

SLOVENSKI STANDARD

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Geosintetične zapore - Zahtevane lastnosti pri uporabi za zaščito pred tekočinami pri gradnji predorov in pri podzemnih gradnjah

Geosynthetic barriers - Characteristics required for use as a fluid barrier in the construction of tunnels and associated underground structures

Geosynthetische Dichtungsbahnen - Eigenschaften, die für die Anwendung beim Bau von Tunneln und damit verbundenen Tiefbauwerken erforderlich sind

Géomembranes, géosynthétiques bentonitiques - Caractéristiques requises pour l'utilisation comme barrière aux fluides dans la construction des tunnels et des structures souterraines associées

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ICS:

59.080.70	Geotekstilije	Geotextiles
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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 13491

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ICS 59.080.70; 91.100.50

Supersedes EN 13491:2004

English Version

**Geosynthetic barriers - Characteristics required for use as a fluid
barrier in the construction of tunnels and associated
underground structures**

Barrières géosynthétiques - Caractéristiques requises pour
l'utilisation comme barrière contre les liquides dans la
construction des tunnels et des structures souterraines

Geosynthetische Dichtungsbahnen - Eigenschaften, die für
die Anwendung beim Bau von Tunneln und damit
verbundenen Tiefbauwerken erforderlich sind

This European Standard was approved by CEN on 23 May 2013.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



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COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 13491:2013) has been prepared by Technical Committee CEN/TC 189 “Geosynthetics”, the secretariat of which is held by NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2014, and conflicting national standards shall be withdrawn at the latest by January 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13491:2004.

The following technical changes were introduced in comparison with the previous edition:

- The normative references were updated.
- Table 1 was revised.
- "Chemical resistance" was added to Clause 4.
- "Release of dangerous substances" was added to Clause 4.
- Annex A revised: "raw or incoming material" and Tables A.1 to A.3 were added.
- Annex B was revised.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This document allows manufacturers to describe geosynthetic barriers on the basis of declared values for characteristics relevant to the intended use and if tested to the specified method. It also includes procedures for evaluation of conformity and factory production control.

This document can also be used by designers, end-users and other interested parties as a tool to define relevant and appropriate characteristics for specifications and on-site quality control. It should be emphasised however that not all characteristics and test methods quoted in this document are suitable for the purpose of on-site quality control.

Tests for some non-mandated characteristics are still under study and will be included when the standard is revised.

The term “product” used in this document refers to a geosynthetic barrier, including polymeric geosynthetic barriers, clay geosynthetic barriers and bituminous geosynthetic barriers.

This document is part of a group of standards, addressing the requirements for geosynthetic barriers when used in a specific application.

Particular application cases can contain requirements about additional properties and - preferably standardised - test methods, if they are technically relevant and not conflicting with European Standards.

The design life of the product should be determined, since its function may be temporary, as a construction expediency, or permanent, for the lifetime of the structure.

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EN 13491:2013 (E)

1 Scope

This European Standard specifies the relevant characteristics of geosynthetic barriers, including polymeric geosynthetic barriers, clay geosynthetic barriers and bituminous geosynthetic barriers, when used as fluid barriers in the construction of tunnels and associated underground structures, and the appropriate test methods to determine these characteristics.

The intended use of these products is to control the leakage of water through the construction wall.

This document is not applicable to geotextiles or geotextile-related products.

This document provides for the evaluation of conformity of the product to this document.

This document defines requirements to be met by manufacturers and distributors with regard to the presentation of product properties.

This document does not cover applications where the geosynthetic barrier is to be in contact with water that has been treated for human consumption.

Where potable water is or may be in direct contact with the product the designer should also refer to other relevant standards, requirements and/or regulations.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 495-5, *Flexible sheets for waterproofing — Determination of foldability at low temperature — Part 5: Plastic and rubber sheets for roof waterproofing*

EN 1109, *Flexible sheets for waterproofing — Bitumen sheets for roof waterproofing — Determination of flexibility at low temperature*

EN 1844, *Flexible sheets for waterproofing — Determination of resistance to ozone — Plastic and rubber sheets for roof waterproofing*

EN 1849-1, *Flexible sheets for waterproofing — Determination of thickness and mass per unit area — Part 1: Bitumen sheets for roof waterproofing*

EN 1849-2, *Flexible sheets for waterproofing — Determination of thickness and mass per unit area — Part 2: Plastic and rubber sheets*

EN 12224, *Geotextiles and geotextile-related products — Determination of the resistance to weathering*

