(*See* Notes 1 and 2)	C
iv)	Melting point,°C	150	D

NOTES

1 Asphalt is required to saturate paving fabric only. Asphalt retention must be provided in manufacturer certification. Value does not indicate the asphalt retention rate required for construction.

2 Product asphalt retention property must meet the MARV provided by the manufacturers certification.

ANNEX A
(*Foreword*)

EXPLANATORY NOTE

A-1 GEO-TEXTILES FOR SUB-SURFACE DRAINAGE REQUIREMENTS

This standard is applicable to placing a geo-textile against a soil to allow for long-term passage of water into a sub-surface drain system retaining the *in-situ* soil. The primary function of the geo-textile in sub-surface drainage application is filtration. Geo-textile filtration properties are a function of the *in-situ* soil gradation, plasticity and hydraulic conditions.

A-2 GEO-TEXTILES FOR SEPARATION REQUIREMENTS

This standard is applicable to the use of a geo-textile to prevent intermixing of a sub-grade soil and an

aggregate material (sub-base, select embankment, etc). This standard may also apply to situations other than beneath pavements where separation of two dissimilar materials is required but where water seepage through the geo-textile is not a critical function.

The separation application is appropriate for pavement structures constructed soils with a California bearing ratio equal to or greater than 3. (Shear strength greater than approximately 90 kN/m^2.) It is appropriate for unsaturated sub-grade soils. The primary function of a geo-textile in this application is separation.

The property values given in Table l represent default values which provide sufficient geo-textile survivability under moist construction conditions. The information provided under Table l provides for a reduction in the minimum property requirements when sufficient survivability information is available. The engineer may also specify properties different from those listed in Table 1 based on engineering design experience.

A-3 GEO-TEXTILES FOR STABILIZATION REQUIREMENTS

This standard is applicable to the use of a geo-textile in wet, saturated conditions to provide the coincident functions of separation and filtration. In some installations, the geo-textile can also provide the function of reinforcement. Stabilization is applicable for pavement structures constructed over soils with a California bearing ratio between 1 and 3 (1 < CBR > 3). (Shear strength between approximately 30 kN/m^2 and 90 kN/m^2.)

The stabilization application is appropriate for sub-grade soils which are saturated due to a high ground water table or due to prolonged periods of wet weather. This standard is not appropriate for embankment reinforcement where stress conditions may cause global sub-grade foundation or stability failure. Reinforcement of pavement section is site specific design issue.

A-4 GEO-TEXTILES FOR PERMANENT EROSION CONTROL

This standard is applicable to the use of a geo-textile between energy absorbing armor systems and in the *in-situ* soil to prevent soil loss resulting in excessive scour and to prevent hydraulic uplift pressures causing instability of the permanent erosion control system. This standard does not apply to other types of geo-synthetic soil erosion materials such as turf reinforcement mats.

The primary function the geo-textile serves in permanent erosion control applications filtration. Geo-textile filtration properties are a function of hydraulic conditions, and *in-situ* soil gradation, density and plasticity.

A-5 GEO-TEXTILES FOR TEMPORARY SILT FENCE REQUIREMENTS

This standard is applicable to the use of a geo-textile as a vertical, permeable interceptor designed to remove suspended soil from overland water flow. The function of a temporary silt fence is to filter and allow settlement of soil particles from sediment laden water. The purpose is to prevent eroded soil from being transported off the construction site by water runoff. The geo-textile used for temporary silt fence may or may not be supported between posts with wire or polymeric mesh.

A-6 GEO-TEXTILES FOR PAVING REQUIREMENTS

This standard is applicable to the use of a paving fabric, saturated with asphalt cement, between pavement layers. The function of the paving fabric is to act as a water proofing and stress relieving membrane within the pavement structure. This standard is not intended to describe fabric membrane systems specially designed for pavement joints and localized (spot) repairs.

ANNEX B
(*Table* 7)

METHOD OF TEST FOR GRAB BREAKING LOAD AND ELONGATION OF GEO-TEXTILES

B-1 GENERAL

B-1.1 This test method is an index test which provides a procedure for determining the breaking load (grab strength) and elongation (grab elongation) of geo-textiles using the grab method. This test method is not suitable for knitted fabrics and alternate test methods shall be used. The grab test methods does not provide all the information needed for all design applications.

