NorGeoSpec 2012

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A Nordic system for the certification and specification of geosynthetics and geosynthetic-related products

This document presents a Nordic system for the certification and specification of geosynthetics and geosynthetic-related products for separation, filtration and/or reinforcement.

NorGeoSpec 2012 defines a system for the certification and quality control testing of geosynthetics and geosynthetic-related products and defines requirements related to the intended purpose (function) of the products. NorGeoSpec 2012 is implemented as a complete system as a revision and extension of the NorGeoSpec 2002.

The Nordic system NorGeoSpec 2012 (NGS) was developed by users from several countries (Norway, Sweden, Finland and Estonia) to help the users of geosynthetics, especially in Europe, in their specific projects, to fulfil local regulations and guidelines. All users (owners, specifiers, manufacturers) took part in the definition and the development of the NorGeoSpec 2012.

NorGeoSpec 2012 helps:

- owners and specifiers to formulate product specifications for their particular project in strict respect of competition rules;
- to ensure the quality of incoming products by defining the requirements and levels of performance justified by the specific project needs; these requirements may concern either
- the frequency and the level of the verifications for the performance of the products corresponding to these specific project needs
- „additional" characteristics compared to the harmonised standard justifiable for this specific project and in strict respect of competition rules
- „additional" characteristics for product identification

NorGeoSpec 2012 is not intended to cover in any way the requirements linked to the CE marking and the provision of CPR.

The aim of NorGeoSpec 2012 is to give answers and tools to designers, specifiers and users of geosynthetics in specific situations based on justified needs.

NorGeoSpec 2012 proposes additional features which should be considered to ensure sustainability of the geosynthetics during installation and for the lifetime of the project.

NorGeoSpec 2012 is a voluntary system which helps to improve the functionality and reduce the costs of
- the design of simple structures
- the surveillance and control of each specific project by the application of fair and strict competition rules.

The NorGeoSpec 2012 System includes two parts:

- Part one "Product Certification (PC)" presents current product requirements for three different functions and frequent uses of geosynthetics for specific projects. A corresponding evaluation of the geosynthetics' quality regarding fitness for purpose for these functions is stated by a certificate on Product Certification

- Part two "Product Specification (PS)" covers some special areas of application, current cases of use, requirements and levels of performance which may be requested for such specific projects. A corresponding evaluation of the geosynthetic regarding fitness in use for such purposes is stated by a certificate on Product Specification.

The Nordic system NorGeoSpec 2012 is intended to be compatible with the provisions of CPR, in particular with CPR Art 8(3), and not to contravene EU legislations.

Compliance with the NorGeoSpec requirements is declared by the NorGeoSpec Certification Body (NCB) to any manufacturer who applies for it, or to his authorized representative, on condition that the product concerned satisfies the rules currently published on the website www.norgeospec.org.

The NCB administers the procedures of both "Product Certification" and "Product Specification" and is advised by the Technical Committee.

The rules of NorGeoSpec and the responsibilities of the parties involved are described in part one, "Product Certification" and part two "Product Specification" of these Guidelines.

The following organisations were active in the Revision of NorGeoSpec 2012:

Norwegian Public Road Administration	Norway
Swedish Transport Administration	Sweden
Finnish Transport Agency	Finland
Estonian Road Administration	Estonia

and the work was carried out by

Tseday Damtev	Norwegian Public Road Administration
Aina Anthi	Norwegian Public Road Administration
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Part one – Product Certification (PC) Function: Separation and Filtration Reinforcement

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1. General

1.1 Scope

This part of the document presents the Nordic system for certification and quality control of geosynthetics and geosynthetic-related products (NorGeoSpec) used for separation, filtration and/or reinforcement applications. The aim of NorGeoSpec Product Certification is to assess whether the products are fit for purpose for specific projects within the areas of use specified in this part of the document.

1.2 Ongoing quality compliance

The applicant must ensure that appropriate NGS Specific Quality Controls are in place to:

- demonstrate that the product continuously complies with the requirements of the NGS certificate which has been issued for the product
- provide records for inspection during audits; these must document the test results achieved, and the inspections carried out to ensure ongoing quality compliance.

Note: the goal of the NGS Specific controls is to ensure the quality of the product used in specific projects (e.g. verification of values).

1.3 Responsibility

Any manufacturing faults or errors of marking and/or labelling are the responsibility of the applicant.
Under no circumstances does the granting of the NorGeoSpec Certificate transfer any liability to the NorGeoSpec Certification Body (the abbreviation NCB, "**N**orGeoSpec-mandated **C**ertification **B**ody"; is used in the following); the applicant remains legally responsible in all respects relating to the placement of the product in the market.

1.4 Assignment and transfer

Under no circumstances may the right to use the NorGeoSpec Certificate be transferred, or assigned to another party.

In the case of a change of corporate status (e.g. merger, takeover, bankruptcy), the manufacturer of the certified product shall inform the NCB, who will verify whether all the conditions for the original approval are still satisfied. If this is not the case, the right to use the Certificate will be cancelled once the remaining stock of certified product has been sold (within a period of no more than 6 months).

1.5 Product / Product range

Product
A geosynthetic, or geosynthetic-related product, is defined by a commercial designation which includes both a name and reference number or descriptor (e.g. "Unitex 25a", "Unitex Filterplus").

Product range
The products of a product range resemble one another and are manufactured by the same manufacturing process, in the same production facility, and from the same raw material(s). However, they differ e.g. in the size and cross-section of the elements, in unit weight and in their mechanical and hydraulic properties.

1.6 Languages

The language used in all matters relating to NorGeoSpec Certificates and certification shall be English.

2. Normative references

This document also contains provisions from other publications, such as dated or undated references. These normative references are cited at the relevant places in the text, and publications are listed in the following. If dated references are changed or revised, the changes or revision will not be valid in the NorGeoSpec system. They will only become valid through the publication of an amendment or a revised edition of NorGeoSpec system. For undated references, the latest edition of the cited publication is valid.

EN ISO	9001	Quality management systems – Requirements
EN ISO	9862	Geosynthetics – Sampling and preparation of test specimens
EN ISO	9864	Geosynthetics – Test method for the determination of mass per unit area of geotextiles and geotextilerelated products
EN ISO	10318	Geosynthetics – Part 1 Terms and definitions and part 2 symbols and pictograms
EN ISO	10319	Geosynthetics – Wide-width tensile test
EN ISO	10320	Geotextiles and geotextile-related products – Identification on site
EN ISO	10722	Geosynthetics – Index test procedure for the evaluation of mechanical damage under repeated loading – Damage caused by granular material
EN ISO	11058	Geotextiles and geotextile-related products – Determination of water permeability characteristics normal to the plane, without load
EN	12224	Geotextiles and geotextile-related products – Determination of the resistance to weathering
EN ISO	12236	Geosynthetics – Static puncture test (CBR test)
EN	12447	Geotextiles and geotextile-related products – Screening test method for determining the resistance to hydrolysis in water
EN ISO	12956	Geotextiles and geotextile-related products – Determination of the characteristic opening size
EN ISO	12957	Geosynthetics – Part 1: Direct shear test
EN	13249	Geotextiles and geotextilerelated products. Required characteristics for use in the construction of roads and other trafficked areas
EN	13250	Geotextiles and geotextilerelated products. Required characteristics for use in the construction of railways
EN	13251	Geotextiles and geotextilerelated products. Required characteristics for use in earthworks, foundations and retaining structures
EN	13252	Geotextiles and geotextilerelated products. Required characteristics for use in drainage systems
EN	13253	Geotextiles and geotextilerelated products. Required characteristics for use in external erosion control systems
EN	13254	Geotextiles and geotextilerelated products. Required characteristics for use in the construction of reservoirs and dams
EN	13255	Geotextiles and geotextilerelated products. Required characteristics for use in the construction of canals
EN	13256	Geotextiles and geotextile-related products – Characteristics required for use in the construction of tunnels and underground structures
EN	13257	Geotextiles and geotextilerelated products. Required characteristics for use in solid waste disposals
EN	13265	Geotextiles and geotextilerelated products. Required characteristics for use in liquid waste containment projects
EN ISO	13431	Geotextiles and geotextile-related products – Determination of the tensile creep and creep rupture behaviour
EN ISO	13433	Geosynthetics – Dynamic perforation test (cone drop test)
EN ISO	13438	Geotextiles and geotextile-related products – Screening test method for determination the resistance to oxidation
ISO	14025	Environmental labels and declarations – Type III environmental declarations – Principles and procedures
EN	14030	Geotextiles and geotextile-related products – Screening test method for determining the resistance to acid and alkaline liquids
EN	15381	Geotextiles and geotextile-related products – Characteristics required for use in pavements and asphalt overlays
EN ISO/IEC	17025	General requirements for the competence of testing and calibration laboratories
ISO/TS	13434	Geosynthetics – Guidelines for the assessment of durability
ISO/TR	20432	Guidelines for the determination of the long-term strength of geosynthetics for soil reinforcement

