

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 in all applications. The products are covered by the following European standards:

- EN 13249 Roads and other trafficked areas
- EN 13250 Railways
- EN 13251 Earthworks, foundations and retaining structures
- EN 13252 Drainage systems
- EN 13253 External erosion control systems
- EN 13254 Reservoirs and dams
- EN 13255 Canals
- EN 13256 Tunnel and underground structures
- EN 13257 Solid waste disposals
- EN 13265 Liquid waste containment
- EN 15381 Pavements and asphalt overlays

Barriers¹⁾

- EN 13361 Reservoirs and dams
- EN 13362 Canals
- EN 13491 Liquid waste disposal sites
- EN 13492 Tunnels and underground structures
- EN 15382 Transportation infrastructures

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

1) Under preparation, not yet part of these Guidelines

A two-stage product-certification procedure is used to document the conformity of a product with the requirements set out in these Guidelines.

Stage I: Quality Product Certification (QPC)

Function: Separation and Filtration
Reinforcement
Sealing¹⁾
Drainage¹⁾
Protection¹⁾

1) Under preparation, not yet part of these Guidelines

Stage II ²⁾: Quality Product Specification (QPS)

Function: Separation and Filtration – roads and other trafficked areas (other applications under preparation)

2) At the moment stage II is only foreseen for products with the functions Separation and Filtration

The Stage I procedure is obligatory and must in all cases precede any Stage II procedure. In all cases in which specifications are available, the products must be classified in accordance with these Guidelines.

Compliance with the NorGeoSpec requirements is declared by the NorGeoSpec Notified 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 „Quality Product Certification“ and „Quality 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 (Stage I) and part two – Quality Product Specification (Stage II) of these Guidelines.

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Part one – Quality Product Certification (QPC)

Function: Separation and Filtration

Reinforcement

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1. General

1.1 Scope

This part of the guideline presents the Nordic system for certification and control of geosynthetics and geosynthetic-related products (NorGeoSpec) used for separation, filtration and/or reinforcement in all applications.

1.2 Ongoing quality compliance

The applicant must ensure that appropriate Factory Production Control (FPC) systems are in place to:

- demonstrate that the product continuously complies with the requirements of the certificate which has been granted to 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.

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-**m**andated **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.

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

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.

in the NorGeoSpec system. They will only become valid through the publication of an amendment or a revised edition of NorGeoSpec. 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 – Terms and definitions
EN ISO	10319	Geosynthetics – Wide-width tensile test
EN ISO	10320	Geotextiles and geotextile-related products – Identification on site
EN ISO	11058	Geotextiles and geotextile-related products – Determination of water permeability characteristics normal to the plane, without load
EN ISO	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 – 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	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	21930	Sustainability in building construction – Environmental declaration of building products

3. Terms, definitions and abbreviations

In general all terms are referred to in EN ISO 10318 Geotextiles – Terms and Definitions. In the specific requirements the following terms are used:

Nominal value	The value of a characteristic stated by the manufacturer. The nominal value is considered to correspond to the mean value of a large number of samples
Tolerance	The tolerance for a characteristic is to be stated by the manufacturer. The tolerance(s) is/are used to define the one/both sided 95% confidence limit for the characteristic
Uniformity requirement	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
95% confidence limit	The nominal value plus or minus the tolerance is defined as the one/both sided 95% confidence limit
Sample	In the delivery control 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 in the sample
F	Maximum tensile strength (kN/m)
ε	Strain at maximum tensile strength
R	Strain energy index, $R = 1/2 * F * \epsilon$
RF_{CH}	Reduction factor for environmental effects
RF_{CR}	Reduction factor for creep-rupture
RF_{ID}	Reduction factor for installation damage
RF_W	Reduction factor for weathering
T_i	The tolerance of the characteristic in engineering units
U	Uniformity requirement
MD	Machine Direction
CMD	Cross-machine Direction
TC	NorGeoSpec Technical Committee, with representatives from national transport administrations in the countries where the NorGeoSpec is applied, the NCB and a laboratory involved in the system
NCB	NorGeoSpec Certification Body, mandated and nominated by the Technical Committee appointed by the National Roads Administrations of the countries where NorGeoSpec is applied
QPC	Quality Product Certification
QPS	Quality Product Specification