B-1.2 Procedures for measuring the breaking load and elongation by the grab method in both the dry and wet

state are included; however, testing is normally done in the dry condition unless specified otherwise in an agreement or specification.

B-2 PRINCIPLE

A continually increasing load is applied longitudinally to the specimen and the test is carried to rupture. Values for the breaking load and elongation of the test specimen are obtained from machine scales or dials, autographic recording charts, or interfaced computers.

NOTES

1 Most geo-textile fabrics can be tested by this test method. Some modification of clamping techniques may be necessary for a given fabric, depending upon its structure. Special adaptation may be necessary with strong fabrics, or fabrics made from glass fibres, to prevent them from slipping in the clamps or being damaged as a result of being gripped in the clamps, such as cushioning the clamp or boarding the specimen within the clamp.

2 This test method is applicable for testing fabrics either dry or wet. It may be used with constant-rate-of-traverse (CRT) or constant-rate-of-extension (CRE) type tension machines. However, there may be no overall correlation between the results obtained with the CRT machine and the CRE machine. Consequently, these two tension testers cannot be used interchangeably. In case of controversy, the CRE machine shall prevail.

B-3 APPARATUS

B-3.1 Tensile Testing Machine, of the constant-rate-of-extension (CRE) or constant-rate-of-traverse (CRT) type with autographic recorder.

B-3.2 Clamps, having all gripping surfaces parallel, flat, and capable of preventing slipping of the specimen during a test. Each clamp shall have one jaw face measuring 25.4 mm × 50.8 mm, with the longer dimension parallel to the direction of application of the load. The other jaw face of each clamp shall be at least as large as its mate. Each jaw face shall be in line, both with respect to its mate in the same clamp and to the corresponding jaw of the other clamp.

B-4 SAMPLING AND SELECTION

Sampling and preparation of specimen shall be done in accordance with IS 14706.

B-5 CONDITIONING

B-5.1 Bring the specimens to moisture equilibrium in the atmosphere for testing geo-textiles. Equilibrium is considered to have been reached when the increase in mass of the specimen of successive weighing made at intervals of not less than 2 h does not exceed 0.1 percent of the mass of the specimen. In general practice, the industry approaches equilibrium from the as received side.

B-5.2 Specimens to be tested in the wet condition shall be immersed in water maintained at a temperature of 27 ± 2°C. The time of immersion must be sufficient to wet-out the specimens thoroughly, as indicated by no significant change in strength or elongation following a longer period of immersion, and at least 2 min. To obtain thorough wetting, it may be necessary or advisable to add not more than 0.05 percent of non-ionic neutral wetting agent to the water.

B-6 PROCEDURE

B-6.1 Test the conditioned specimens in the standard atmosphere for testing in accordance with IS 6359.

B-6.2 Set the distance between the clamps at the start of the test at 75 ± 1 mm. Select the load range of the testing machine such that the maximum load occurs between 10 and 90 percent of full-scale load. Set the machine to operate at a speed of 300 ± 10 mm/min.

B-6.3 Secure the specimen in the clamps of the testing machine, taking care that the long dimension is as nearly as possible parallel to the direction of application of the load. Be sure that the tension in the specimen is uniform across the clamped width. Insert the specimen in the clamps so that approximately the same length of fabric extends beyond the jaw at each end. Locate the jaws centrally in the widthwise direction by having the line which was drawn 37 mm from the edge of the specimen run adjacent to the side of the upper and lower front jaws which are nearest this edge. This ensures that the same lengthwise yarns are gripped in both clamps.

B-6.4 If a specimen slips in the jaws, breaks at the edge of or in the jaws, or if for any reason attributed to a faulty operation the result falls markedly below the average for the set of specimens, discard the result and take another specimen. Continue this procedure until the required number of acceptable breaks have been obtained.

NOTES

1 The decision to discard a break shall be based on observation of the specimen during the test and upon the inherent variability of the fabric. In the absence of other criteria for rejecting a so-called jaw break, any break occurring within 5 mm of the jaws which results in a value below 80 percent of the average of all the other breaks shall be discarded. No other break shall be discarded unless it is known to be faulty.