3. Terms, definitions and abbreviations

In general all terms are referred to EN ISO 10318 (Part 1 and Part 2).
In the specific requirements the following terms are used:

Nominal value	Value of a material property as declared by the producer/supplier of the material for the purpose of NGS.
Nominal strength	The value of the strength of the product as defined by the manufacturer.
Strain at nominal strength	The value of the strain at nominal strength as defined by the manufacturer.
NGS-tolerance	The NGS-tolerance for a characteristic is to be stated by the manufacturer in compliance with the NGS requirements.
Uniformity requirement U	Some products may have a large difference in strength and strain between machine and cross-machine direction. A uniformity requirement of 1.5 is included in order not to give credit for strain at failure higher than 1.5 times the direction with the smaller value.
NGS confidence limit	The nominal value plus or minus the NGS-tolerance is defined as the one / both sided NGS-confidence limit.
Sample	A sample consists of several single specimens. The number of tests on single specimens for a specific characteristic is specified in the test standards.
Test result	The average value of the tests on single specimens from the sample.

F	Maximum tensile strength (kN/m)
ε	Strain at maximum tensile strength
R	Energy index, R = 1/2*F*ε
RFCH	Reduction factor for environmental effects
RFCR	Reduction factor for creep-rupture
RFID	Reduction factor for installation damage
RFW	Reduction factor for weathering
Ti	The tolerance of the characteristic in engineering units
U	Uniformity requirement
MD	Machine Direction
CMD	Cross-machine Direction
TC	Technical Committee
AB	Advisory board
NCB	NorGeoSpec Certification Body
TL	Testing laboratories involved in the NGS system
PC	Product Certification
PS	Product Specification
EAGM	European Association of Geosynthetic product Manufacturers

4. Technical and Management administration

4.1 Technical Committee (TC)

The TC represents partners involved in NorGeoSpec, including representatives from the National Transport Administration in the countries where NorGeoSpec is applied and the NorGeoSpec certification body.
Each member of the TC board must sign a secrecy declaration; this is re-signed annually and continues in force after membership of the committee has expired.
The chairman of the TC is elected amongst its members for a period of 5 years. He is also the chairman of the advisory board.
The NCB representative manages the secretariat of the TC and the advisory board.
For the TC a minimum of one physical meeting per year shall be organized. Day-to-day information is handled by using the e-room (no response in two weeks means accepted).

Responsibilities: Technical Committee (TC)

The TC is responsible for:

- Review of information and results (checklist, inspection report and test results) which are presented by the NCB
- Recommending decisions for the certification of single products
- Final approval of NorGeoSpec document (e.g. revisions and new editions).

The TC is composed of:

- representatives nominated from the public administrations (one vote for each country),
- one representative from the NCB
- other representatives who may be appointed at the discretion of the TC.

A simple majority decides in cases of issuing certification or approval of a product. In cases of a hung vote, the chairman has the casting vote.

4.2 Advisory Board (AB)

In addition to the TC there is an advisory board whose membership is extended to include representatives of the producers and the testing laboratories involved in the NGS system (TL).
For the AB, a minimum of one physical meeting per year shall be organized. Day-to-day information is handled by using the e-room; no response in two weeks means accepted.

Responsibilities
The task of the AB is to give advice for:

- defining the strategic development and supporting the promotion of the system
- contributing to drawing up and revising the NorGeoSpec document
- ensuring that the NorGeoSpec document is harmonized with European and national regulations
- helping to resolve any conflicts out of court between involved parties by setting up Working Groups if necessary
- proposing experts for accreditation to the TC **(see Annex A: Role of experts)**

The AB is composed of

- the members of the TC
- Representatives from the manufacturers nominated by the European Association of Geosynthetic product Manufacturers (EAGM). The number of representatives is equivalent to the number of NorGeoSpec member states. Only manufacturers having product(s) certified according to NorGeoSpec certification should be nominated to the AB. Manufacturers' representatives are nominated by the EAGM for a period of 3 years. In order to ensure the continuity of the work in the AB, only one manufacturers' representative may be replaced after the 3-year period (In the introduction period of the NorGeoSpec 2012, exceptions to this rule are possible).
- two representatives from the testing laboratories. These are appointed by the laboratories involved in the NorGeoSpec system for a period of 3 years.

In order to ensure the continuity of the work in the AB, only one laboratory representative may be replaced after the 3-year period.

Recommendations of the AB require a majority of 2/3 of the members present (Example: 6 of 9, or 7 of 10 members). Should no majority be possible, for whatever reason, the chairman has the casting vote. The weighting of the votes is defined as follows: national transport administrations have one vote per country; the NCB, every manufacturer and every laboratory have one vote each.

4.3 Certification Body (NCB)

The certification body is mandated by the NorGeoSpec Technical Committee. The certification body receives the request from an applicant, is responsible for the subsequent certification process, and awards certification, taking advice from the TC.
Responsibilities
The NCB is responsible for the following:

- the application of the rules set out in this document
- carrying out all evaluation activities
- being responsible for, and retaining authority for decisions relating to certification
- the implementation of decisions recommended by the TC / AB
- ensuring that the Technical Committee properly performs its tasks in accordance with the rules laid down in the NorGeoSpec document
- organizing and running the administrative and technical secretariat
- investigations of files of certification requests, of inspections and verifications, of complaints, etc.
- preparation of and attendance at meetings of the TC / AB and the group of technical experts
- organization and management of all inspections and verifications
- mandating the inspection agents (inspectors / sampler)
- continual improvement in the quality of the test results of participating laboratories
- publication of certificates and other relevant information on the website
- nominating and managing the group of experts.

Requirements
The NCB must:

- be an organization conforming to EN ISO/IEC 17065 (General requirements for bodies operating product-certification systems)
- be accredited for product certification by an accreditation body involved in European Accreditation
- be a notified certification body under the CPR for product area Geosynthetics and geosynthetic-related products
- be completely impartial
- operate independently of the laboratories used for testing
- be mandated by the NorGeoSpec Technical Committee.

4.3.1 Inspection Body

The inspection body is mandated by the NCB. The accreditation of the inspection body is reviewed annually by the NCB in accordance with the requirements defined in the NorGeoSpec document. The inspection body can act as an inspector and/or a sampler.

