First Edition

DRAFT TANZANIA STANDARDS

Specifications for geotextiles

Foreword

This Draft Tanzania Standard is being developed by the specialized Textile Technical Committee under supervision of the Textile and Leather Division Standards Committee and it is in accordance with the procedures of the Tanzania Bureau of Standards.

Geo-textiles are used in civil engineering to improve the soil on which roads, dams, pipelines and large infrastructure are built. There are different geotextile materials for different properties like separation, filtration and protection where by geotextiles play an important role in separation or preventing water from mixing with soil layers.

This Tanzania Standard has been prepared with assistance drawn from;

i. Technical specifications of geotextile prepared by International Research Journal of Engineering and Technology (IRJET), 2020(e-ISSN: 2395-0056
ii. TNZ F/7: 2003 specification for geotextiles

1. Scope

This Draft Tanzania standard specifies the requirements and test methods for geotextiles used for Soil stabilisation, pavements, erosion control, drainage system, protection, separation, filtration and other general applications.

2. Normative References

For the purpose of this Draft Tanzania Standard the following references shall apply:

a) ISO 9864 – Test method for the determination of mass per unit area of geotextiles and geotextile-related products.

b) TZS 327/ISO 1833-Textile-Binary fibre mixtures-Quantitative chemical analysis

c) TDC5 (2232)/ISO 10319; Geosynthetics Wide-width tensile test

d) TZS3198/ISO 10318-1; Geosynthetics — Part 1: Terms and definitions

e) TDC5 (2727) ISO 12236 Test method for determination of Static CBR Puncture Strength.

f) ASTM D 7238 – Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus.

g) TZS 22/ISO 13937-2 :2023TextilesTear properties of fabric Part 2: Determination of tear force of trouser-shaped test specimens (Single tear method)

h) ISO 4892-3- Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps

i) ASTM D4491- Test Methods for Water Permeability of Geotextiles by Permittivity

j) TDC5 (2729) DTZS/ISO12956:2019- Geotextiles and geotextile-related products Determination of the characteristic opening size

3. Terms and Definitions

3.1 For the purpose of this Draft Tanzania Standard the following definitions shall apply:

Geotextile is a permeable fabric which is used to separate, filter, reinforce, protect, stabilize and drain the soil structure.

Non-woven geotextile fabric- a fabric structure made from staple and long fibres, bonded together by chemical, mechanical (needle punch), heat or solvent treatment.

Woven geotextile fabric - a fabric structure produced by interlacing two or more sets of yarns, fibres, rovings, or filaments where the elements pass each other essentially at right angles and one set of elements is parallel to the fabric axis.

Knitted Geotextile fabric-a fabric structure made through the process of interlocking a series of loops of yarn together.

3.2 Other definitions shall be as defined in TZS 3198/ISO 10318-1, Geosynthetics-Part 1: Terms and definitions

4. Material Requirements

4.1 General requirements

4.1.1 Geotextile fabrics

Geotextile fabrics may be non-woven, woven or knitted fabrics. They shall be rot proof, chemically stable and shall have low water absorbency. Filaments shall resist delamination and maintain their relative dimensional stability in the geotextile.

4.1.1.1 The threads used for joining the lengths of geotextile fabrics shall be composed of at least 95% by mass of synthetic fibres.

4.1.1.2 The weight of the geotextile fabrics shall meet the requirements as given in Table 1

4.1.1.3 Geotextiles shall be free of any flaws, which may have an adverse effect on the physical and mechanical properties of the geotextile.

4.1.1.4 Geotextiles shall be stabilised against ultraviolet radiation such that when tested in accordance with ISO 4892 shall retain the strength of at least 50% after 500 hours of test exposure.

4.1.1.5 For woven monofilament geotextiles, the required minimum average roll Value (MARV) for tear strength is 250 N.

4.3 Geotextile Strength Class Requirements

Geotextiles for the applications of separation and/or filtration shall meet the relevant requirements of Table 1.