EN 12225, *Geotextiles and geotextile-related products — Method for determining the microbiological resistance by a soil burial test*

EN 12310-1, *Flexible sheets for waterproofing — Part 1: Bitumen sheets for waterproofing — Determination of resistance to tearing (nail shank)*

EN 12311-1, *Flexible sheets for waterproofing — Part 1: Bitumen sheets for roof waterproofing — Determination of tensile properties*

EN 12311-2, *Flexible sheets for waterproofing — Determination of tensile properties — Part 2: Plastic and rubber sheets for roof waterproofing*

- EN 13361, *Geosynthetic barriers — Characteristics required for use in the construction of reservoirs and dams*
- EN 13362, *Geosynthetic Barriers — Characteristics required for use in the construction of canals*
- EN 13492, *Geosynthetic barriers — Characteristics required for use in the construction of liquid waste disposal sites, transfer stations or secondary containment*
- EN 13493, *Geosynthetic barriers — Characteristics required for use in the construction of solid waste storage and disposal sites*
- EN 14150, *Geosynthetic barriers — Determination of permeability to liquids*
- EN 14151, *Geosynthetics — Determination of burst strength*
- EN 14196, *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, *Geosynthetic barriers — Test method for determining the resistance to leaching*
- EN 16416, *Geosynthetic clay barriers — Determination of water flux index — Flexible wall permeameter method at constant head*
- CEN/TS 14416, *Geosynthetic barriers — Test method for determining the resistance to roots*
- CEN/TS 14417, *Geosynthetic barriers — Test method for the determination of the influence of wetting-drying cycles on the permeability of clay geosynthetic barriers*
- CEN/TS 14418, *Geosynthetic barriers — Test method for the determination of the influence of freezing-thawing cycles on the permeability of clay geosynthetic barriers*
- EN 14575, *Geosynthetic barriers — Screening test method for determining the resistance to oxidation*
- EN 14576, *Geosynthetics — Test method for determining the resistance of polymeric geosynthetic barriers to environmental stress cracking*
- EN 15382, *Geosynthetic barriers — Characteristics required for use in transportation infrastructure*
- EN ISO 527-1:2012, *Plastics — Determination of tensile properties — Part 1: General principles (ISO 527-1:2012)*
- EN ISO 527-3:1995, *Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets (ISO 527-3:1995)*
- EN ISO 527-4:1997, *Plastics — Determination of tensile properties — Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites (ISO 527-4:1997)*
- EN ISO 9862, *Geosynthetics — Sampling and preparation of test specimens (ISO 9862)*
- EN ISO 9864, *Geosynthetics — Test method for the determination of mass per unit area of geotextiles and geotextile-related products (ISO 9864)*
- EN ISO 10318:2005, *Geosynthetics — Terms and definitions (ISO 10318:2005)*
- EN ISO 10319, *Geotextiles — Wide-width tensile test (ISO 10319)*
- EN ISO 10320, *Geotextiles and geotextile-related products — Identification on site (ISO 10320)*

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EN ISO 10773, *Clay geosynthetic barriers — Determination of permeability to gases (ISO 10773)*

EN ISO 11358, *Plastics — Thermogravimetry (TG) of polymers — General principles (ISO 11358)*

EN ISO 11925-2, *Reaction to fire tests — Ignitability of products subjected to direct impingement of flame — Part 2: Single-flame source test (ISO 11925-2)*

EN ISO 12236, *Geosynthetics — Static puncture test (CBR test) (ISO 12236)*

EN ISO 13438, *Geotextiles and geotextile-related products — Screening test method for determining the resistance to oxidation (ISO 13438)*

ISO 34-1:2010, *Rubber, vulcanized or thermoplastic — Determination of tear strength — Part 1: Trouser, angle and crescent test pieces*

ISO 11357-6, *Plastics — Differential scanning calorimetry (DSC) — Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)*

ASTM D696, *Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 °C and 30 °C With a Vitreous Silica Dilatometer*

ASTM D1434, *Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting*

ASTM D5890, *Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners*

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3 Terms, definitions and abbreviations**3.1 Terms and definitions**

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For the purposes of this document, the terms and definitions given in EN ISO 10318:2005 and the following apply.