4.3.1.1 Inspector

Responsibilities
The Inspector conducts an inspection of the producer´s manufacturing facility to assess whether the requirements of the NorGeoSpec rules are met. To do so, he conducts an audit inspection of the producer's manufacturing process. The basis for the inspection audit is a checklist provided by the NCB which is completed jointly by the Inspector and the producer. The questionnaire places particular emphasis on the following points:

- organisation
- quality management
- NorGeoSpec products and functions
- incoming goods control
- finished goods control
- control of NGS non-conform products
- type and spot testing

The Inspector prepares a report (Checklist) on the result of the inspection and gives this to the NCB.

Requirements
The Inspector must be accredited or be of recognized competence, especially in geosynthetics. The Inspector shall comply with the requirements of EN ISO 19011. Proof of the appropriate training must be demonstrated to the NCB.

4.3.1.2 Sampler

Responsibilities
The sampler shall take samples to be sent to the laboratory for testing. In doing so, he must observe the requirements of EN ISO 9862 and must take particular care to ensure that the product is marked in accordance with EN ISO 10320.

Requirements
The sampler must possess appropriate experience in the taking of samples, and must know and apply the provisions of EN ISO 9862 and NorGeoSpec.
The sampler shall be impartial and independent of the applicant.

4.4 Testing Laboratory (TL)

General
The testing laboratories involved in the NGS system are mandated by the NCB. The mandate is reviewed annually by the NCB in accordance with the requirements defined in this NorGeoSpec document. The laboratories perform tests on samples received from the inspection body. The results of the tests are sent to the NCB.
No direct contact is permitted between the testing laboratory and the producer in connection with an application for NorGeoSpec certification. Laboratories which contravene this rule will be excluded from further testing for a period decided in consultation with the TC.

Responsibilities
- The laboratory is responsible for testing the product in accordance with the test plan prepared by the NCB.
- The laboratory prepares a report on the results of the tests and submits this to the NCB. Interpretation of test results related to NorGeoSpec requirements may be given in an informative annex to the report.

Requirements
The laboratories shall fulfil the following requirements:
- The laboratory has an accreditation according to EN ISO/IEC 17025 covering the test performed,
- The laboratory is independent and impartial, i.e. not owned by a manufacturer of geosynthetics or by a holding company which also owns such a manufacturer.
- The laboratory is operating independently of the NCB.
- The laboratory participates in the programme of continuous improvement of testing quality organised by the NCB.

4.5 Confidentiality clause

All individuals involved in the Certification process must maintain absolute confidentiality about all matters to which they may become party. These include all information relating to certification and specification processes of NGS certification and specification requests regarding producers and products and all specific matters mentioned as confidential in TC meetings.

To this end, all members of the Technical Committee, the NCB, the laboratories involved in testing and the persons assigned to collecting samples sign a document in which they undertake to keep secret all information they receive relating to a specific manufacturer and/or his products. This confidentiality agreement continues in force while the individual is working for or represents NorGeoSpec as a member, and for a period of five years after the individual concerned has ceased his activities for NorGeoSpec.

5. Certification Process

Introduction

Compliance with the NorGeoSpec requirements is declared by the NCB to any manufacturer who applies for it, or to his authorized representative, on condition that the product concerned satisfies the rules currently published on the website www.norgeospec.org. **(see Annex B: Principle of the certification procedure)**

Compliance with the requirements is documented by:

- a Product Certification (PC)

The NCB is the prime contact of the manufacturer, or the manufacturer´s authorized representative.

5.1 Product Certification (PC)

In order to ensure that products are of the required quality, and to guarantee that this quality is maintained for a product lifetime equal to or greater than 25 years, the PC procedure includes

- primary inspection of the production process (validation of the values)
- primary testing of the products in a testing laboratory
- an estimation of product functionality for the declared service life
- continuous surveillance including unannounced random product sampling and control checks.

These activities are complemented by repeating the production inspection, and by re-taking samples and carrying out material testing, at regular intervals.
The applicant receives a Certificate with the results of the procedure.

5.2 Certification request

General Requirements

The geotextiles and geotextile-related products must comply with the requirements as set down in the relevant hen Application Standards.

Compliance of a product with the NGS system can only be confirmed for manufacturers

- who fulfil NGS Specific Quality Control requirements, and
- whose product characteristics comply with the requirements stated in Annex C, table 1.

The values called for in the Product Certification depend on the function and the declared product lifetime.
Irrespective of the function, a minimum lifetime of 25 years is required.
The product values called for (or the procedure to be followed in estimating their lifetime), their relevance to the conditions of use, and the test methods to be used are detailed in Annex C **(Scope of testing for Product Certification).**

5.2.1 Responsibilities of the applicant

The applicant is responsible for any manufacturing faults, and for errors of marking and labelling. The right to use the NorGeoSpec certificate does not transfer the applicant's liability to the NCB or TC under any circumstances. In essence the manufacturer remains legally responsible in all respects relating to the placement of the product in the market.

- The products for which approval is requested must have a CE Mark in accordance with the relevant hen Application Standards
- The manufacturer of the product(s) must have a documented system for the factory production control.
- Any changes in raw materials, in production methods or in the methods used to monitor production quality (such as characteristics declared for CE marking, or those required by NorGeoSpec, e.g. mass per unit area and dimensions) must be made known to the NCB immediately. Such changes could automatically induce the withdrawal of NorGeoSpec Certification for this product and must be discussed with the NCB.
- The applicant accepts all the conditions imposed by the current issue of the NorGeoSpec and its annexes.

5.2.2 Responsibilities of the NCB

The NCB is responsible for the application of the PC as defined in the NorGeoSpec and its annexes.
In addition, the NCB

- receives requests from the applicants and, dependent on the level of documentation, declares compliance with the NorGeoSpec requirements for the Product Certification
- guarantees that all applicants are treated equally
- mandates the inspection agent.

5.3 Requirements

Compliance with the NorGeoSpec requirements is declared by the NCB to any applicant (manufacturer, or importer/distributor acc. Article 15 CPR) manufacturer´s authorised representative), who applies for it, on condition that the product concerned satisfies the rules set out herein.
In cases in which the applicant is not the producer

- the applicant has the right to use the NorGeoSpec under his own brand name as long as the producer maintains the NorGeoSpec certificate for this product.
- compliance can only be declared for a product with the same name as on the document accompanying its CE Mark.

The applicant applying for compliance with the NorGeoSpec rules must:

- have a contract with the NCB, which will be responsible for the certification process and for conducting continuous surveillance. This involves unannounced sampling at production sites, at the warehouse, and on construction site (rules and number of samplings are given in **Annex D: Sampling and sampling procedure)**
- publish the same nominal value for each required characteristic for the NorGeoSpec as for the DoP (Declaration of Performance) at the time of certification
- inform the NCB of any fundamental modifications made to the production process, such as a change in the DoP
- facilitate the assignments of the inspection agent described in the present rules
- accept without objection decisions taken in accordance with the present rules
- inform the NCB in cases where manufacturing or the manufacturing control process has ceased
- inform the NCB of all production facilities and stock locations operated by the manufacturer for the products for which Certification has been requested
- accept publication of the list of its certified or attested products and their NorGeoSpec 2012 Product Certificates
- ensure that there is no association of the NorGeoSpec Certificates with information not covered by the Certificate.

5.3.1 Requirements: Service life up to 25, 50 and 100 years

If a product service life up to 25, 50 and 100 years is to be certified for a product, the product or product family must fulfil all the conditions and requirements set out in relevant hen application standards (functions separation and filtration) and additional requirements of ISO/TR 20432 and ISO TS 13434 (Function reinforcement), (see ANNEX C)

The NCB can issue a Product Certificate according to the following requirements:

- the geosynthetic or the geosynthetic-related product must fulfil all the conditions and requirements set out in relevant hen application standards.
- the manufacturer shall provide values and tolerances for the characteristics according to **Table 1, Annex C** [1)] of this document

1) Values corresponding to 95% confidence limits. Value ± the tolerances shall be within the tolerances given in Table 1, Annex C.

