

EUROPEAN AND INTERNATIONAL
GEOTEXTILE STANDARDS

A SHORT GUIDE
(revised version)

by **Dr Fred Foubert (Centexbel)**,
secretary to **CEN/TC 189 Geosynthetics**

Important note:

This short guide means to be an introduction to European and international standards on geotextiles and geotextile-related products. This guide only reflects the main elements contained in the application-related product standards and the supporting test standards and has in no way the intention to replace the existing standards. The full text of the standards can be purchased from your national standardization body:

NBN
Brabançonnellaan 29
B-1000 Brussel

NBN
Avenue de la Brabançonne 29
B-1000 Bruxelles

GEOTEXTILE STANDARDS

Introduction

European standards on geotextiles and geotextile-related products are developed by CEN/TC 189 Geosynthetics. International standards are developed by ISO/TC 221 Geosynthetics.

Over the past 20 years both Committees have issued more than 80 standards and amendments to standards, covering both geotextiles (and geotextile-related products) and geosynthetic barriers.







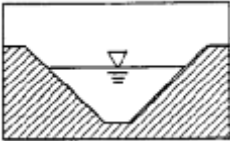



This guide only covers geotextiles and geotextile-related products, not geosynthetic barriers (geomembranes).

European geotextile standards can be roughly divided in product specifications (related to applications) and test methods. This guide will give a summary of the content of the product specifications and a short description of the test methods.

Application-related product specifications

Context

The geotextile product standards form a set of 11 standards, each of them specifying the requirements for geotextiles (and geotextile-related products) used in a given application:

<p>EN 13249: roads and other trafficked areas</p> 	<p>EN 13250 : railways</p> 
<p>EN 13251: earthworks, foundations and retaining walls</p> 	<p>EN 13252 : drainage systems</p> 
<p>EN 13253 : erosion control works</p> 	<p>EN 13254 : reservoirs and dams</p> 
<p>EN 13255 : canals</p> 	<p>EN 13256 : tunnels and underground structures</p> 
<p>EN 13257 : solid waste disposals</p> 	<p>EN 13265 : liquid waste containment</p> 
<p>EN 15381 asphalt reinforcement (no pictogram)</p>	

Structure

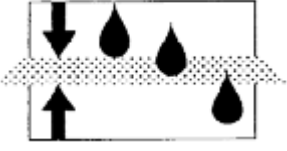
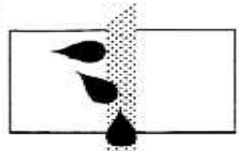
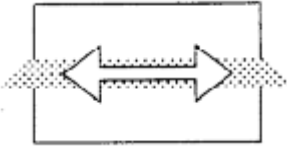
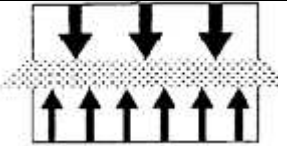
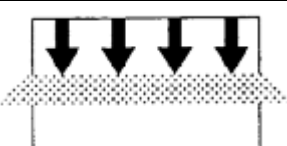
Each of the 11 standards follows the same framework:

- Scope
- Normative references
- Definitions and abbreviations
- Requirements
- Evaluation of conformity
- Marking (not CE)
- Annexes
 - o Factory production control (normative)
 - o Durability aspects (normative)
 - o Selection of the appropriate product standard (informative)
 - o Durability flow chart (informative)
 - o Annex ZA : Relationship with the CPD
 - ZA.1 : relation of characteristics with the CPD and the Mandate
 - ZA.2 : attestation of conformity system
 - ZA.3 : CE-marking and accompanying documents
 - o Bibliography (reference to Mandate M/107)(informative)

GEOTEXTILE STANDARDS

Functions

Geotextiles used in any of the above cited applications fulfil one or more of the following functions:

 <p>FILTRATION (F)</p>	 <p>DRAINAGE (D)</p>	 <p>REINFORCEMENT (R)</p>
 <p>SEPARATION (S)</p>	 <p>PROTECTION (P) (when used in combination with a geosynthetic barrier)</p>	<p>(no pictogram)</p> <p>INTERLAYER BARRIER (B) STRESS RELIEF (STR) (in conjunction with a bitumen layer for asphalt reinforcement)</p>

NOTE: The function « separation » is never specified alone and hence shall only be used in combination with other functions (filtration, reinforcement) with regard to testing and to attestation of conformity.