Table 1- Geotextile Classes Minimum Requirements

SN	Property	Geotextile Classes						Test method
		1		2		3		
1	Fibre Composition	As declared						TZS 327/ISO 1833
		Grade A	Grade B	Grade A	Grade B	Grade A	Grade B	
2	Mass per unit area, g/m^2	2000	1000	800	600	400	350	ISO 9864
3	Tensile properties, • Strength, kN/m • Strain at max load, %	 160 50	 100 50	 60 50	 45 50	 40 50	 30 50	ISO 10319
4	Tear strength, kN	0.5	0.45	0.40	0.35	0.25	0.18	ISO 13937-2
5	CBR Puncture • Max force, kN • Elongation at maximum force, mm	 10 38	 8 38	 5 38	 4.5 38	 3.6 38	 3.0 38	ISO 12236
6	Ultraviolet (UV) stability, %	50% retained strength after 500h of exposure						ISO 4892-3

Notes:

1. The severity of installation conditions for the application generally dictates the geotextile Class. Class 1 is specified for more severe or harsh installation conditions where there is a greater potential for geotextile damage, Classes 2 and 3 are specified for less severe conditions.

2. Elongation % is according to ISO 12236 that used for the grab strength test.

Table 2-Geotextile Applications and required Classes

SN	Geotextile applications	Geotextile classes
1	Filtration applications in subsurface drainage	2
2	Separation of soil subgrades (soaked CBR ≥3;or Shear Strength≥90 kPa)	2
3	Stabilization of soft subgrades (soaked 1 <CBR<3;or 30 kPa<Shear Strength<90 kPa)	1
4	Permanent erosion control (for example, geotextiles beneath rock riprap)	2 for woven monofilament, 1 for all other geotextile

Table 3- Geotextile properties requirements for Filtration in Subsurface Drainage

Property	**Requirements(% in-situ soil passing 0.075 No. 200 sieve**			**Test methods**
	<15 %	**15 % to 50 %**	**>50 %**	
Strength	Class 2 from Table -1 [2]			
Permittivity s^{-1} [3, 4]	0.5	0.2	0.1	ASTM D4491
Apparent Opening size (AOS), mm [3,4]	0.43	0.43	0.43	ASTM D4751

Notes:

1. Based on grain-size analysis of in-situ soil in accordance with The American Association of State Highway and Transportation Officials T88 (AASHTO T88)

2. The engineer may specify a Class 3 geotextile from Table -1 for trench drain applications based on;
   i. field experience,
   ii. laboratory testing, or
   iii. sub surface drain depth < 2 m, drain aggregate < 30 mm in diameter and compaction requirement < 95% of AASHTO T99.

3. These default filtration property values are based on the predominant particle sizes of in-situ soil.

4. Site-specific geotextile design should be performed especially if one or more of the following problematic soil environments are encountered: unstable or highly erodible soils such as non-cohesive silts, gap-graded soils, alternating sand/silt laminated soils, dispersive clays, and/or rock flour.

5. For cohesive soils with a Plasticity Index (PI) > 7, geotextile Maximum Average Roll Value for AOS is 0.30 mm.

Table 4- Geotextile properties requirements for Separation

Property	Requirements	Test method
Strength	Class 2 from Table -1 [1]	
Permittivity s^{-1} [3, 4]	00.2 [2]	ASTM D4491
Apparent Opening size (AOS), mm, Max.	0.60	ASTM D4751

Notes:

The separation requirements will be applicable to the use of geotextile at the subgrade level if the soaked CBR ≥ 3 or shear strength ≥ 90 KPa. These are appropriate for unsaturated subgrade soils.

1. The engineer may specify a Class 3 geotextile from Table -1 based on;

   I. Field experience,
   II. Laboratory testing,
   III. Aggregate cover thickness of the first lift over the geotextile > 300 mm and the aggregate < 50 mm in diameter, or (VI) Aggregate cover thickness of the first lift over the geotextile > 150 mm, aggregate < 30 mm IN diameter and construction equipment pressure < 550 kPa.

2. Default value, however, the permittivity of geotextile (Ψ_{gio}) should be greater than that of the soil (Ψ_{soil}). The engineer may also need the permeability of the geotextile (K_{geo}) to be greater than that of the soil (K_{soil}).

