



उत्पाद मैनुअल
भुक्त्रिम - फुटपाथ संरचनाओं में सबग्रेड अलगाव में प्रयुक्त भुवस्त्रादि - विशिष्टि
IS 16391:2015 के अनुसार

PRODUCT MANUAL FOR
Geosynthetics- Geotextiles Used in Sub-Grade Separation
in Pavement Structures-Specification as per IS 16391:2015

विभिन्न उत्पादों के लिए भारतीय मानक ब्यूरो) अनुरूपता मूल्यांकन (विनियम, 2018 की योजना -I के तहत प्रमाणन के संचालन में एकरूपता और पारदर्शिता के लिए इस उत्पाद मैनुअल का उपयोग सभी क्षेत्रीय / शाखा कार्यालयों और लाइसेंसधारियों द्वारा संदर्भ सामग्री के रूप में किया जाएगा। दस्तावेज़ का उपयोग बीआईएस प्रमाणन प्राप्त करने के इच्छुक संभावित आवेदकों द्वारा भी किया जा सकता है।

This Product Manual shall be used as reference material by all Regional/Branch Offices & licensees to ensure uniformity of practice and transparency in operation of certification under Scheme-I of Bureau of Indian Standards (Conformity Assessment) Regulations, 2018 for various products. The document may also be used by prospective applicants desirous of obtaining BIS certification.

1.	मानक संख्या IS No.	:	IS 16391:2015
	शीर्षक Title	:	Geosynthetics- Geotextiles Used in Sub-Grade Separation Structures- Specification
	संशोधनों की संख्या No. of amendments	:	01
2.	नमूना दिशानिर्देश Sampling Guidelines		
a)	कच्चा माल Raw material	:	The materials used in the manufacturing of Geotextiles shall conform to the requirements specified at cl.4.1, cl.4.2 and cl.4.3 of IS 16391:2015 Conformity of materials shall be established by supplier's test certificate, or test reports issued by BIS recognized/empaneled labs or any other lab having valid NABL accreditation as per IS/ISO/IEC 17025 or in house testing or combination thereof Note: This section indicates the requirements for raw material (if specified in the IS) for which compliance is to be established during Grant of Licence/Change in Scope of Licence/Factory Surveillance

b)	समूहीकरण दिशानिर्देश Grouping Guidelines	:	Please refer Annex A
c)	नमूने का परिमाण Sample Quantity	:	Full width sample with sufficient length to form a minimum of 06 sq m of sample and if polymer is used in the fasteners, threads to join the rolls ; then in this case separate sample is required approx. 1 kg. Note: This section indicates the quantity of the sample of the product and/or the raw material (if applicable), required to be sent to the laboratory for testing, for the purpose of Grant of Licence/Change in Scope of Licence/ Factory Surveillance (in case of market surveillance, effort may be made to procure therequired quantity of product sample, as far as possible since raw material sample may not be available in market)
3.	परीक्षण उपकरणों की सूची List of Test Equipment	:	Please refer Annex – B
4.	निरीक्षण और परीक्षण की स्कीम Scheme of Inspection and Testing	:	Please refer Annex - C
5.	Sampling Guidelines for Surveillance	:	During each operative year, one factory sample and one market sample shall be tested for all requirements other than Durability Properties. Further, once every 5 years, one factory sample shall be tested only for Durability Properties
6.	एक दिन में संभावित परीक्षण Possible tests in a day	:	On pre-conditioned samples: All tests are possible to be carried out in a day except for Apparent Opening Size(A.O.S), Durability Properties Note: This section is for the guidance of BIS Certification Officers/Technical Auditors of BIS Authorized Outside Surveillance Agencies (OSAs) during factory inspection to provide ready reference regarding the tests which can be witnessed during the inspection in the factory by the officer/auditor.
7.	लाइसेंस का दायरा /Scope of the Licence:		
	Licence is granted to use Standard Mark as per IS 16391:2015 with the following scope:		
	Name of the product	Geosynthetics- Geotextiles Used in Sub-Grade Separation in Structures	
	Type	Woven/Non-Woven	
	Material	Polyolefins (Polypropylene or Polyethylene), Polyester	
	Class(Elongation Percent)	Class 1(Elongation < 50 %), Class 1 (Elongation ≥ 50%) Class 2(Elongation < 50 %), Class 2 (Elongation ≥ 50%)	