- the production facility and the factory production control must have successfully passed inspection by the NCB or an inspector designated by the NCB.
- when requesting certification, primary type testing must be performed on all products and for all characteristics according to **Table 1, Annex C**
- sampling and testing must be organised by the NCB. The testing must be performed in an NCB-accredited external laboratory.
- the results of primary product testing must be available and fulfil the requirements of the NorGeoSpec Documents.

5.4 Decision procedure: Product Certification

Service life 25 years

- If the test result(s) (average of the sample tested) for the particular characteristic(s) is (are) within the 95% NGS- confidence limits, the product is accepted.
- If the test results for one or more of the particular characteristics are outside 1.5 times the tolerance values provided by the manufacturer, the product does not comply with the requirements.
- If the test results for one or more of the particular characteristics are between 1 and 1.5 times the tolerance values given by the manufacturer, sample B shall be tested.
- If the test results of sample B for one or more of the same particular characteristics are within the tolerance values provided by the manufacturer, the product is accepted as complying with respect to that (those) characteristic(s).
- If the test results of sample B for one or more of the same particular characteristics are outside the tolerance values given by the manufacturer, the product does not comply with respect to that (those) characteristic(s).

Service life up to 50 and 100 years

Same requirements as for 25 years, plus

- An estimate of the product lifetime for the foreseen function must be provided and accepted by the NCB.
- A system for the ongoing monitoring of the long-term properties must be agreed between the producer and the NCB according to the present system, and be implemented.

5.5 Non-conformity

In case of non-conformity of a product, the NCB, with advice of the TC, reaches and communicates a decision; this may be a suspension of between 3 and 12 months, or complete cancellation of the NorGeoSpec Product Certificate. Other reactions may be decided based on advice from the TC.
Non-conformity is declared when test results from random sampling and testing are outside the declared NGS- confidence limits.

5.6 Validity of the Certificate

The NorGeoSpec 2012 Product Certificate is valid in all countries in which NorGeoSpec applies.
The NCB distributes the information on behalf of the TC on the website www.norgeospec.org. [1)]

1) Signed certificates are only provided on the NorGeoSpec website.

The NorGeoSpec Product Certificate is valid for a 2-year period, provided that the rules as defined in this document are adhered to.

The Certificate states:

- the name of the NCB which has issued the Certificate
- the declared values fulfilled by the product (function: separation and filtration, reinforcement)
- the information related to the product durability.

5.7 Renewal of a request

A request that has been refused cannot be renewed within a period of six months after the refusal.

6. Verifications

6.1 Verifications performed by the applicant

The applicant is responsible for controlling the equipment, raw materials and manufacturing of products in order to benefit from the right to use the NorGeoSpec Product Certificate. He must ensure a continued verification of the production and must maintain reliable records of the results.

On request, he must present these to the inspector and facilitate the accomplishment of the inspector's mission.

6.2 Verifications performed by the inspection agent

Verifications are made at the production location of the products to be certified. The inspector conducts

the inspection following the points mentioned in point 5.1 of this document and takes samples for all tests stated in the present rules.

6.3 Verification of PC, continuous surveillance

Verification of NGS Specific Control samplings of all certified products and testing of all characteristics are undertaken every second year by the NCB at the production location and performed in an NCB-approved laboratory, on the NCB's initiative.

For products one of whose most important properties is their long-term behaviour (e.g. reinforcement function), the NCB draws up a programme designed to continually update the characteristics which determine the long-term behaviour. **Annex E: Scope of random control-check testing** gives an indication of some of the likely aspects of such a programme.

6.4 Unannounced random product sampling and control checks

The NCB organizes random control checks.
Samples can be taken from:

- Producer's stock
- Distributor's stock
- Construction site

Principle: For the client, there is no difference between the stock of the producer and the stock of the distributor; the producer is responsible for guiding and training the distributor to handle and store the products in a manner commensurate with maintaining the properties and service life. If samples taken from stock fail to pass: See point 7.4 of this document. If samples taken from a site fail to pass: NGS certification body organizes announced random sampling from stock („new B-sample") and checks the factory production control data.

The announcement about the random sampling and checks to the producer and/or the applicant[1)] is made three working days prior to the check. If the samples are taken from the distributor's warehouse, or from a construction site, the distributor is also informed.

PC: At least one unannounced random control per year must be organized. During the certification period of two years, a product will be tested at least once, but not necessarily on all the characteristics.
Note: A full audit, sampling and testing will be performed every two years, and one unannounced sampling will take place per year.

The selection of products for random sampling takes into account information as to which products have been produced and are available at the time of the audit. Excluded from this rule are products of which less than 2,000 m² have been produced in the previous 12 months. In this case, the producer must notify the NCB in writing that less than 2,000 m² have been produced, and sampling is then carried out as soon as manufacture of this product is re-started.

Notes on sampling, and on the tests carried out during the random control checks, are given in **Annex E**.

[1)] In cases in which the applicant is not the manufacturer of the product, or manufacture takes place outside the European Economic Area EEA, sampling may be carried out at the applicant´s warehouse.

Random sampling on site by the client (National Transport agency)

The client can organize random sampling on site. The samples are taken by trained inspectors and sent (in agreement with the NCB) to a TL. Results are sent also to the NGS certification body. If the product fails, the project manager decides on consequences (e.g. economic). Based on results, the NGS certification body may organize announced random sampling or checks on the factory production control data.

6.5 Extraordinary verifications

On request, the NCB will investigate all abnormal occurrences (e.g. objections, complaints). If no solution is found the Technical Committee shall be involved. The costs of such verifications must be borne by the applicant for the NorGeoSpec 2012 Product Certificate if product non-conformities are found.

7. Certification

The NCB, with advice from the TC, decides whether a product complies with the NorGeoSpec requirements and authorises the issuing of a Product Certificate for that product, or for the family of products represented by the product tested.

The award, renewal, suspension or cancellation of Certification takes effect from the date of receipt of the decision by the applicant. However, the obtaining of the NorGeoSpec Certification is dependent on the payment of all the related costs (see 7.3 below).

Product Certificates are published on the NorGeoSpec website: www.norgeospec.org. These Certificates are valid for a period of two years from the date of issue unless they are suspended or cancelled as outlined below:

7.1 In case of non-conformity of a product

Where an inspection, whether announced or unannounced, reveals non-conformity of a product, the TC is immediately notified and meets (in person, or by other means) to recommend appropriate action to the NCB. The NCB decides what action needs to be taken e.g. whether Certification for that product, and any product family represented, should be suspended or cancelled with immediate effect. In this case, a notice is posted on the NorGeoSpec website. The manufacturer is informed by the TC in writing within 10 days of the steps which need to be taken to re-instate the Certification.

If Certification has been cancelled, the manufacturer, or his authorised representative, must re-apply for Certification. If the Certification has been suspended, the manufacturer has a period of 60 days from receipt of the TC's communication in which to demonstrate compliance with the steps required. At the end of this period, if the TC is not convinced that compliance has been adequately demonstrated, the TC recommends cancellation of Certification to the NCB. The suspension remains in force until the NCB has reached its decision.

7.2 In case of voluntary withdrawal of a product

Voluntary withdrawal of a product is possible after a minimum period of 2 years from the date of issue of the Certification. The cancellation is announced by the NCB and any remaining stock of the product, or of the related product family, may be sold under the NorGeoSpec within a period of 6 months from the date of cancellation.