3.1.1**product**

geosynthetic barrier, including polymeric, bituminous and clay barriers

3.1.2**specification**

document in which the works, functions, specific conditions and required material property values of the geosynthetic barrier of use are described

3.1.3**underground structure**

constructed void below ground which belongs to the tunnel construction

3.1.4**tunnel**

underground passage, open to the daylight at one or both ends, with a minimum diameter of one meter, which is made by removing soil or rock

3.1.5**moisture barrier**

barrier used to prevent the ingress of liquids and vapours, mainly water, without external hydrostatic pressure, to a tunnel or underground structure

3.1.6

pressure water barrier

barrier used to prevent or reduce the escape from or the ingress of water to a tunnel or underground structure when subject to external hydrostatic pressure

3.1.7

fluid barrier

barrier used to prevent or reduce the escape from or the ingress of fluids to a tunnel or underground structure when subject to differential pressure

3.2 Abbreviations

For the purposes of this document, the abbreviations given in EN ISO 10318:2005 apply:

- **GBR-P:** polymeric geosynthetic barrier;
- **GBR-B:** bituminous geosynthetic barrier;
- **GBR-C:** clay geosynthetic barrier.

4 Required characteristics and corresponding methods of test

4.1 General

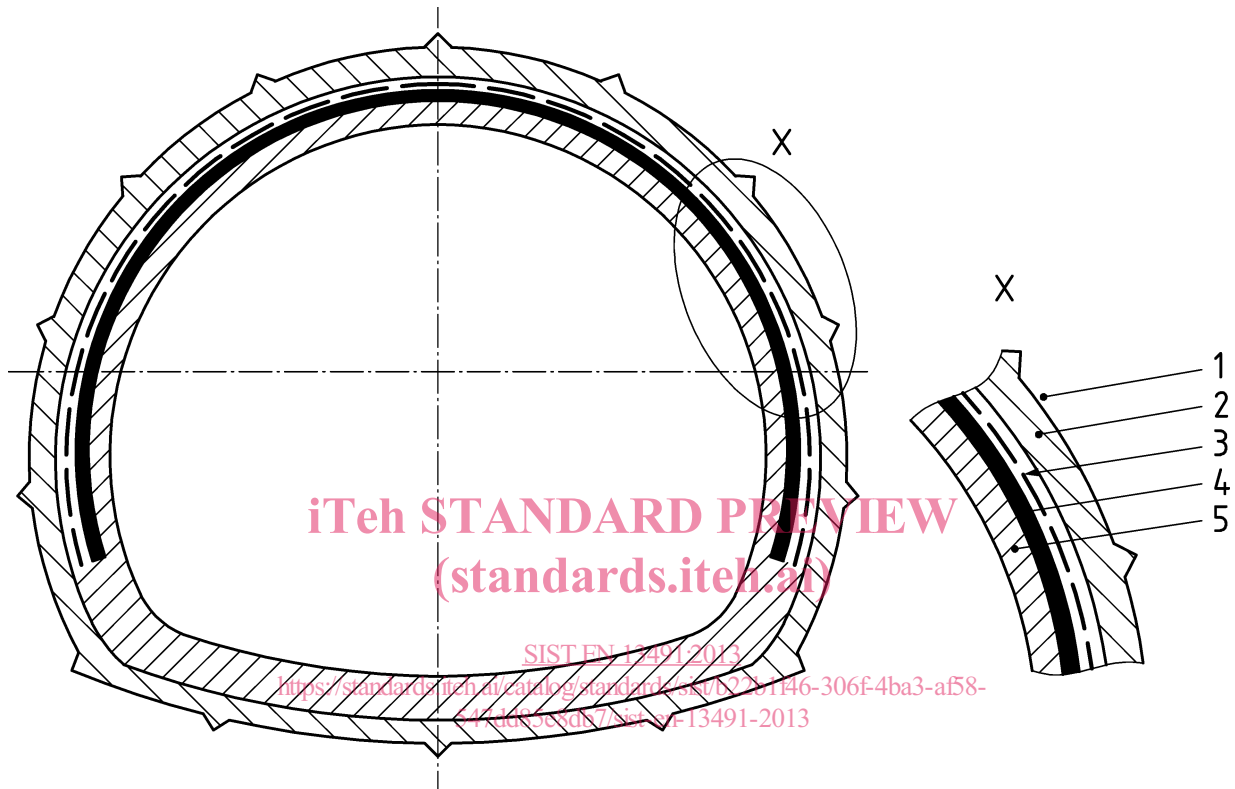
The main function of geosynthetic barriers used in the construction of tunnels and associated underground structures is to prevent or reduce the flow of fluid through the structure wall. Damage during installation has not been addressed in this document.