3. These default filtration property values are based on the predominant particle sizes of in-situ soil.

4. Site-specific geotextile design should be performed especially if one or more of the following problematic soil environments are encountered: unstable or highly erodible soils such as non-cohesive silts, gap-graded soils, alternating sand/silt laminated soils, dispersive clays, and/or rock flour.

Table 5- Geotextile properties requirements for Stabilization

Property	Requirements	Test method
Strength	Class 1 from Table -1 [1]	
Permittivity s^{-1} [3, 4]	0.05 [2]	ASTM D4491
Apparent Opening size (AOS), mm, Max.	0.43	ASTM D4751

Notes:

The stabilization requirements will be applicable to the use of a geotextile layer at the subgrade level to provide the coincident functions of separation, filtration and reinforcement if the subgrade soil is in wet, saturated conditions due to a high groundwater table or due to prolonged periods of wet weather. Stabilization is appropriate if the subgrade soils are having soaked 1 < CBR < 3; or 30 kPa < Shear Strength < 90 kPa.

1. The engineer may specify a Class 2 or 3 geotextile from Table -1 based on;
   (I) Field experience, or
   (II) Laboratory testing.

2. Default value, however, the permittivity of geotextile (Ψ_{gio}) should be greater than that of the soil (Ψ_{soil}). The engineer may also need the permeability of the geotextile (K_{geo}) to be greater than that of the soil (K_{soil}).

3. These default filtration property values are based on the predominant particle sizes of in-situ soil.

4. Site-specific geotextile design should be performed especially if one or more of the following problematic soil environments are encountered: unstable or highly erodible soils such as non-cohesive silts, gap-graded soils, alternating sand/silt laminated soils, dispersive clays, and/or rock flour.

Table 6- Geotextile properties requirements for Permanent Erosion Control

Property	**Requirements(% in-situ soil passing 0.075 mm [1]) No. 200 sieve**			**Test methods**
	<15 %	**15 % to 50 %**	**>50 %**	
Strength	For woven monofilament geotextiles, Class 2 from Table-1 [2] - For all other geotextiles, Class 1 from Table -1 [2, 3]			
Permittivity s^{-1} [1, 4]	0.7	0.2	0.1	ASTM D4491
Apparent Opening size (AOS), mm [3,4] Max.	0.43	0.25	0.22 [5]	ASTM D4751

Notes:

The erosion control requirements will be applicable to the use of a geotextile layer between energy absorbing armor system and 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.

1. Based on grain-size analysis of in-situ soil in accordance with AASHTO T88.

2. As a general guideline, the default geotextile selection is appropriate for conditions of equal or less severity than either of (I) Armor layer stone weights ≤ 100 kg, stone drop height is < 1m, and no aggregate bedding layer is required, or (II) Armor layer stone weighs > 100 kg, stone drop height is < 1m, and the geotextile is protected by a 150mm thick aggregate bedding layer designed to be compatible with the armor layer.

3. The engineer may specify a Class 2 geotextile from Table -1 based on;

I. Field experience
II. Laboratory testing
III. Armor layer stone weighs < 100 kg, stone drop height is < 1m, and the geotextile is protected by a 150 mm thick aggregate bedding layer designed to be compatible with the armor layer, and (VI) Armor layer stone weights < 100 kg and stone is placed with a zero-drop height.

4. These default filtration property values are based on the predominant particle sizes of in-situ soil.

5. Site-specific geotextile design should be performed especially if one or more of the following problematic soil environments are encountered: unstable or highly erodible soils such as non-cohesive silts, gap-graded soils, alternating sand/silt laminated soils, dispersive clays, and/or rock flour. However, for cohesive soils with a Plasticity Index (PI) > 7, geotextile Maximum Average Roll Value for AOS is 0.30 mm.

5 Packing, Labelling and Marking

5.1 Packing

Unless otherwise agreed, each geotextile roll shall be wrapped with the material that will protect the geotextile from the damage during the transportation and storage.

5.2 Labelling and Marking

5.2.1 Geotextiles may be marked with the ‘tbs’ standards mark.

5.2.2 Each geotextile shall be labelled and marked at one end with the following:

a) Product name and fibre composition of the filaments or yarns;
b) Manufacturer's name, and or supplier's name, initials or trade mark;
c) Class type and grades;
d) Width and length of geotextile.