7.3 In case of non-payment of the fees

If, after the customary warning notice, the applicant has failed to pay the fees due, the NCB rules on cancellation of Certification. From the date of cancellation, no further sale of product in stock may be made under the NorGeoSpec system. A notice regarding the cancellation is published on the NorGeoSpec website.

7.4 In case of non-compliance by the applicant in respect of the responsibilities

Where an inspection, whether announced or unannounced, reveals deficiencies in the Factory Production Control systems relating to the certified product, Certification for that product, and any product family represented, is suspended with immediate effect. A notice to this effect is published on the NorGeoSpec website. The manufacturer is informed by the TC in writing within 10 days of the steps which must be taken to re-instate the Certification.

The manufacturer has a period of 60 days from the date of the inspection in which to demonstrate compliance with the steps required by the TC. At the end of this period, if the TC decides that compliance has not been adequately demonstrated, the TC recommends cancellation of Certification to the NCB. The suspension remains in force until the NCB has reached its decision.

7.5 Dates of taking effect

The certified or attested products affected by a suspension or a cancellation are removed from the list of NorGeoSpec products on the website.

7.6 Change in the commercial reference of certified product

A change in the commercial reference of certified products can take place under the following conditions:

- All properties remain unchanged.
- The applicant does not manufacture under the old reference from the date from which the new reference applies.
- The validity of old certificates is limited to 6 months after the change of reference.
- The applicant does not publish both references on the technical data sheets or commercial documents.
- The applicant does not re-use the names of products previously certified or attested.

7.7 Appeals

Where the applicant disagrees with a Certification-related decision, he may lodge one, and only one, appeal with the TC. The appeal must be presented within a period of 30 days from the date of receipt of the notification of the corresponding decision. All costs related to the appeal must be borne by the applicant.

Three different types of appeal are possible:

I. on the test results recorded by the TL
II. for non-compliance with the applicant's responsibilities
III. for non-payment of costs

In case number I, additional tests are carried out on specimens retained from the original sample in an alternative TL mandated and chosen by the NCB. If the results are in accordance with the values indicated by the applicant, the TC is consulted by e-mail for final decision. If the results are not in accordance with the values, the case is considered at the next TC meeting and a decision recommended to the NCB. In case number II the appeal is studied by the TC and recommendations are made to the NCB. The NCB prepares the file and meets the applicant if possible. A final decision is reached by the NCB and communicated to the applicant. Appeals do not delay the application of the decision.

7.8 Unauthorised use of the certificate

In case of unauthorised use of a NorGeoSpec 2012 Product Certificate, the TC can decide and take any action it deems necessary.

8. Contentious matters

The law and tribunals of the country of the NCB apply with regard to contentious matters.

9. Identification of characteristic properties – Fingerprint tests (informative)

The fingerprint test is a method of identifying differences between the raw material used for the primary type testing and that used in products from current production. Until a sufficiently broad database has been built up, it does not form part of the certification process.

Background

Tests designed to investigate the long-term performance of geosynthetics and geosynthetic-related products are mainly based on long-term testing (e.g. creep behaviour, or resistance to oxidation in the oven test, or to chemicals in the hydrolysis test). A test may typically take up to 10,000 h.

In addition, these tests are usually performed on specimens from one production lot.

In the course of external testing of such a product or product family, it is not possible to detect changes in raw materials (e.g. the use of different additives, or fewer additives, or the use of material from a different supplier) within an acceptable period.

It is well known that the performance characteristics of reinforcement products depend on the

- kind and specification of the raw material (e.g. density, molecular weight)
- kind and amount of the additives (e.g. masterbatch)
- production process, which influences the morphology of the material

The fingerprint test will provide a method of identifying differences between the raw material used for the primary type testing, and products from ongoing production.

Depending on the raw material used, tests selected from table 1 **Annex H** will have to be carried out, compared with the material from the primary type test and, if differences are detected, evaluated by a NorGeoSpec-approved expert.

Further steps

The fingerprint method is a new approach to controlling the long-term performance of reinforcement products. Once financing is secured a research programme will be implemented to investigate whether the approach can fulfil expectations.

If the results from this programme are positive, it is intended to make the fingerprint method obligatory in a future version of NorGeoSpec.

Annex A: Role of experts

General

In all areas in which the long-term behaviour of NorGeoSpec certified products is important, the NCB avails itself of external experts with the relevant experience [1)].

The NCB will provide the applicants with a list of approved experts.

The applicant is free to choose the expert. In individual cases, a connection between the expert and the applicant is not permissible. Such a case exists, for example, when a test result differs from that obtained in the initial type testing and the expert was involved in the original assessment of long-term behaviour.

The approval of an expert is valid for a period of 5 years.

Tasks of the experts

The tasks of the experts are:

- to prepare estimates of long-term behaviour for the applicant
- to advise on the choice of the relevant fingerprint testing and evaluation of the test results
- to give expert advice to the TC/AB in case of disagreement

Qualification of the experts

Experts must prove their experience in the area of durability. The following qualifications should be considered in their evaluation:

- at least 10 years of experience in the field of durability of geosynthetics
- publications in the field of durability of geosynthetics
- member of WG 5 CEN TC 189 (Durability)
- access to knowledge in the field of durability of polymers

1) When applying for a lifetime expectancy assessment for their products, applicants should preferably draw on the list of experts approved by the NCB.

Remarks:

Experts must refer to the latest state of the art in their assessments. Meetings organised annually by the NCB are designed to promote a harmonised approach of experts in their assessment of lifetime expectancy. Experts must sign a confidentiality agreement with the NCB.

Annex B: Principle of the certification procedure

The Certification process comprises a total of four phases:

1. Application phase

The Application phase begins with the submission of a request for Certification being made by the manufacturer or his authorized representative. The manufacturer, or his authorized representative, applies for a particular NorGeoSpec Product Certification for one or more of his products. The application form should be accompanied by a list of the products with the required functions as well as a statement relating to the required product lifetime. The applicant enters into a third-party audit and product-control contract with the TC mandated NorGeoSpec Certification Body (NCB).

The NCB considers the application and, bearing in mind the Certification applied for, stipulates the properties for which evidence must be provided. Alternatively, the NCB can offer the applicant a coordinating discussion on the Certification procedure and the properties for which evidence is to be provided.

The NCB checks whether all documents received are complete and correct.

2. Evaluation phase

In the second phase, the NCB or its designated representative examines the applicant's production facilities and takes samples of the products for which an application has been made. These are subsequently tested in a NorGeoSpec-approved laboratory in accordance with the NGS requirements. The results of the evaluation and the tests are documented in a report.

The NCB reviews the documentation presented by the applicant and the results of the audit and tests. The NCB submits a summary of the audit and tests results with a recommendation to the TC on whether the request should be refused or compliance with NorGeoSpec should be declared.

3. Certification phase

In this phase, the TC reviews the results of the evaluation and decides whether the request should be refused or compliance should be declared.

If the TC decides that the compliance should be declared, the NCB issues the NorGeoSpec 2012 Product Certificate and publishes it on the website.

4. Inspection phase (Surveillance phase)

The Certification is valid for a period of 2 years. To confirm that the quality of the product remains unchanged throughout this period, a production audit including sampling is carried out at a predetermined interval. Selected properties of the samples are measured to confirm that the quality has remained at the required level

Annex C: Scope of testing for Product Certificate (PC)

The properties which must be tested for the Product Certification are listed in Tables 1-2 and described in the clause "Performance assessment of this Annex.

