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**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**

Specification of
**Non-woven Geotextile to be used as separator /filtration
in Railway formation**

Specification No. RDSO/2018/GE: IRS-0004- Part-I

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Geo-Technical Engineering Directorate,
Research Designs and Standards Organisation
Manak Nagar, Lucknow – 11



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Annexure-1

Specification of Non-woven Geotextile to be used as separator /filtration in Railway formation (Specification No. RDSO/2018/GE: IRS-0004 - Part-I)

(A) Properties of Nonwoven Geotextile :

The Non-woven geotextile to be used as separator /filtration layer (Primary role as separator and secondary role as filtration), shall have following properties, when tested as per the latest edition of the test method indicated therein , for Railway application:

Sl. No.	Property	Test Method	Value
I Polymer and Type			
1	Material/Polymer	-	Polypropylene/ Polyethylene/ Polyamide, Polyester or any combination thereof
2	Type/Structure	-	Non-woven Needle Punched and Mechanically or Thermally bonded type or equivalent
II Mechanical Properties			
1	Elongation at Failure (*)		>50% in both direction
2	Grab Strength (*): (i) On top of subgrade or prepared subgrade before laying blanket or any where within the embankment (ii) Below the ballast and above the Blanket Layer	ASTM D4632 - 2015	700 N 1750 N
III Hydraulic Properties			
1	Apparent Opening size	ASTM D4751- 2016	≤ 85 micron
2	Water Flow Rate normal to the Plane	ASTM D4491- 2017	20 lit/m ² /Sec
IV Survivability Properties			
1	Trapezoidal Tear Strength (*): (i) On top of subgrade or prepared subgrade before laying blanket or any where within the embankment (ii) Below the ballast and above the Blanket Layer	ASTM D4533- 2018	250 N 800 N

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Sl. No.	Property	Test Method	Value
2	Puncture Strength – CBR (*): (i) On top of subgrade or prepared subgrade before laying blanket or any where within the embankment. (ii) Below the ballast and above the Blanket Layer	ASTM D6241-2014	1800 N 5800 N
V Durability Properties			
1	Abrasion Strength (% strength retained in breaking load) (*)	ASTM D4886 - 2018	80%
2	Ultraviolet Stability Requirement after 500 Hours of exposure (*) Retained breaking strength in Strip tensile test	ASTM D4355-2018	Not less than 70% (After unwrapping, the geotextile should be installed and covered within a maximum of 14 days)
3	Minimum retained Ultimate Tensile Strength(*)	EN:12447-2001 and EN ISO: 13438-2004	50% (tested as per Clause B.4 of EN: 13250-2016, for 100 year service life)

* is Minimum Average Roll Value (MARV), which is derived statistically as average value minus two standard deviations.

Note:

1. The adherence to above listed specification should be checked by testing the samples at IIT, NIT or other NABL accredited lab.
2. Manufacturing of geosynthetics shall be in accordance with the manufacturer's QAP for quality control.
3. The product being supplied by the manufacturer should have been successfully used for similar application (separator /filtration. primary role as separator and secondary role as filtration) at minimum 3 locations, with minimum 3 year's experience at one of the location, with supporting documents as an evidence for satisfactory performance.
4. To ensure proper quality assurance and reproducibility of the product, following stipulations should be ensured:
 - i) The manufacturer of non-woven geotextile should have ISO:9001/CE Certification for the product being supplied. The manufacturer of Geo-synthetics should have a well-documented Quality Assurance Procedure (QAP)/Factory Production Control (FPC) Manual, covering every specific product produced on specific production site, which shall be referred/stipulated in the ISO: 9001/CE Certification. The QAP/FPC Manual shall consist of a permanent internal production control system to ensure that product being manufactured conforms to the requisite properties and it addresses following items:
 - (a) Produce design requirement and criteria.

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- (b) Acceptance criteria of raw/incoming material and procedures to ensure that these are met.
 - (c) Relevant features of the plant and production process; giving frequency of inspections, checks & tests, together with values/criteria required on equipment and action(s) to be taken when control values or criteria are not obtained.
 - (d) Tests on finished products – Size of the samples and frequency of sampling with results obtained.
 - (e) Details of alternative tests and procedures, if any, and their correlation with reference tests.
 - (f) Calibration of equipment having influence on test results.
 - (g) Records to be maintained for various inspections, checks and tests carried out during factory production.
 - (h) Assessment of results of various inspections, checks and tests carried out during factory production; where possible and applicable.
 - (i) System of traceability and control of designs, incoming materials and use of materials.
 - (j) Corrective action for non-conforming materials and finished products.
 - (k) Training, job description and responsibility of the personnel involved in the manufacturing process.
- ii) Any subsequent changes in raw materials, manufacturing procedures or the control scheme that effects the properties of a product shall be recorded/revised in the QAP/FPC Manual and certified by the ISO:9001/CE Certification.
 - iii) Surveillance of QAP/FPC Manual shall be undertaken at least once per year. The surveillance shall include a review of the test plan(s) and production processes for each product to determine if any changes have been made since the last assessment or surveillance. The significance of changes shall be assessed.
 - iv) Records of all in-house test results, as per QAP/FPC Manual, shall be shown to the purchaser; whenever requested by the purchaser

(B) Packing, Handling, Storage and Laying of Geotextiles

- (i) A tag or other method of identification shall be attached to each roll of geotextile indicating following:
 - (a) Manufacturer or Supplier Name
 - (b) Product or Style Name
 - (c) Roll Number
 - (d) Lot or Batch Number
- (ii) Rolls of geotextiles should not be dragged on the ground and they must be lifted off the ground before moving them.
- (iii) Geotextiles slowly degrade in the presence of Ultra Violet (UV) rays which are present in sunlight. Hence, they should be wrapped with a material that will protect them from damage due to shipment, sunlight

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(UV exposure) and contaminates. The protective wrapping, in which the geotextiles come wrapped from factory, should be kept on till their storage and installation. After unwrapping, the geotextile should be installed and covered within a maximum of 14 days.