Table 1: Functions and applications

<u>Standard</u>	<u>Application</u>	F	D	R	S	P	STR	B
EN 13249	Roads and other trafficked areas	X		X	X			
EN 13250	Railways	X		X	X			
EN 13251	Earthworks, foundation and retaining walls	X		X	X			
EN 13252	Drainage systems	X	X		X			
EN 13253	Erosion control	X		X	X			
EN 13254	Reservoirs and dams	X		X	X	X		
EN 13255	Canals	X		X	X	X		
EN 13256	Tunnels and underground structures					X		
EN 13257	Solid waste disposal	X		X	X	X		
EN 13265	Liquid waste containment	X		X		X		
EN 15381	Asphalt reinforcement			X			X	X

GEOTEXTILE STANDARDS

Test methods and relevance of properties for each function

The manufacturer shall provide data on a set of properties, which are related to each function, as claimed in the manufacturer's product information.

These properties may be either imposed by the Mandates M/107 and M/386 of the European Commission (H-properties, for regulatory purposes), or be of a voluntary nature to be used in all conditions of use (A-properties) or some conditions of use (S-properties).

The H-properties are directly related to the function and independent from the application.

The A- and S-properties may vary with the application and the actual conditions of use. Their relevance is specified in the individual standards. Typical A- and S-properties are strength of seams and junctions, tensile and compressive creep, abrasion, damage during installation, friction.

General provisions on dangerous substances and on fire behaviour (for tunnels and waste disposal) are also included.

Table 2: H-properties and test methods vs. functions

<u>Property</u>	<u>Test method</u>	F	D	R	S	P	STR	B
Tensile strength	EN ISO 10319	X	X	X	X	X	X	X
Elongation (at break)	EN ISO 10319		X	X		X	X (**)	X
Static puncture (CBR) resistance	EN ISO 12236 (*)			X	X	X	X	X
Dynamic perforation resistance	EN ISO 13433	X	X	X		X		X
Water permeability (perpendicular to the plane)	EN ISO 11058	X						
Characteristic opening size	EN ISO 12956	X						
Water flow capacity (in the plane)	EN ISO 12958		X					
Durability (to be assessed in accordance with guidelines specified in annex to the standards- applicability of test methods dependent on materials and conditions of use)	EN 12224 EN 12225 EN 12447 EN 14030 EN ISO 13438	X	X	X	X	X	X	X

(*) for a product fulfilling a protective function EN 13719 shall be used.

(**) both elongation at breaking load and bitumen retention (according to EN 15381, annex C) shall be assessed

Durability assessment

Durability of geotextiles is linked to a number of parameters:

- Duration of exposure to sunlight on site
- Soil conditions (pH, temperature, contamination)
- Expected lifetime of the construction
- Composition and structure of the geotextile

From the annexes B and E (flow chart) the appropriate type of durability testing can be derived.

Expression of values – verification of values

The geotextile product standards do not specify minimum requirements, as these are related to the construction, in which the geotextile is used. The information the manufacturer has to provide should mention a nominal value and a tolerance value, corresponding to the 95% confidence interval. This system presumes the availability of sufficient statistical data from the manufacturer's factory production control.

In case of dispute a verification system is provided, in which two samples (A and B) are taken. Only sample A is used for testing. If the test result is within the tolerance values stated, the material is accepted, but if the result is outside more than 1.5 times the tolerance value the material is rejected. If the result is between 1 and 1.5 times the tolerance value a second test is made with sample B, which should give results within the tolerance values stated.

The initial type testing (for CE-marking and product information) comprises the properties imposed by the Mandate (see table 2).

Factory production control

Factory production control (FPC) is a mandatory element in the attestation of conformity procedure. A normative annex in the standards specifies the main requirements to be met by a FPC system. These correspond to the requirements of an ISO 9001 system.

ZA-annexes - link with the CPD

The relevant properties, for which values and tolerances have to be declared, can be derived from table 2.