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4.2 Types of application

4.2.1 Application 1: "seepage water tunnel"

Application where the geosynthetic barrier is used as a stand-alone seepage (moisture) barrier. Figure 1 shows a typical cross-section.



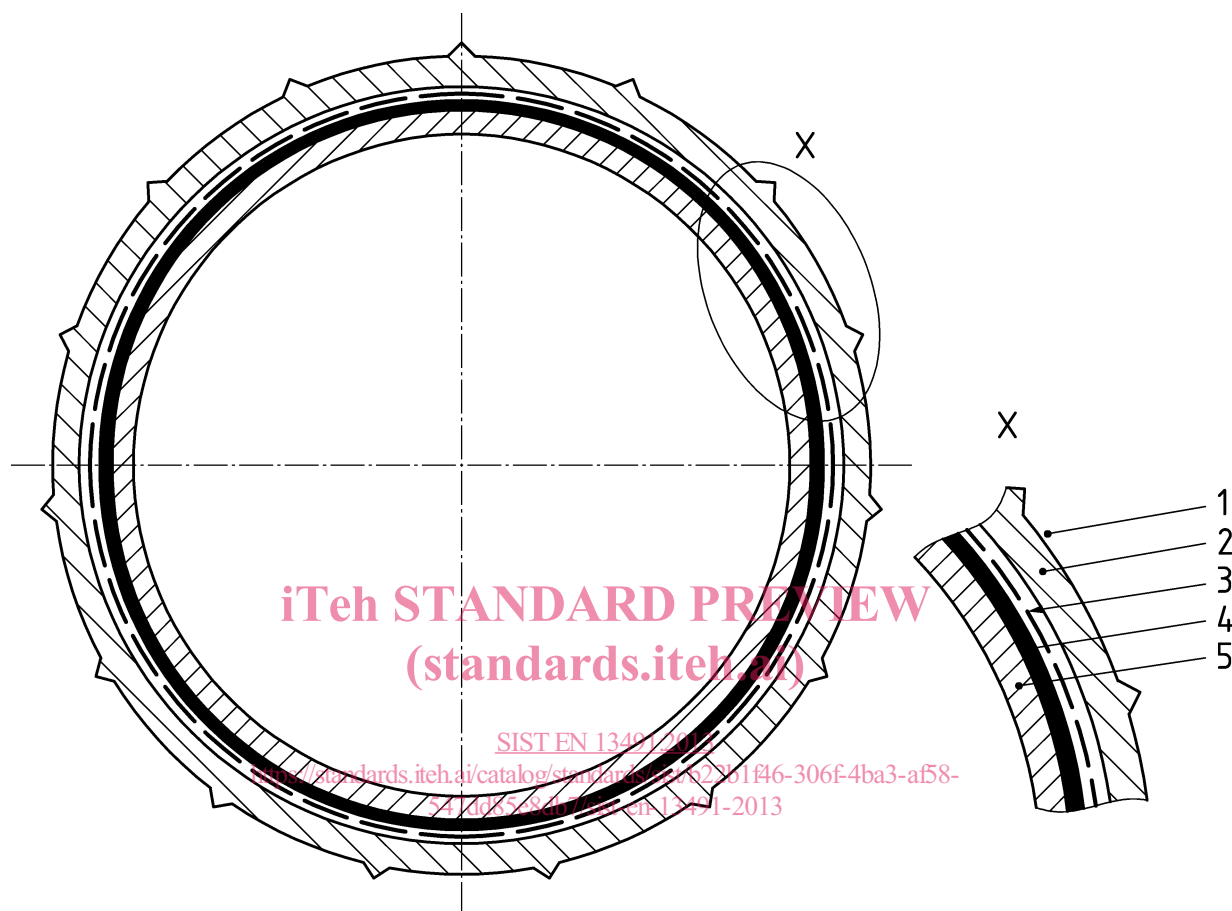
Key

- 1 rock
- 2 shotcrete
- 3 geotextile
- 4 geosynthetic barrier
- 5 concrete

Figure 1 — A geosynthetic barrier in a drilled seepage water tunnel

4.2.2 Application 2: "pressurised water tunnel"

Application where the geosynthetic barrier is used as a barrier against pressurised water. Figure 2 shows a typical cross-section.



Key

- 1 rock
- 2 shotcrete
- 3 geotextile
- 4 geosynthetic barrier
- 5 concrete

Figure 2 — A geosynthetic barrier in a drilled pressurised water tunnel