Table 1: Certified values with tolerance (in % of values) depending on the function fulfilled by the product

Characteristic	Standard	Unit	Function		
			Filtration	Separation	Reinforcement
Product identification					
Mass per unit area[1)]	EN ISO 9864	g/m²	± 10 %	± 10 %	± 10 %
Tensile elements	Annex F		n.r.	n.r.	Manufacturer's data
Dimensions	Annex F [2)]	mm	n.r.	n.r.	± 15 %
Mechanical tests					
Max tensile strength	EN ISO 10319[3)]	kN/m	-10 %	-10 %	n.r
Tensile strain at max tensile load	EN ISO 10319	%	-20 %	-20 %	n.r
Nominal tensile strength	EN ISO 10319	kN/m	n.r	n.r	-5 %
Tensile strain at nominal strength	EN ISO 10319[3)]	%	n.r.	n.r.	± 20 %
Tensile stiffness at 2, 5, 10% tensile strain	EN ISO 10319	kN/m	n.r.	n.r.	-20 %
Static puncture test	EN ISO 12236	kN	-10 %	-10 %	-10%[4)]
Dynamic perforation resistance	EN ISO 13433	mm	+25 %	+25 %	+25%[4)]
Hydraulic tests					
Permeability normal to the plane without load	EN ISO 11058	mm/s	-30 %	-30 %	-30 %[4)]
Characteristic opening size	EN ISO 12956	µm	±30 %	±30 %	±30 %[4)]

[1)] We regard the plus/minus NGS-tolerance on the mass per unit area as an indication of the process stability. Process stability means that the process delivers constant, predictable results.

[2)] Applicable only for geogrids (definition acc. EN ISO 10318).

[3)] MD and CMD direction. For uniaxial products, test only the direction of load uptake

[4)] Voluntary

n.r. = not required

Performance assessment (Service Life up to 25, 50 and 100 years)

If a product service life up to 25, 50 and 100 years is to be certified for a product, the product or product family must fulfil all the conditions and requirements set out in relevant hen application standards (functions separation and filtration) and additional requirements of ISO/TR 20432 and ISO TS 13434 (Function reinforcement):

- the reduction factor determination should be made by an expert recognised by the NCB
- the tests forming the basis of the service life and reduction factor determination may not be older than 5 years and must have been carried out in accordance with, or based on, the procedures detailed in Table 2, Reduction factor determination.
- the tests forming the basis of the product service life and reduction factor determination shall be carried out in laboratories which are accredited in accordance with EN ISO/IEC 17025 and / or recognised by the NCB .

Should any doubt exist regarding the competence of individual laboratories, the NCB reserves the right to reject the results of such laboratories. In individual cases, testing may be carried out in the producer's laboratory (if this laboratory is appropriately equipped). In such cases, the NCB will convince itself of the competence of the producer's laboratory.

The producer must regularly update the data which formed the basis for the product lifetime estimate. The nature and extent of this testing are agreed between the producer and the NCB, and form part of the certification.

Table 2: Reduction factor determination

Characteristic	Standard	Requirements
Resistance to weathering	EN 12224	RF_W
Chemical resistance [1)]	EN 12447 EN ISO 13438 EN 14030	RF_{CH}
Tensile creep rupture	EN ISO 13431 ASTM D 6992	RF_{CR}
Damage during installation	Annex G	RF_{ID}
Direct shear test [2)]	EN ISO 12957-1	Manufacturer declaration

RF_W = reduction factor for weathering

RF_{CH} = reduction factor for environmental effects

RF_{CR} = reduction factor for creep-rupture

RF_{ID} = reduction factor for installation damage

1) Depending on raw material

2) Voluntary

The tests listed in Table 2 can be performed on a type representative of the product group.

Annex D: Sampling and sampling procedure

General

Samples are taken in accordance with EN ISO 9862 – Geosynthetics: Sampling and preparation of test specimens. Two samples (A and B sample) are taken from two different rolls [1)2)]. The sample lengths are:

- for the Separation and Filtration functions: 5 m (over the whole width of the roll)
- and for the Reinforcement function: 2 m (over the whole width of the roll)

Samples A and B are sent to the NorGeoSpec-approved laboratory selected by the NCB. In case B sample tests are necessary, tests on B samples can be carried out in the same laboratory as the A sample. To reduce the number of sampled rolls, the B sample roll can be sealed. In case B sampling testing is necessary, the sealed part of the roll must be cut off and sent to the laboratory which carried out the A sample tests. In case B sample tests are necessary, only the failed characteristic and the identification test have to be repeated, and the producer is free to take additional samples for his own Factory Production Control. The producer is responsible for the dispatch of samples.

The samples must be identified in an unmistakable manner and the following minimum information must be provided:

a) Description of the sample (A or B)
b) Product name and type
c) Production direction
d) Roll number and date of sampling
e) Signature of person responsible for sampling.

1) In order to sample as wide a cross-section of the production as possible, rolls should be selected whose numbers are spaced as far apart as possible.

2) Samples are taken from the max. width delivered to the market.

The person responsible for sampling must write a report, sign it, and have it countersigned by the producer or the producer's representative. The report must contain at least the following information:

a) Producer and factory
b) Location of sampling
c) Product name and type
d) Roll number
e) Product function (Separation and Filtration, Reinforcement, ...)
f) Product description in accordance with EN ISO 10320
g) Details of any and all variances from the defined sampling procedure, including observations made during selection and sampling (e.g. faulty areas)
h) Number of rolls in the warehouse or on site of each product due for testing
i) Place and date
j) Signatures (Producer/Representative, Person responsible for sampling)

A copy of the report is given to the producer immediately after sampling; the original is retained by the person responsible for sampling.

The following minimum number of rolls of each NorGeoSpec-certified product must be available in the producer's or the dealer's warehouse, or on site, for initial testing and for regular sampling for continuous monitoring:

- for the Separation and Filtration function 10 rolls
- and for the Reinforcement function 5 rolls

Shipment:
Products for the function separation and filtration should be folded not smaller than 1 m x 1 m.
Products for the function reinforcement should (depending on the product) preferably be shipped wound on a solid core.

Unannounced random product sampling

The selection of products for random sampling may be based upon information as to which products have been produced and are therefore available at the time of the audit.

For products of which less than 2000 m² have been produced in the previous 12 months, no sampling is required. In this case, the producer must notify the NCB in writing that less than 2000 m² have been produced. Sampling is then carried out as soon as manufacture of the product is restarted. For these products the NCB is informed in advance on production dates of materials requested for sampling.

Table 1: Definition of representative stock and number of products to be sampled based on the numbers of products in the range (unannounced random product sampling)

No. of products certified [1)]	**Number of products on stock**	**Number of products sampled**
n = 1	1	1
n ≤ 5	at least 2 or 80 % of n[2)]	at least 2
5 < n ≤ 10	at least 6 or 80 % of n[2)]	at least 50% of n[1)]
n > 10	at least 8 or 80 % of n[2)]	at least 50% of n[1)]

1) Valid for one product range

2) If the result of multiplying by 50 % or 80 % is a fraction, the number is rounded up

Annex E: Scope of Random Control-Check Testing

The properties to be tested in the random control checks are listed in Table 1.

Random control

Table 1: tests to be carried out [1)]

Characteristic	Standard	Unit	Function		
			Filtration	Separation	Reinforcement
Mass per unit area	EN ISO 9864	g/m²	+	+	+
Tensile elements	Annex F		n.r.	n.r.	+
Dimensions	Annex F	mm	n.r.	n.r.	+
Mechanical tests					
Max tensile strength	EN ISO 10319	kN/m	+	+	n.r.
Tensile strain at max. load	EN ISO 10319	%	+	+	n.r.
Nominal tensile strength	EN ISO 10319	kN/m	n.r. -	n.r. -	+
Tensile strain at nominal strength	EN ISO 10319	%	n.r.	n.r.	+
Tensile stiffness at 2, 5, 10% strain	EN ISO 10319	kN/m	n.r.	n.r.	+
Static-puncture test	EN ISO 12236	kN	+	+	see table 1
Dynamic perforation resistance	EN ISO 13433	mm	+	+	see table 1
Hydraulic tests					
Permeability normal to the plane without load	EN ISO 11058	mm/s	+	+	n.r.
Characteristic opening size	EN ISO 12956	µm	+	+	n.r.