Examples:

- Filtration and reinforcing layer : tensile strength, elongation, static puncture, dynamic perforation, water permeability, opening size, durability assessment
- Protection layer for a geomembrane : tensile strength, elongation, static puncture (according to EN 13719), dynamic perforation, durability assessment
- Drainage layer : tensile strength, elongation, dynamic perforation, water flow capacity, durability assessment.

The attestation of conformity system for geotextiles is 4 for the separation function and 2+ for all other functions. As separation should be never specified alone, in practice only the system 2+ shall be used.

System 2+ is based on the following division of tasks:

- Tasks for the manufacturer:
 - Factory production control
 - Initial type testing
- Tasks for the approved body:
 - Certification of the FPC on basis of:
 - Initial audit and approval of the FPC system
 - Continuous surveillance, assessment and approval of the FPC system with regard to the H-properties of the product.

The approved body draws up a certificate of factory production control, whereas the manufacturer draws up a declaration of conformity

CE-marking

The CE-marking on the packaging of the product is limited to a strict minimum:

- The CE-marking itself
- The reference number of the approved body
- The name of the product

All other information is given on the accompanying documents:

- The CE-marking
- The identification number of the notified body
- The name and type of the product
- The name or identifying mark and registered address of the producer
- The last two digits of the year in which the marking was affixed
- The number of the FPC certificate
- The annex and reference number of the applicable European standard(s)
- The identification of product and intended use(s) (functions)
- Information on regulated characteristics with mean value and tolerance value
- A durability declaration

Supporting test standards

The standards in table 3 were developed as test methods or otherwise in support of the geosynthetics product standards. Items printed in **bold** are summarised in a data sheet.

Table 3: Supporting standards

Reference	Title
CEN/TR 15019:2005	Geotextiles and geotextile-related products - On-site quality control
CEN/TS 14416:2005	Geosynthetic barriers - Test method for determining the resistance to roots
CEN/TS 14417:2005	Geosynthetic barriers - Test method for the determination of the influence of wetting-drying cycles on the permeability of clay geosynthetic barriers
CEN/TS 14418:2005	Geosynthetic barriers - Test method for the determination of the influence of freezing-thawing cycles on the permeability of clay geosynthetic barriers
EN 12224:2000	Geotextiles and geotextile-related products - Determination of the resistance to weathering
EN 12225:2000	Geotextiles and geotextile-related products - Method for determining the microbiological resistance by a soil burial test
EN 12226:2000	Geotextiles and geotextile-related products - General tests for evaluation following durability testing
EN 12447:2001	Geotextiles and geotextile-related products - Screening test method for determining the resistance to hydrolysis in water
EN 13562:2000	Geotextiles and geotextile-related products - Determination of resistance to penetration by water (hydrostatic pressure test)
EN 13719:2002	Geotextiles and geotextile-related products - Determination of the long term protection efficiency of geotextiles in contact with geosynthetic barriers
EN 13738:2004	Geotextiles and geotextile-related products - Determination of pullout resistance in soil
EN 14030:2001	Geotextiles and geotextile-related products - Screening test method for determining the resistance to acid and alkaline liquids (ISO/TR 12960:1998, modified)
EN 14150:2006	Geosynthetic barriers - Determination of permeability to liquids
EN 14196:2003	Geosynthetics - Test methods for measuring mass per unit area of clay geosynthetic barriers
EN 14414:2004	Geosynthetics - Screening test method for determining chemical resistance for landfill applications
EN 14415:2004	Geosynthetic barriers - Test method for determining the resistance to leaching