BUREAU OF INDIAN STANDARDS

Manak Bhawan, 9, Bahadur Shah
Zafar Marg, New Delhi – 110002

Annexure A

GROUPING GUIDELINES

- 1) IS 16391:2015 covers the requirements for geotextiles used to prevent mixing of sub-grade soil and an aggregate cover material in pavement structures.
- 2) The requirements for the material for manufacturing of Geotextiles have been specified at cl.4. Specific Requirements for Geotextiles have been specified under Table 1.
- 3) As per Table 1 , Geotextiles have been classified as per the following parameters:-
 - a) Class- Class 1 , Class 2
 - b) Within each Class, Geotextiles can be of 2 types i.e. Woven or Non-Woven. Further, requirements are specific to the percentage elongation i.e. Elongation < 50 % and Elongation ≥ 50%
- 4) In view of above, the following Grouping Guidelines shall be considered for the purpose of GoL/CSoL:-
 - a) **Sample of each Class (Class 1 and Class 2) for each type (woven and non-woven) of Geotextile shall be drawn and tested.**
 - b) **Within each class, separate sample for Geotextile for each percentage Elongation (Elongation < 50 % and Elongation ≥ 50%) shall also be drawn and tested.**
 - c) **Separate samples for each type of material (Polyolefin and Polyester) are also required to be drawn and tested.**
- 5) However, it shall be ensured that the firm is having all the necessary manufacturing and testing facilities for manufacturing of all the types and classes covered in the scope of the licence.
- 6) During the operation of the licence, BOs shall ensure that all types and classes covered in the scope of the licence are drawn for independent testing in rotation over a period of time.

Annexure B

LIST OF TEST EQUIPMENTS

(INDICATIVE LIST, FOR GUIDANCE ONLY)

Sl. No.	Tests Used in with Clause Reference	Test Equipment/Chemicals and Identification Numbers (Where applicable)
1.	Roll Length, Roll Width, m Requirements of Geotextiles for Separation Applications, Table 1	Calibrated Steel Rule of atleast 2 meter, Flat Surface, Conditioning Chamber, In-line roll length counter
2.	Grab Strength, N, Requirements of Geotextiles for Separation Applications, Table 1	Constant Rate of Extension Tensile Testing Machine or CRT Type with Autographic Recorder, Clamps, Sample Preparation/Cutting Equipment, Conditioning Chamber, Vernier Caliper, Steel Scale, Non-Ionic Wetting Agent
3.	Sewn Seam Strength, Requirements of Geotextiles for Separation Applications, Table 1	Constant Rate of Extension Tensile Testing Machine or CRT Type with Autographic Recorder, Clamps, Jaws, Sample Preparation/Cutting Equipment, Conditioning Chamber, Vernier Caliper, Steel Scale
4.	Trapezoidal Tear Strength, Requirements of Geotextiles for Separation Applications, Table 1	Constant Rate of Extension type Tensile Testing Machine, Clamps, Trapezoidal Template, Water Bath maintained at 27 ± 2 °C, Non-Ionic Wetting Agent, Sample Preparation/Cutting Equipment, Conditioning Chamber, Vernier Caliper, Steel Scale
6.	CBR Puncture Strength, Strength, Requirements of Geotextiles for Separation Applications, Table 1	Puncture Strength Machine capable of constant rate of displacement of 50 ± 5 mm/min with autographic recorder, Stainless Steel Plunger, Clamping System, Sample Preparation/Cutting Equipment, Conditioning Chamber
7.	Burst Strength, kPa, Requirements of Geotextiles for Separation Applications, Table 1	Bursting Tester, Sample Preparation/Cutting Equipment, Conditioning Chamber
8.	Permittivity, Requirements of Geotextiles for Separation Applications, Table 1	Water Permeability Tester, De-Aired Water, Conditioning Chamber

9.	Apparent Opening Size (AOS), mm Requirements of Geotextiles for Separation Applications, Table 1	Mechanical Seive Shaker, Pan, Cover, 200 mm Diameter Sieves, Spherical Glass Beads or Graded Sand Particles, Balance (L.C. 0.05 g), Static Eliminating Device or Anti-Static Spray, Drying Oven, Pan for collecting Sieved Beads, Distilled Water
12	Resistance to installation damage, Percent retained strength, SC/SW/GP Requirements of Geotextiles for Separation Applications, Table 1	Conditioning Chamber, Compression Machine, Test Container, Loading Plate, Aggregate
13	Ultraviolet Stability at 500h, Retained strength, Percent of original strength Requirements of Geotextiles for Separation Applications, Table 1	Conditioning Chamber, Sample Preparation/Cutting Equipment, Xenon Arc Apparatus, Tensile Test Apparatus

