
**Geotextiles and geotextile-related
products — Screening test methods
for determining the resistance to acid
and alkaline liquids**

*Géotextiles et produits apparentés — Méthodes d'essai sélectives pour
la détermination de la résistance aux liquides acides et alcalins*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 189, *Geosynthetics*, in collaboration with ISO Technical Committee TC 221, *Geosynthetics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition of ISO 12960 cancels and replaces ISO/TR 12960:1998, which has been technically revised. This document consolidates ISO/TR 12960:1998 and EN 14030:2001 and replaces both.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

In nearly all applications, geotextiles and geotextile-related products (hereinafter, geotextile products) can be in contact with aqueous solutions of acids, bases or dissolved oxygen. The resistance of geotextile products to these chemicals depends, on the one hand, on polymer formulation, processing, textile structure and the presence of existing damage and, on the other hand, on the composition of the liquid and in situ conditions such as temperature, pressure and the presence of further mechanical stress.

It is the purpose of this document to provide methods of screening (index testing) the resistance of geotextile products to acids and bases.

Since an index test requires exposure times that are short compared to the expected lifetimes of geotextile and geotextile-related products, the process needs to be accelerated. The data obtainable are suitable for screening but not for deriving performance data such as lifetime, unless supported by further evidence.

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Geotextiles and geotextile-related products — Screening test methods for determining the resistance to acid and alkaline liquids

1 Scope

This document specifies methods for screening the resistance of geotextile and geotextile-related products to liquids while not subjecting them to external mechanical stress.

It is applicable to all geotextiles and geotextile-related products. Method A applies particularly to polyamides and method B to polyesters and polyamides. The test results are intended to be interpreted in the context of site conditions.

This document is intended to be used in conjunction with ISO/TS 13434.

NOTE This document only considers conditions where the specimens are fully immersed in the liquids. Though outside the scope of this document, the test conditions can be modified to accommodate particular applications, e.g. gaseous media. This document does not preclude use for test specimens that are pre-treated by some method, e.g. by weathering, aqueous extraction conditions or installation damage.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 10318-1, *Geosynthetics — Part 1: Terms and definitions*

EN 12226, *Geosynthetics — General tests for evaluation following durability testing*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 10318-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Principle

Test specimens are completely immersed in a test liquid for a given test duration at a fixed temperature. The properties of the test specimens are tested before and after immersion and, if applicable, after drying. Wherever possible, the test results are compared with those of control specimens stored under reference conditions.

5 General requirements and procedure

5.1 Apparatus

5.1.1 Container, e.g. pneumatic vessel, equipped with items described in 5.1.2 to 5.1.6. The material of the container and equipment shall be resistant to the test chemicals. Such materials are in general borosilicate glass or stainless steel. The container shall be large enough for the quantity of test liquid (see 5.6.1), which shall be held at constant temperature (see 5.3).

5.1.2 Sealing lid or equivalent device and, if necessary, reflux condenser or equivalent device to restrict evaporation of volatile components.

5.1.3 Stirring or equivalent device, to maintain homogeneity of the liquid and the exchange of matter between the liquid and the specimens.

5.1.4 Specimen holders, to ensure correct placing of the specimens (see 5.6.2), the free distance between specimens being at least 10 mm.

5.1.5 At least **one closable aperture** in the lid for access to control the composition of the liquid.

5.1.6 Device for passing air into the liquid, to ensure full air saturation.

5.2 Reagents and materials

Chemicals or reagents of analytical grade should be used. Water shall comply with ISO 3696, grade 3.

Requirements for handling of chemicals and for disposal of test liquids are given in national safety regulations.

Two types of test liquids are to be used.

5.2.1 Inorganic acid liquid: 0,025 M sulfuric acid, with 1 mMol ferrisulfate and 1 mMol ferrosulfate added (method A).

5.2.2 Inorganic alkaline liquid: Calcium hydroxide $[\text{Ca}(\text{OH})_2]$, used as a saturated suspension, i.e. approximately 2,5 g/l (method B).

Requirements for handling of chemicals and for disposal of test liquids are given in national safety regulations.

For any test medium, it is an important condition that its composition remains constant during the test exposure. This can be difficult if the concentration of any active component is low or if the liquid is not a stable one-phase system. In such cases, the concentration should be monitored and, if possible, adjusted or the test medium replaced on a regular basis. Attention should be paid also to possible catalytic or synergistic effects, including effects of simultaneous chemical and mechanical stresses (e.g. environmental stress cracking in polyolefins). The concentration of the active species is chosen so as to avoid significant changes in concentration during the test and to accelerate the reaction but not using too high a concentration that could result in a change in the active mechanism.

5.3 Test temperatures

The test temperature shall be $(60 \pm 1)^\circ\text{C}$ for each method.

5.4 Test duration

The test duration shall be three days for each method.

5.5 Sampling and preparation of test specimens

Sampling and preparation of specimens shall be carried out in accordance with EN 12226.

The number of specimens shall be five test specimens and five control specimens.

It is recommended that additional specimens be exposed. In case a mechanical test is invalid, a further specimen should be tested in its place.

If the products are sheathed by some coating, which can be penetrated during installation, the product should be tested with and without the coating. If not, the possibility of a change in chemical resistance in case of destruction or damage to the sheath should be noted in the report.

5.6 Procedure

5.6.1 Quantity of test liquid

The quantity of test liquid shall be greater than 30 times the mass of the specimens and shall cover the specimens completely.

5.6.2 Positioning of specimens

The specimens shall be placed in the vessel free of any significant mechanical stress.

The mean distance between the specimens, between the specimens and the walls of the vessel, and between the specimens and the surface of the liquid shall be at least 10 mm. No significant proportion of the surface of the specimens shall make contact with a material other than the test liquid itself.

Specimens of different materials shall not be tested in the same vessel. During the test, the exchange of matter between liquid and geotextile and geotextile-related products shall not be hindered by poor convection of the test liquid.

Calcium hydroxide shall be stirred continuously, sulfuric acid at least once per day. Sulfuric acid shall be stirred by continuous passing of air into the liquid. Where necessary, liquid shall be replenished or replaced to maintain the original pH at least every 24 h. The liquid and the specimens shall be shielded from light.

5.6.3 Control specimens

The control specimens shall be immersed for 1 h in water at the same temperature as the test specimens. Water shall be in accordance with [5.2](#).

5.6.4 Rinsing, wiping and drying

Rinsing shall be performed in water complying with [5.2](#), then in 0,01 M sodium carbonate solution, finally in water again. The quantities shall be sufficient to ensure thorough cleaning.

In exposing polyester geotextiles and geotextile-related products to calcium hydroxide, it is necessary to remove adhering crystals of calcium terephthalate. This may be done by immersion for 5 min within a 10 % solution (mass fraction) of trisodiumnitriolotriacetate (NTA) in an agitating device, followed by rinsing in a 3 % solution (mass fraction) of acetic acid and finally rinsing with water.

Specimens shall be dried at room temperature or at elevated temperature up to 60 °C. Specimens should not be subjected to undue stress during drying.

5.7 Determination of changes in properties

The changes shall be determined in accordance with EN 12226.