2 It is difficult to determine the precise reason for breakage of test specimens near the edge of the jaws. If breaks are caused by damage to the specimen by the jaws, then the results should be discarded. If, however, they are merely due to randomly distributed weak places in specimens, the results should be considered perfectly legitimate. In some cases, breaks may be caused by a concentration of stress in the area adjacent to the jaws. If this occurs, the specimen is prevented from contracting in width as the load is applied. In such cases, a break near the edge of the jaws is inevitable and shall be accepted as a characteristic of the geo-textile when tested by this test method.

B-6.5 Start the tensile testing machine and the area measuring device, if used, and continue running the test to rupture. Stop the machine and reset to the initial gage position. Record and report the test results for each direction separately.

B-6.6 If fabric manifests slippage in the jaws, the jaw faces, but not the jaw dimensions, may be modified. If a modification is used, the method of modification should be stated in the report.

B-6.7 If a measure of the elongation of the specimen is required, the initial length and therefore the measured elongation depend upon the pre-tension applied in placing the specimen in the clamps of the machine. In this case, secure the specimen in one clamp of the machine and apply a pre-tension to the specimen of approximately 0.5 percent of the breaking load, or other initial load specified for the particular material in question, before gripping the specimen in the other clamp.

B-6.8 Unless otherwise specified, measure the elongation of the fabric at any stated load by means of a suitable autographic recording device, at the same time the breaking strength is determined. Measure the elongation from the point where the curve leaves the zero loading axis established after pre-load is applied, to a point of corresponding force in millimetres.

B-7 CALCULATION

B-7.1 Breaking Load

Calculate the breaking load by averaging the value of breaking load for all accepted specimen results. The breaking load shall be determined separately for the machine direction specimens and cross-machine direction specimens.

B-7.2 Apparent Elongation

Calculate the apparent elongation at the breaking load or at other specified loads by averaging the values of apparent elongation for all accepted specimen results. The apparent elongation shall be determined separately for the machine direction specimens and cross-machine direction specimens and expressed as the percentage increase in length, based upon the initial nominal gauge length of the specimen. Report this as the apparent elongation.

ANNEX C
(*Table* 7)

METHOD OF TEST FOR DETERMINATION OF ASPHALT RETENTION

C-1 GENERAL

This test method covers a procedure for determining the asphalt retention for paving fabrics. Paving fabrics are used in a fabric membrane interlayer system in pavements before the placement of an asphaltic overlay.

C-2 PRINCIPLE

C-2.1 Test specimens are individually weighed prior to being submerged in an asphalt cement that will be used for the overlay. The asphalt cement is maintained at a specified temperature. After submerging the specimens in the asphalt cement test, the specimens are hung to drain in the oven for a specified period of time at the same oven temperature.

C-2.2 Upon completion of specimen submersion in asphalt, and draining, the individual specimens are weighed and asphalt retention is determined.

C-3 APPARATUS

C-3.1 Scale or Balance, with a capacity and sensitivity sufficient to weigh the specimens to within ± 0.l g. The accuracy of the scale should be certified by a recognized authority.

C-3.2 Cutting Die or Cutting Template, measuring 100 mm × 200 mm with a tolerance of ± l mm in each linear dimension.

C-3.3 Mechanical Convection Oven, capable of maintaining the required test temperature within ± 2°C.

C-3.4 Asphalt Cement, viscosity GradeA.C.20, or equivalent, as recommended by the specifying agency.

NOTES

1 Asphalt cement should not be used for more than three series of tests. Repeated heating and cooling may change the test results due to handling of the asphalt.

2 Repeated heating and cooling of the asphalt can change the viscosity of the asphalt and lead to higher values of asphalt retention. If an increasing trend in asphalt retention values is observed the asphalt cement should be changed.

C-4 SAMPLING AND PREPARATION OF TEST SPECIMEN

Sampling shall be done in accordance with IS 14706.

C-5 CONDITIONING

C-5.1 Condition the specimens by bringing them to approximate moisture equilibrium in the standard atmosphere for testing as prescribed in IS 6359.

C-5.2 Equilibrium is considered to have been reached when the increase in weight of the specimen in successive weighing made at intervals of not less than 2 h does not exceed 0.1 percent of the weight of the specimen.

C-5.3 Paving fabrics that are not significantly affected by minor variations in atmospheric conditions may be tested in prevailing room atmospheres.