- (iv) If stored outside, they should be elevated from the ground surface and adequately covered to protect them from site construction damage, precipitation, UV radiation including sun light, chemicals that are strong acids/bases, flames including welding sparks, temperatures in excess of 71⁰C etc.
- (v) If the protective wrapping of the geotextile roll is damaged, the rolls must be elevated off the ground surface and covered with a tarpaulin or opaque plastic sheet. If the outer layer of the geotextile itself is damaged, the outermost wraps of the geotextile must be removed and discarded. This is also required when the roll is exposed to sunlight for a period beyond that permitted by the project specifications.
- (vi) If the geotextiles is exposed to moisture or water, prior to installation, it absorbs water up to three times their weight, especially non-woven geotextiles. This can lead to serious handling problems due to extra weight and installation problem because it is nearly impossible to unroll wet rolls. In addition, the strength of wet geotextile may also diminish to the point that it may not support the required load during installation/construction.
- (vii) If the geotextile becomes wet, it is permissible to remove the waterproof cover to allow for a few days of exposure to wind in order to dry the fabric.
- (viii) In trenches, after placing the backfill material, the geotextile shall be folded over the top of the filter material to produce a minimum overlap of 300mm for trenches greater than 300mm wide. In trenches, less than 300mm wide, the overlap shall be equal to the width of the trench. The geotextile shall then be covered with the subsequent course.
- (ix) Damages to geotextile, if any during installation, shall be repaired by placing a geotextile patch over the damaged area and extending it 1m beyond the perimeter of the tear or damage.
- (x) For laying of Non woven geotextile:
 - (a) Major protrusions on the surface on which geotextile is to be laid, such as rocks & bush stamps, shall be removed and local depressions etc. shall be filled with approved soil before laying the geotextile. The geotextile shall be rolled out smoothly. The geotextile should not be dragged across the subgrade. The entire roll should be placed and rolled out as smoothly as possible. Wrinkles and folds in the fabric shall be removed by stretching as required.
 - (b) Adjacent rolls of geotextiles shall be overlapped, sewn or joined as required. Overlaps can be used to provide continuity between adjacent geotextile rolls through frictional resistance between the overlaps. The amount of overlap depends primarily on the soil conditions as given in the Table below:

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Soil CBR	Minimum Overlap
Greater than 3	300- 450 mm
1 - 3	600 - 1000 mm
Less than 1	Sewn

- (c) For curves, the geotextile shall be folded or cut and overlapped in the direction of construction. Folds in the geotextile shall be stapled or pinned approximately 0.6m centre-to-centre. Before covering, the condition of the geotextile shall be checked for damage (i.e. holes, nips, tears etc.).
- (xi) Before laying the first lift of granular subgrade on the geotextile, a trial stretch of 100m shall be laid to establish a proper construction methodology of placing and compacting the sub-grade in a manner that no damages are caused to the separation layer of nonwoven geotextile.

(C) Measurement for Payment of Geotextiles

The geotextiles for separation / filter layer shall be measured in square metres, with no allowance for overlapping at transverse & longitudinal joints. The contract unit rate for the accepted quantities of geotextile shall be in full compensation for furnishing, preparing, hauling and placing geotextiles including all labour, freight, tools, equipment and incidentals to complete the work as per specifications.

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Feedback Performa of Track for laying of Non woven geotextile

1. Station/ Section/Division/Railway
 - Axle load
 - GMT of the section
 - Last Deep screening done
 - Sectional speed before & after laying
2. **Application** for which Non-woven Geotextile used: For rehabilitation of Existing Formation or in New Construction
3. **Track Structure details**
4. **Embankment formation details** including
 - Cross-section
 - Different layers used
 - Type of soil etc
5. **History of the section** (for old embankment) like
 - Problem faced,
 - Ballast penetration (if any),
 - Rehabilitation measures taken earlier etc.
6. **Details of Geotextile used:**
 - Date of laying
 - Procedure of laying (Manual/BCM)
 - Depth at which Geotextile laid (from sleeper bottom)
 - Total length of Geotextile laid in the section
 - Cost (per sq. meter)
 - Properties, Test method and values of Non-woven Geotextile used as per specification no. RDSO/2018/GE: IRS-0004 Part-I
7. **Details-before and after laying of Non-woven Geotextile:**
 - Chainage/TP wise TGI Values of previous 3 years and after laying of Geotextiles
 - Frequency of Machine Tamping/ Manual track attentions
 - Speed Restrictions
 - Track Parameters (gauge, unevenness, x-level, twist and alignment etc.).
8. **Special maintenance efforts** during summers & monsoons, along with brief description after laying of Non-woven Geotextile
9. **Status of problematic location** after using Non-woven Geotextile in detail.
10. Any problem during **laying/installation** of Non-woven Geotextile.
11. Any other remarks (other than those prescribed above).

Signature of Railway

Official:

Name:

Designation:

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