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 core committee or the advisory board 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:

- examining files, inspection reports and laboratory test reports which are presented by the NCB
- recommending decisions for the certification of single products

The TC is composed of:

- representatives nominated from the public administrations (one vote for each country)
- one representative from the NCB

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

In addition to the TC there is an advisory board whose membership is extended to include representatives of the producers and the laboratories.

Each member of the advisory board must sign a secrecy declaration; this is re-signed annually and continues in force after membership of the core committee or the advisory board has expired.

For the advisory board, 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: Advisory Board (AB)

The AB is responsible 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: Roll of experts**)

The Advisory Board is composed of

- the members of the TC
- three representatives from the manufacturers nominated by the EAGM. Only manufacturers having product(s) certified according to NorGeoSpec certification should be nominated to the advisory board. Manufacturers' representatives are nominated by the EAGM for a period of 3 years. In order to ensure the continuity of the work in the Advisory Board, 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 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 Advisory Board, only one laboratory representative may be replaced after the 3-year period.

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.

Decisions in the Advisory Board 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.

4.3 Certification Body

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 Technical Committee.

Responsibilities

The NCB is responsible for the following:

- the application of the rules set out in this document
- the implementation of decisions recommended by the Technical Committee/Advisory Board
- ensuring that the Technical Committee properly performs its tasks in accordance with the rules laid down in the NorGeoSpec guideline
- 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 Technical Committee/Advisory Board and the group of technical experts

- organization and management of all inspections and verifications
- mandating the inspection agents (auditors/sampler)
- continual improvement in the quality of the test results of participating laboratories
- publication of certificates on the website
- nominating and managing the group of experts.

Requirements

The NCB must:

- be an organization conforming to EN 45011 (General requirements for bodies operating product-certification systems)
- be accredited by an accreditation body involved in European Accreditation
- be a notified body for CE marking of geosynthetics
- be completely impartial
- operate independently of the laboratories used for testing
- be mandated by the NorGeoSpec Technical Committee.

4.3.1 Inspection Agent

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

4.3.1.1 Auditor

Responsibilities

The auditor conducts an audit 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 audit is a questionnaire (**see Annex B: Questionnaire**) which is completed jointly by the auditor and the producer. The questionnaire places particular emphasis on the following points:

- Product identification and traceability
- Incoming inspection and testing of raw materials
- Results of final product inspection and testing
- Procedure for dealing with non-conform products
- Handling, storage and packaging.

The auditor prepares a report on the result of the audit and gives this to the NCB.

Requirements

The auditor must be accredited or be of recognized competence, especially in geosynthetics. The auditor shall conform to 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 Laboratory

General

The laboratories are mandated by the NCB. The mandate is reviewed annually by the NCB in accordance with the requirements defined in the NorGeoSpec document. The laboratories perform tests on samples received from the inspection agent. 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 Technical Committee.

Responsibilities

- the laboratory is responsible for testing the product according to 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 17025 covering the test performed
- the laboratory is independent and impartial (not owned by a manufacturer of geosynthetics or by a holding company which also owns such a manufacturer)
- the laboratory 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. To this end, all members of the Technical Committee, Advisory Board, the NCB, the laboratories involved in testing and the persons assigned to collecting test samples sign a document in which they undertake to keep secret all information they receive relating to a specific manufacturer 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 C: Principle of the certification procedure**)

Compliance with the requirements can be achieved by:

- a Quality Product Certification (QPC)

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

5.1 Quality Product Certification (QPC)

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 QPC procedure includes

- initial inspection of the production process (validation of the values)
- initial testing of the products in an external/independent laboratory
- an estimation of their 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 general requirements as set down in EN 13249 – 13257, EN 13265 or EN 15381.