[1)] Not all properties are required to be tested in the course of the regular control testing.

Performance assessment

The assessment of product reduction factors is valid for five years starting from the date of issue of the Certificate. Throughout this period it must be ensured that the test values on which the assessment is based remain valid, and that they reflect the behaviour of the product at the time of first Certification.
The testing programme required to ensure this is determined and monitored by the NCB (and the independent expert, if required). The NCB ensures that all applicants are treated equally in this regard. Among other items, the test programme to ensure maintenance of long-term properties will

- determine test regimes and frequency of testing
- establish how many products are required to represent a product family
- stipulate which tests are to be performed and how the results are to be interpreted / evaluated
- determine what action is to be taken when results do not correspond with the predetermined values

Annex F: Test procedure for the determination of the grid apertures and dimensions

- **Grid apertures**

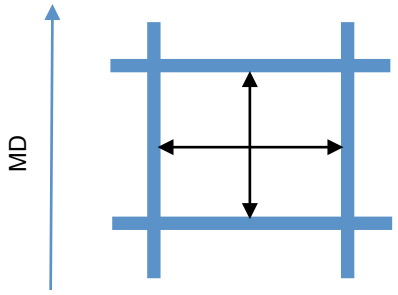
The test method is used to determine the number of grid apertures over the production width.

Testing

Count the numbers of grid apertures over the whole width of the product. Repeat this procedure 3 times and state the number.

Remark:
All three measurements should lead to same grid numbers. If not, counting should be repeated on three further positions.

Example: Biaxial Geogrid

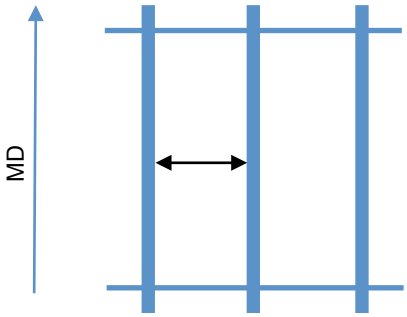


- **Dimension of grid apertures**

The test method is used to determine the dimensions of the grid apertures – and is only to be used for geogrids (GGR).

The report shall specify the following: Mean value, standard deviation and coefficient of variation

Example: Monoaxial Geogrid



- **Test set-up**

The test set-up must allow measurement of the dimensions of the grid apertures, to an accuracy of ±0.1 mm.

- **Test pieces**

Cut at least 10 test pieces (dimensions min. 200 x 200 mm, or use the specimen of the mass per unit area test) spaced over the full width of the sample.

The test pieces must be conditioned for 24 h under standard-climate conditions in accordance with ISO 554 (20 ± 2°C, RH 65 ± 5%).

- **Testing**

The tests must be performed on one mesh per specimen and specified in mm, with one digit after the decimal point.

Annex G: Test procedure damage during installation

Test procedure for damage during installation

In additional to the index tests in accordance with EN ISO 10722 large-scale tests must be carried out to determine the reduction factor for damage during installation.

The testing procedure for these tests is described below.

From the roll of geosynthetic, cut a test sample of sufficient size to serve as reference material for at least 5 wide-width tensile-strength tests according to EN ISO 10319. When performing the tests, deviate from EN ISO 10319 in ensuring that the free gauge length is 300 mm and that, in the case of geogrids, at least 2 complete grid apertures in the test direction are tested. If necessary, protection of the clamping area can be used.

The product to be tested is then laid out on a defined surface, cover filled and the cover fill compacted. The fill material is then excavated and the product removed, taking care that no additional damage is caused during removal.

A 250 mm thick layer of the appropriate aggregate is placed and compacted on a subgrade which is firm enough to permit proper compaction. The bearing capacity and characteristics of subgrade and aggregate used must be stated. The geosynthetic to be tested is then laid on this compacted formation. Before the upper aggregate layer is placed, the areas to be used as test pieces are marked on the geosynthetic. The 10 test pieces (500 x 200 mm plus 100 mm in each direction) must be evenly distributed over the loaded area. The edges of the 10 test samples to be tested must be defined in such a way that they can be positively identified after the samples have been excavated.

The tests must be carried out in the same manner as the reference tests, on the same testing machine with the same clamps and under the same test conditions. All 10 test pieces must be tested and the results included in the test evaluation. The upper 250 mm thick aggregate layer should ideally be placed using a vibratory compactor with a weight between 10 and 12 tonnes. Dynamic compaction should be carried out until a standard Proctor density Dpr of 95 % is achieved. After compaction, the degree of compaction of the fill must be determined.

Three different aggregate particle sizes (fine, medium, coarse) preferably according part 2, Annex B, table 2 of this document should be used.

The test report must describe the soil types used, the installation, and the type of equipment used. In addition, the number of roller passes and the degree of compaction of the aggregate must be stated.

The reduction factor is stated as the reciprocal of the average value exhumed /average value reference of the residual tensile strength.

Annex H: Fingerprint test

Identification of characteristic properties (Fingerprint)

In agreement with the NCB and with the involvement of an expert where necessary, the producer defines the tests which need to be performed, and the characteristics of the polymer used.

After the initial testing of the product, the NCB, together with the producer, fixes the definitive characteristics for continuous monitoring. The fingerprint may be used for follow up of the long-term behaviour of a product range.

Table 1: Test identification of characteristic properties (Fingerprint)

No.	Property	Standard	Raw material[2)]					Require-ment
			PP	PE	PA	PVA	PET	
1	Density	EN ISO 1183-1						1)
2	Melt mass-flow rate MFR Melt volume-flow rate MVR	EN ISO 1133						1)
3	Enthalpy of fusion Melting point Glass-transition temperature	EN ISO 11357-3						1)
4	Carboxyl end-group content	GRI-GG7 or ASTM D 7409						1)
5	Oxidation induction time OIT	EN ISO 11357-6						1)
6	Average molecular weight	GRI-GG8						1)
7	Carbon black content	EN ISO 11358 or ASTM D 1603-06						1)
8	Solid-liquid extraction UV spectroscopy HPCL-analysis on extract	-------						1)
9	FTIR Fourier transform infrared radia-tion spectroscopy							1)
10	Extra test may be added based on proposal of the producer, if validated by the expert and the NCB							

[1)] Manufacturer's specification: consistency of the values shall be proven to the NCB

[2)] The use of raw materials not listed in this Table is only permitted in agreement with the NCB. The NCB fixes the tests to be performed in agreement with the producer.

Part two – Product Specification (PS) Function: Separation and Filtration – roads and other trafficked areas

Table of contents

1. General

This part of the guideline presents the Nordic system for the specification of geosynthetics and geosynthetic-related products used for

- Separation and filtration,

in areas covered by the relevant hen application standards.

Products which are intended to be specified in accordance with a specification require a NorGeoSpec 2012 Product Certificate in accordance with Part 1 of these Guidelines.

Product specifications acc. to part 2 of the NorGeoSpec guideline are voluntary.

2. Specification process

Compliance with the NorGeoSpec specifications is declared by the NorGeoSpec Certification Body (NCB) to any manufacturer who applies for it, or to his authorized representative, on condition that the product concerned satisfies the rules currently published on the website www.norgeospec.org.

Compliance with the requirements can be achieved by a

- Product Specification (PS).