GEOTEXTILE STANDARDS

EN 14574:2004	Geosynthetics - Determination of the pyramid puncture resistance of supported geosynthetics
EN 14575:2005	Geosynthetic barriers - Screening test method for determining the resistance to oxidation
EN 14576:2005	Geosynthetics - Test method for determining the resistance of polymeric geosynthetic barriers to environmental stress cracking
EN ISO 9862:2005	Geosynthetics - Sampling and preparation of test specimens (ISO 9862:2005)
EN ISO 9863-1:2005	Geosynthetics - Determination of thickness at specified pressures - Part 1: Single layers (ISO 9863-1:2005)
EN ISO 9863-2:1996	Geotextiles and geotextile-related products - Determination of thickness at specified pressures - Part 2: Procedure for determination of thickness of single layers of multilayer products (ISO 9863-2:1996)
EN ISO 9864:2005	Geosynthetics - Test method for the determination of mass per unit area of geotextiles and geotextile-related products (ISO 9864:2005)
EN ISO 10318:2005	Geosynthetics - Terms and definitions (ISO 10318:2005)
EN ISO 10319:2008	Geosynthetics - Wide-width tensile test (ISO 10319:2008)
EN ISO 10320:1999	Geotextiles and geotextile-related products - Identification on site (ISO 10320:1999)
EN ISO 10321:2008	Geosynthetics - Tensile test for joints/seams by wide-width strip method (ISO 10321:2008)
EN ISO 10722:2007	Geosynthetics - Index test procedure for the evaluation of mechanical damage under repeated loading - Damage caused by granular material (ISO 10722:2007)
EN ISO 11058:1999	Geotextiles and geotextile-related products - Determination of water permeability characteristics normal to the plane, without load (ISO 11058:1999)
EN ISO 12236:2006	Geosynthetics - Static puncture test (CBR test) (ISO 12236:2006)
EN ISO 12956:1999	Geotextiles and geotextile-related products - Determination of the characteristic opening size (ISO 12956:1999)
EN ISO 12957-1:2005	Geosynthetics - Determination of friction characteristics - Part 1: Direct shear test (ISO 12957-1:2005)
EN ISO 12957-2:2005	Geosynthetics - Determination of friction characteristics - Part 2: Inclined plane test (ISO 12957-2:2005)
EN ISO 12958:1999	Geotextiles and geotextile-related products - Determination of water flow capacity in their plane (ISO 12958:1999)
EN ISO 13426-1:2003	Geotextiles and geotextile-related products - Strength of internal structural junctions - Part 1: Geocells (ISO 13426-1:2003)
EN ISO 13426-2:2005	Geotextiles and geotextile-related products - Strength of

GEOTEXTILE STANDARDS

	internal structural junctions - Part 2: Geocomposites (ISO 13426-2:2005)
EN ISO 13427:1998	Geotextiles and geotextile-related products - Abrasion damage simulation (sliding block test) (ISO 13427:1998)
EN ISO 13428:2005	Geosynthetics - Determination of the protection efficiency of a geosynthetic against impact damage (ISO 13428:2005)
EN ISO 13431:1999	Geotextiles and geotextile-related products - Determination of tensile creep and creep rupture behaviour (ISO 13431:1999)
EN ISO 13433:2006	Geosynthetics - Dynamic perforation test (cone drop test) (ISO 13433:2006)
EN ISO 13437:1998	Geotextiles and geotextile-related products - Method for installing and extracting samples in soil, and testing specimens in laboratory (ISO 13437:1998)
EN ISO 13438:2004	Geotextiles and geotextile-related products - Screening test method for determining the resistance to oxidation (ISO 13438:2004)
EN ISO 25619-1:2008	Geosynthetics - Determination of compression behaviour - Part 1: Compressive creep properties (ISO 25619-1:2008)
EN ISO 25619-2:2008	Geosynthetics - Determination of compression behaviour - Part 2: Determination of short-term compression behaviour (ISO 25619-2:2008)
ISO/TR 13434:2008	Geosynthetics -- Guidelines for the assessment of durability
prEN 14151 (formal vote stage)	Geosynthetics - Determination of burst strength
prEN ISO 10769 (DIS stage)	Clay geosynthetic barriers (GBR-C) - Determination of water absorption of bentonite
prEN ISO 10772 (CD stage)	Test method for pore size determination under turbulent water flow conditions
prEN ISO 10773 (CD stage)	Geosynthetic clay barriers - Determination of gas flow through a GCL or GCB (Geosynthetic Clay Liner or Geosynthetic Clay Barrier)
prEN ISO 10776 (CD stage)	Geotextiles and geotextile-related products - Determination of water permeability characteristics normal to the plane, under load