Additionally, the geosynthetics and geosynthetic-related products must comply with the requirements in this document.

Compliance of a product with these Guidelines can only be confirmed for manufacturers

- who have instituted a system of factory production control (FPC),
- whose products are CE marked.

The values called for in the product certification and product specification respectively depend on the function and the declared product lifetime. Irrespective of the function, a minimum lifetime of 25 years is required. This is generally considered as fulfilled if the products are CE certified for 25 years.

If the declared lifetime is greater than 25 years, it must be proven that the products will fulfil the function for the declared lifetime. As long as no additional functions (e.g. drainage, sealing and protection) are included in this guideline, a declaration of greater than 25 years lifetime is only foreseen for products with the function reinforcement.

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 D (Scope of testing for Quality 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

Application Standards EN 13249 – 13257, EN 13265 or EN 15381.

- 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) 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 QPC 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 Quality 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 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 E: Sampling and sampling procedure**)
- publish the same nominal value for each required characteristic for the CE mark and for the NorGeoSpec at the time of certification.
- inform the NCB of any fundamental modifications made to the production process
- 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: lifetime up to 25 years

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

- the geosynthetic or the geosynthetic-related product must fulfil all the conditions and requirements set out in EN 13249 – 13257, EN 13265 or EN 15381.
- the manufacturer shall provide nominal values and tolerances for the characteristics according to **Table 1, Annex D**¹⁾ of this guideline

¹⁾ the values corresponding to 95% confidence limits¹⁾ (nominal value \pm the tolerances) shall be within the tolerances given in **Table 1, Annex D**. The 95% confidence limit must be determined in accordance with the application standards EN 13249-13257, EN 13265 and EN 15381.

- the nominal values provided by the manufacturer must be in line as that given on the CE mark accompanying document.
- 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, initial type testing must be performed on all products and for all characteristics according to **Table 1, Annex D**
- sampling and testing must be organised by the NCB. The testing must be performed in an NCB-accredited external laboratory.
- the results of initial product testing must be available and fulfil the requirements of the NorGeoSpec Guidelines.
- a declaration of the potential environmental impact of the raw materials used must be made available by the producer (**see Annex F: Environmental declaration**).

5.3.2 Specific requirements: lifetime > 25 years

- an estimate of product lifetime (lifetime assessment) for the product or the product family in accordance with the requirements of these Guidelines must be available (**see ANNEX D**)

5.4 Decision procedure: Quality Product Certification

Lifetime 25 years

- If the test result(s) (average of the sample tested) for the particular characteristic(s) is (are) within the 95% 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).

Lifetime > 25 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 on-going monitoring of the long-term properties must be agreed between the producer and the NCB according to the present guideline, 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.

Non-conformity is declared when test results from random sampling and testing are outside the declared 95% 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 observed.

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)
- information related to the product lifetime.

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. 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 auditor and facilitate the accomplishment of the auditor's mission.

6.2 Verifications performed by the inspection agent

Verifications are made at the production location of the products to be certified. The auditor conducts the audit in accordance with **Annex B** and takes samples for all tests stated in the present rules.

6.3 Verification of QPC, continuous surveillance

Inspection of factory production control (FPC), sampling 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 (reinforcement function), the NCB draws up a programme designed to continually update the characteristics which determine the long-term behaviour. **Annex G: Scope of random control-check testing** gives an indication of some of the likely aspects of such a programme.

5.7 Renewal of a request

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

6.4 Unannounced random product sampling and control checks

The NCB organizes random control checks. These can be at the production location, in the warehouse, or on the construction site.

The announcement to the producer and/or the applicant¹⁾ 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.

QPC: 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 already 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 and G**.

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

7. Certification

The NCB, with advice from the TC, decides whether a product complies with the NorGeoSpec requirements and authorises the issuing of a Quality 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 is dependent on the payment of all the related costs (see 7.3 below).

Quality 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.

6.5 Extraordinary verifications

On request, the NCB will investigate all abnormal occurrences (e.g. objections, complaints). If no solution is found the Advisory board 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.