C-5.4 If the samples cannot be properly conditioned in a reasonable time with the facilities available, perform the test determinations on the material without conditioning. When tests are carried out under conditions which vary from the standard, report the actual conditions prevailing at the time of test. It must be recognized that such results may not correspond with the results obtained from testing specimens conditioned and tested in the standard atmosphere for testing.

C-6 PROCEDURE

C-6.1 Select at random four machine direction and four cross-machine direction specimens measuring 100 mm × 200 mm from the individual test sample.

C-6.2 Condition the individual test specimens in accordance with IS 6359, and then individually weigh to the nearest 0.1 g,

C-6.3 Preheat asphalt cement to 135 ± 2°C .

C-6.4 Then submerge the individual test specimens in the specified asphalt cement maintained at a temperature of 135 ± 2°C in a mechanical convection oven. Keep the specimens submerged for 30 min. Two clamps may be placed on the fabric, one on each end to facilitate handling the specimen.

C-6.5 After the required submersion, remove the asphalt cement-coated, saturated test specimens and hang to drain (long axis vertical) in the oven at 135 ± 2°C. Hang the test specimens for 30 min from one end and then 30 min from the other end to obtain a uniform saturation of the fabric. Before reversing the hanging direction, also place two clamps on the bottom side which will make it easier to hang the specimen. After securing the specimen, remove the first clamps.

C-6.6 Allow the asphalt cement-coated, saturated test specimens to cool for a minimum of 30 min and then trim any excess asphalt cement, such as edge drippings, after removing the clamps that were holding the samples.

C-6.7 Weigh the trimmed asphalt cement-coated, saturated test specimens to the nearest 0.1 g.

C-7 CALCULATION

C-7.1 Asphalt Retention, l/m^2

Calculate the average of the asphalt retention observed for all acceptable test specimens. Calculate the asphalt retention for individual test specimens as follows:

$$R_A \quad \frac{W_{sat} \quad W_g}{A_g}$$

where

R_A = asphalt retention, l/m^2;

W_{sat} = weight of saturated test specimens, in g;

W_g = weight of geo-textile test specimen before saturation, in g; and

A_g = area of geo-textile test specimen before test, in m^2.

ANNEX D
(*Table* 7)

METHOD FOR DERTERMINATION OF MELTING POINT

D-1 GENERAL

This test method allows determining the temperature at which the material begins to lose its shape or form and becomes molten or liquefies. Allowing material to reach its melting point results in permanent fibre change.

D-2 APPARATUS, REAGENTS AND MATERIALS

D-2.1 Melting Point Apparatus

D-2.2 Fisher-Johns Melting Point Apparatus

D-2.3 Differential Scanning Calorimeter (DSC)

D-2.4 Materials Needed for Fisher-Johns Apparatus

D-2.4.1 *18-mm Micro Cover Glasses* — Round No. 2.

D-2.4.2 *Test Reagent Set* — A set of test reagents, precision 0.5°C, or reagent grade chemicals for checking the calibrated thermometers.

D-2.5 Materials Needed for DSC

a) Aluminum pans and lids,
b) Indium, zinc, and tin standards, and
c) Sample crimper.

D-3 CALIBRATION

D-3.1 Calibration of Fisher-Johns Apparatus

The calibration of each thermometer should be verified periodically as recommended by the hot stage manufacturer or with reagent grade chemicals, using the same rate of temperature rise chosen for the tester. Recommended chemicals include I-menthol melting at 42 to 43°C, hydroxyquinoline at 75 to 76°C, acetanilide at 113 to 114°C, succinic acid at 189 to 190°C, and phenolphthalein at 261 to 262°C.

D-3.2 Calibration of DSC

The temperature and heat calibration should be performed using the indium, zinc, and tin a standards for the working temperature range.

D-4 PROCEDURE

D-4.1 Determine the approximate melting point of the fibre by a trial run.

D-4.2 Procedure for Fisher-Johns Apparatus

D-4.2.1 Place the specimen between two cover glasses, lay the entire unit on the hot stage, and press gently but. firmly into place. Rapidly heat the stage to about 15°C below the expected melting point, and then lower the heating rate to about 3 or 4°C/min.

D-4.2.2 Press lightly on the upper cover glass with a spatula or pick needle and observe the specimen with the aid of the lens.

D-4.2.3 Record the temperature to within 1°C when the specimen is seen to melt rapidly and spread between the glasses or when the final traces of solid fiber structure disappear in cases where the fiber melts slowly over a wide range of temperature. If the melting range is greater than 1°C, report the melting range.