ANNEXURE C

SCHEME OF INSPECTION AND TESTING

1. QUALITY ASSURANCE PLAN

1.1 It is expected that manufacturers (licensees/applicants) will implement a Quality Assurance Plan i.e. a plan of regular testing and in-process controls, designed to ensure that the product bearing the Standard Mark conforms to all requirements of the Indian Standard.

1.2 The manufacturers shall define a Quality Assurance Plan defining the control unit (i.e. lot/batch etc.) and the levels of control (i.e. the frequency and number of samples for conducting the different tests as per the Indian Standard) and submit the same to BIS Branch Office for information. The manufacturer shall comply with the same and maintain test records in accordance with para 2.4.

1.3 RECOMMENDED LEVELS OF CONTROL/CONTROL UNIT:

1.3.1 For the guidance of manufacturers, the recommended definition of control unit is: Entire quantity of Geotextiles of the same type, class and manufactured under similar conditions in a single day from the same material.

1.3.2 For the guidance of manufacturers in preparing the Quality Assurance Plan, recommended levels of control are given in **Table 1**.

1.3.3 The manufacturer shall ensure inspection and testing as per the Quality Assurance Plan submitted by them on the whole production of the factory which is covered by this plan. Alternatively, the manufacturer has the option of adherence to the quality plan as per levels of control recommended in column 3 of Table 1.

1.4 However, all manufacturers shall ensure compliance of their products to all the requirements of the Indian Standard.

2. ENSURING COMPLIANCE THROUGH TESTING- It is expected that manufacturers (licensees/applicants) will establish a suitably equipped and staffed in house laboratory (In house testing facility) for testing at least those parameters of the Indian Standard which require routine testing for ensuring quality of the product. This includes in-process controls as may be defined and put in place by the manufacturer and testing parameters/requirements which can only be performed in the factory.

2.1 For the guidance of manufacturers, Table 1 giving the recommended levels of control is given below. Column 2 of Table 1 indicates routine tests where test equipment is required in house as "R" or other tests which can be subcontracted as "S". Subcontracting is permitted to BIS recognized/empanelled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025.

2.2 For MSME manufacturers, the requirement of maintaining a laboratory/in-house testing facility for routine tests (indicated as "R" in Column 2 of Table 1) is also optional.

2.2.1 MSME manufacturers may utilize common cluster based facilities as per guidelines for the utilization of cluster based test facilities by MSMEs or the provisions of Sharing of testing facilities or get testing done from BIS recognized/empaneled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025.

2.3 Large Scale manufacturers shall maintain an in-house laboratory equipped at least with test facilities for routine tests (indicated as “R” in Column 2 of Table 1), where different tests given in the specification shall be carried out in accordance with the method given in the specification. They shall also implement a calibration plan for the in-house test equipment.

2.3.1 Alternatively, in lieu of an in-house laboratory, large scale manufacturers can also utilize the provisions of Sharing of testing facilities as per the Guidelines for Grant of Licence available on BIS website www.bis.gov.in. (Under Conformity Assessment>Product Certification Process). Even for subcontracted tests, provisions for sharing of testing facilities can be utilized.

2.4 TEST RECORDS- The manufacturers maintaining an in-house laboratory or utilizing common cluster based facilities or shared test facilities shall maintain test records for the tests carried out to establish conformity. For the tests being subcontracted to BIS recognized/empanelled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025, test reports issued by the laboratories shall be available for inspection by BIS.

3. PACKING AND MARKING - The Standard Mark as given in the Schedule of the licence shall be incorporated legibly and indelibly on each roll provided always that the material so marked conforms to each requirement of the specification.