The NCB is the prime contact of the manufacturer, or the manufacturer´s authorized representative. The NCB administers the procedures of both „Product Certification“ and „Product Specification“ and is advised by the Technical Committee.

2.1 Function: separation and filtration

The specification part of the function separation and filtration includes five specification profiles based on seven characteristics measured with test methods defined by CEN and ISO. The system also includes guidelines for the selection of the relevant specification profile.

The separation function is always used in conjunction with filtration; accordingly separation will never be specified alone.

This specification should not be applied in cases where high water flow is expected, such as in ditches. In such cases other specifications based on a site-specific design should be used.

With the specification procedure, the products under examination can be allocated to one of the 5 different specified profiles in NorGeoSpec Part 2, **Table 1, Annex A** of this document. Guidelines for evaluation of the relevant specification profile dependent on the application are given in NorGeoSpec Part 2, **Annex B**.
The applicant receives a Certificate of the profile achieved (NorGeoSpec 2012 Product Certificate).

2.2 Decision procedure: Product Specification

Function: separation and filtration

- the results of initial product testing must comply with the requirements of the profile applied for **(Table 1, Annex A)**

2.3 Validity of the Certificate

The NorGeoSpec Product Specification is valid in all countries in which NorGeoSpec is applied.
The NCB distributes the information on behalf of the TC on the website www.norgeospec.org.

The Product Specification (PS) is valid for a 2 year period, provided that the rules as defined in this document are followed.
The NorGeoSpec 2012 Product Certificate includes:

- the name of the NCB which has issued the PC
- the signature(s) of responsible persons in the NCB and the head of TC

Function: separation and filtration

- the profile number of the product.

Annex A: Required values – Product Specification

Table 1: Required values – Product Specification

	Function: separation and filtration							
Characteristic	**Testing standard**	**Unit**	**Maximum tolerance [1)]**	**Required[2)] values corresponding to 95% confidence limit**				
				Product Specification profiles				
				1	**2**	**3**	**4**	**5**
Min tensile strength	EN ISO 10319	kN/m	-10%	6	10	15	20	26
max. load	EN ISO 10319	%	-20%	15	20	25	30	35
Max cone drop diameter	EN ISO 13433	mm	+25%	44	38	28	22	13
Min energy index		kN/m		1.2	2.1	3.2	4.5	6.5
Min velocity index	EN ISO 11058	10^{-3} m/s	-30%	3	3	3	3	3
Max characteristic opening size, O_{90}	EN ISO 12956	mm	±30%	0.2	0.2	0.2	0.15	0.15
Max tolerance for mass per unit area	EN ISO 9864	g/m²	±10%					
Max tolerance for static puncture strength	EN ISO 12236	kN	-10%					

1) The tolerance shall be stated by the manufacturer; this table gives the maximum allowable tolerance.

2) The tolerances are not to be added to the required values. The nominal values ± the tolerance shall fulfil the requirement.

Strength and strain properties, 95% confidence limits

The 95% confidence limits for strength and strain characteristics are calculated as:

$$F_{MD,95} = \left\{F_{MD} - T_{F,MD}\right\}, \quad F_{CMD,95} = \left\{F_{CMD} - T_{F,CMD}\right\}$$
$$\varepsilon_{MD,95} = \left\{\varepsilon_{MD} - T_{\varepsilon,MD}\right\}, \quad \varepsilon_{CMD,95} = \left\{\varepsilon_{CMD} - T_{\varepsilon,CMD}\right\}$$

For the tensile strength and tensile strain at maximum load the specification profiles are related to average characteristics in machine and cross machine direction (MD and CMD). To give limited credit for large differences in strength in MD and CMD, a uniformity requirement (U=1.5) is included in this specification. Strength values higher than 1.5 times the minimum of the MD and the CMD are not taken into account. The 95% confidence limits for the average characteristics are then calculated as:

$$F_{a,95} = 1/2 \cdot \left\{F_{MD,95} + F_{CMD,95}\right\}, \quad \left\lfloor F_{a,95} \le \tfrac{1}{2} \cdot (1+U) \cdot Min(F_{MD,95}, F_{CMD,95}) \right\rfloor$$
$$\varepsilon_{a,95} = 1/2 \cdot \left\{\varepsilon_{MD,95} + \varepsilon_{CMD,95}\right\}$$

Strain energy index, 95% confidence limit

The strain-energy index R is defined as the product of the maximum tensile strength multiplied by the strain at maximum strength divided by two. The average of MD and CMD is used for both strength and strain.

$$R_a = 1/2 \cdot F_a \cdot \varepsilon_a$$

The manufacturer is not obliged to state the tolerance value for the strain-energy index R. T_R is therefore estimated on the basis of the tolerances for strength and strain. The average tolerances in machine and cross machine direction are calculated as:

$$T_{F,a} = {}^1/_2 \, (T_{F,MD} + T_{F,CMD}), \qquad T_{\varepsilon,a} = {}^1/_2 \, (T_{\varepsilon,,MD} + T_{\varepsilon,\,CMD})$$

The nominal values for the average strength and strain properties are calculated as:

$$F_a = 1/2 \cdot \left\{F_{MD} + F_{CMD}\right\}, \quad F_a \le \tfrac{1}{2} \cdot (1+U) \cdot Min(F_{MD}, F_{CMD})$$
$$\varepsilon_a = 1/2 \cdot \left\{\varepsilon_{MD} + \varepsilon_{CMD}\right\}$$

Assuming that the tensile strength and the strain at maximum tensile strength are independent variables, the tolerance of the strain-energy index can be estimated using the following formula[3]:

$$T_{R,a} = \tfrac{1}{2} \sqrt{T_{F,a}^2 \cdot \varepsilon_a^2 + F_a^2 \cdot T_{\varepsilon,a}^2}$$

The 95% confidence limit for R is expressed as:

$$R_{a,95} = 1/2 \cdot F_a \cdot \varepsilon_a - T_{R,a}$$

[3] The calculation must be made with the tolerances in engineering units

Annex B: Guidelines for selection of specification profile

The selection of the product-specification profile is based on subsoil conditions, fill-material grain size and a combination of construction conditions and quality requirements for the road. For conditions not covered by these guidelines, a special evaluation of required specification profile should be made.

The construction conditions and road-quality requirements are combined into traffic classes Normal and High according to the following:

Subsoil:
The subsoil is divided into two groups, Soft and Firm. These groups can be categorised according to soil type and shear strength:

- Soft: soft clay with undrained shear strength ≤ 25 kPa, and peat.
- Firm: medium and stiff clay with undrained shear strength > 25 kPa, and sand and gravel.

Construction conditions:
- Normal: Two or more of the following conditions: Heavy construction traffic, angular and sharp fill material, compaction with heavy and vibrating equipment, construction traffic running on fill layers with a thickness less than 300 mm.
- Favourable: For fill material with maximum grain size < 200 mm and layer thickness > 1,5 x d_{max} (maximum grain size).

Traffic:
- High: - medium and high-volume roads (> 500 vehicles per day)
- Low: - access roads, lightly-trafficked roads (< 500 vehicles per day)

Based on these input parameters, the selection of the relevant specification profile can be made according to Table 2.

Table 2: Selection of relevant specification profile

Subsoil	Construction conditions	Traffic	Maximum grain size (dmax) in fill material (mm)			
			d_{max}<63	63< d_{max}<200	200< d_{max}<500	d_{max}>500
Soft	Normal	High Normal	3 3	4 4	5 4	5 5
	Favourable	High Normal	3 2	3 3	--	--
Firm	Normal	High Normal	2 2	3 2	3 3	4 3
	Favourable	High Normal	2 2[1)]	2 2	--	--

[1)] Specification profile 1 may be used for roads with temporary traffic, access roads or similar.