D-4.2.4 Cool the stage to about 50°C below the observed melting point and repeat the measurement on a new specimen.

D-4.3 Procedure for DSC

D-4.3.1 *Sample Preparation*

Cut the samples into very small pieces with scissors, and put approximately 5 to 7 mg specimens into the aluminum pan. Make a small hole on the lid with a needle and close the pan with the help of a sample crimper. Make another sample, which will be used as the reference sample by closing an empty pan with lid.

D-4.3.2 Put the sample and the reference in the designated heating blocks in accordance with the instrument manufacturer's manual inside the heater chamber. Close the chamber, and start heating at the rate of 10°C/min to approximately 50°C above the melting point of the fiber being tested.

D-4.3.3 Record the temperature. Cool the chamber, and repeat the measurement on a new specimen.

ANNEX H
(*Foreword*)

COMMITTEE COMPOSITION

Geo-synthetics Sectional Committee, TXD 30

Organization	*Representative(s)*
The Bombay Textile Research Association, Mumbai	Dr A. N. Desai (***Chairman***)
All India Wool Felt & Namda Association, Jaipur	Representative
Central Building Research Institute, Roorkee	Shri A. Ghosh Shri Sujit Saran (*Alternate*)
Central Road Research Institute, New Delhi	Shri Sudhir Mathur Shri Jai Bahagwan (*Alternate*)
Charminar Nonwovens Ltd, Hyderabad	Managing Director
Coir Board, Kochi	Dr U. S. Sarma Shri M. Kumaraswamy Pillay (*Alternate*)
Directorate General of Supplies and Disposals, New Delhi	Shri A. K. Sehgal Shri Sunder Lal (*Alternate*)
E.I. Dupont India Pvt Ltd, Gurgaon	Shrimati Roli Jindal Shri V. Senthil Kumar (*Alternate*)
Garware Wall Ropes Ltd, Pune	Shri S. J. Chitnis
Gokak Mills, Belgaum	Shri H. S. Bhaskar Shri R. Venkatachalpathy Pillay (*Alternate*)
Gujarat Engineering Research Institute, Vadodara	Shri L. V. Ashara Research Officer (*Alternate)*
Indian Institute of Technology, Kharagpur	Prof B. Adhikari
Indian Jute Industries' Research Association, Kolkata	Shri J. Srinivasan Shri P. K. Choudhury (*Alternate*)
Jaya Shree Textiles, Hooghly	Shri Pawan Sharma Shri A. Nair (*Alternate*)
Kusumgar Corporates, Mumbai	Shri Y. K. Kusumgar Dr M. K. Talukdar (*Alternate*)
Madura Coats Ltd, Madurai	Shri R. M. Sambandam Shri N. Nadarajan (*Alternate*)
Office of the Textile Commissioner, Mumbai	Shri B. B. Bharti Shri P. Aravindan (*Alternate*)
Oriental Synthetic & Rayon Mills Pvt Ltd, Mumbai	Shri Vishwanath S. Chalke Shri Satishkumar P. Nikam (*Alternate*)
Poritts & Spencer (Asia) Ltd, New Delhi	Shri M. K. Arora
Premier Polyfilms Ltd, Ghaziabad	Dr Sanjeev K. Verma Shri Harinder Kumar (*Alternate*)
R.I.T.E.S Ltd, Mumbai	Representative
SRFP Ltd, Chennai	Representative
Supreme Nonwovens Pvt Ltd, Hyderabad	Shri C. K. Chaudhuri Shri C. K. Jain (*Alternate*)
Techfab India, Mumbai	Dr Jimmy Thomas Shri Anant Kanoi (*Alternate*)
The Synthetics & Art Silk Mills Research Association, Mumbai	Dr A. K. Rakshit Dr (Shrimati) M. R. Mathur (*Alternate*)
Urja Products Pvt Ltd, Ahmedabad	Shri Janak Nanavaty
Veermata Jijabai Technological Institute, Mumbai	Shri S. P. Borkar
BIS Directorate General	Shri P. Bhatnagar, Scientist E & Head (TXD) [Representing Director General (*Ex-officio*)]

Member Secretary
Shri Anil Kumar
Scientist E (TXD), BIS

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