3.1 Packing and Marking shall be done as per the Indian Standard.

3.2 Additional Marking requirements: The material shall also be marked with the following additional requirement on each roll:

a) “For BIS certification details please visit www.bis.gov.in”

3.3 Information and samples as specified in the standard shall be submitted by the manufacturer to the purchaser.

4. TEST CERTIFICATE - For each consignment of BIS Certified material conforming to **IS 16391:2015** there shall be a test certificate which shall contain the Standard Mark, the cast/Control Unit number and the corresponding test results (as given in Annexure-I enclosed)

5. STORAGE AND PROTECTION – Requirements of the Indian Standards shall be complied.

6. REJECTION - All the production which conforms to the Indian Standard and covered under the scope of this licence shall be marked with the Standard Mark. Disposal of non-conforming product shall be done in such a way so as to ensure that there is no violation of provisions of BIS Act, 2016.

TABLE 1
(ONLY FOR GUIDANCE PURPOSE)

(1)				(2)	(3)		
Test Details				Test equipment requirement R: required (or)S: Sub-contracting permitted	Levels of Control		
Cl.	Requirement	Test Methods Clause Reference			No. of Sample	Frequency	Remarks
4	Materials and construction requirements	4.1, 4.2, 4.3	IS 16391	S	Adequate inspection to ensure that the material used for the manufacture of Geotextiles shall conform to the requirements of the specification. However, appropriate records shall be maintained by the manufacturer for evidence of conformity.		Conformity of materials shall be established by supplier's test certificate, or test reports issued by BIS recognized/empaneled labs or any other lab having valid NABL accreditation as per IS/ISO/IEC 17025 or in house testing or combination thereof
4.3, Table 1	Requirements of Geotextiles for Separation Applications						
i)	Index properties						
a)	Type of geotextile	----	IS 16391	R	----	----	Woven/Non-Woven
b)	Roll Length	----	IS 1954	R	Adequate inspection to ensure that each roll conforms to the length as per specification or as agreed		
c)	Roll Width	----	IS 1954	R	Adequate inspection to ensure that each roll conforms to the length as per specification or as agreed		
d)	Grab Strength	----	IS 16342	R	One	Each Control Unit	----
e)	Sewn Seam Strength	----	IS 15069	R	One	Each Control Unit	----
f)	Trapezoidal Tear Strength	----	IS 14293	R	One	Each Control Unit	----
g)	CBR Puncture Strength	----	IS 16078 IS 13162 (Part 4)	R	One	Each Control Unit	----
h)	Burst Strength	----	IS 1966 (Part 2)	R	One	Each Control Unit	----
ii)	Structural Integrity Properties:						
a)	Permittivity	----	IS 14324	S	One	Once in a month	----

b)	Apparent Opening Size	---	IS 14294	S	One	Once in month	a----
iii)	Durability properties						
a)	Resistance to installation damage	---	IS 17420	S	One	Once in 5 years and whenever there is change in raw material/raw material supplier	
b)	Ultraviolet Stability at 500h, Retained strength		IS 13162 (Part 2)	S	One	Once in 5 years and whenever there is change in raw material/raw material supplier	
7	Packing	----	IS 16391	R	Manufacturer shall ensure that each roll or package is packed as per the requirements of the specification.		

Scheme of Inspection and Testing

TEST CERTIFICATE FORMAT

Annexure-I

Test Certificate for Geosynthetics- Geotextiles Used in Sub-Grade Separation in Pavement Structures-Specification

TEST CERTIFICATE NO. _____ **DATED** _____

TO M/s _____

It is certified that the material described below fully conforms to IS 16391:2015. All requirements of the product, as tested in accordance with the Scheme of Inspection and Testing contained in the BIS Certification Marks Licence No. CM/L_____are as indicated below against each order no. etc.
(PLEASE REFER TO IS 16391:2015 FOR DETAILS OF SPECIFICATION REQUIREMENTS)

Order No. & Date	Type (Woven/Non-Woven)	Class (I/II)	Material (Polyolefin (Polyethylene or Polypropylene) , Polyester)	Percentage Elongation (<50% />=50%)	Index Properties						Structural Integrity Properties		Durability Properties	
					Roll Length and Width	Grab Strength	Sewn Seam Strength	Trapezoidal Tear Strength	CBR Puncture Strength	Burst Strength	Permittivity	A.O.S	Resistance to installation damage, Percent retained strength, SC/SW/G P	Ultraviolet Stability at 500h, Retained strength, Percent of original strength

REMARKS SHIPPING ADVICE NO.

WAGON NOS.

FOR XYZ TEXTILE COMPANY