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 pronounced 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 posted on the NorGeoSpec website and all members are informed by e-mail.

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 posted 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 (accredited laboratory)
- 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 (accredited laboratory) 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 Technical Committee 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 initial 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. master batch)
- 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 initial type testing, and products from ongoing production.

Depending on the raw material used, tests selected from table 1 **Annex J** will have to be carried out, compared with the material from the initial 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. 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/Advisory Boards 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: Questioner

 SINTEF		audit report	
		<input type="checkbox"/> NorGeoSpec 2012 revision1 <input type="checkbox"/> initial certification <input type="checkbox"/> re- certification	
SINTEF Building and Infrastructure Address: NO-7465 Trondheim, NORWAY Location: Høgskoleringen 7a Project Leader: Christian Recker Telephone: +49 171 9501912 Fax: +49 7130 6211		<input type="checkbox"/> FPC - CE-marking company:	
project no.:	date:	place:	auditor / contact person

1 Compliance with the NorGeoSpec requirements		References		
1.1	Has the manufacturer a description of how design requirements and criteria are identified, checked, controlled and updated to be unambiguous and relevant to the use of the product and its specification?			
1.2	Has the manufacturer a description of the communication of the design to the internal production departments or to external subcontractors?			
Evaluation:		A	B	C
Verification / conclusion:				

2 Product identification and traceability		References		
2.1	What are the means used for the unique identification of any individual finished product?			
2.2	Is it possible to identify and check date, place and general manufacturing conditions (including raw material used) through the identifications on the final product?			
2.3	Does the marking on the final product comply with EN ISO 10320, as requested in the relevant harmonised standard (EN 13249, 13250, 13251, 13252, 13253, 13254, 13255, 13256, 13257, 13265)?			
Evaluation:		A	B	C
Verification / conclusion:				

3	Production process control	References		
3.1	Are there documents which define the production process parameters which could affect quality?			
3.2	Are the standards, quality plan and procedures implemented?			
3.3	Are the specified requirements concerning process validation, including the associated personnel and equipment, documented?			
Evaluation:		A	B	C
Verification / conclusion:				

4	Inspection and testing on receipt of raw materials	References		
4.1	Are there specification sheets concerning incoming raw materials?			
4.2	Are there documents which define what shall be done in case of non-conformance of raw materials?			
4.3	Are the nature and frequency of the evaluation of incoming raw materials described and followed?			
Evaluation:		A	B	C
Verification / conclusion:				

5	Inspection and testing during manufacturing	References		
5.1	Are there inspections or tests during the manufacturing process with specific requirement for the results?			
5.2	Are there documents concerning inspection or testing during the manufacturing process with requirement for the results?			
5.3	Do they define what shall be done in case of non-conformance of the product with the requirements?			
5.4	Are non-conforming products separated from conform products when they are detected during manufacturing?			
5.5	Is there a procedure for handling non-conforming products?			
Evaluation:		A	B	C
Verification / conclusion:				

6	Final inspection and testing	References		
6.1	Are there installations, equipment and personnel for final inspection and tests?			
6.2	Are there standards and methods for final inspection and testing? Have they been implemented?			
Evaluation:		A	B	C
Verification / conclusion:				

6	Final inspection and testing					References	
6.3	What tests are implemented (standard used) and at what frequency? These tests should preferably be called up in the harmonised standards. If the tests are not performed to these European standards, is there a proven correlation between the test(s) used for FPC and the corresponding EN?						
	No.	Test	internal	external	not applicable	Test frequency	
	1	EN ISO 9864					
	2	EN ISO 10319					
	3	EN ISO 11058					
	4	EN ISO 12236					
	5	EN ISO 12956					
	6	EN ISO 13433					
	Durability tests						
	7	EN 12224					
	8	EN 12225					
	9	EN 12447					
	10	EN ISO 13438					
	11	EN 13719					
	11.1	EN 14574					
	12	EN 14030					
Evaluation:					A	B	C
Verification / conclusion:							

6	Final inspection and testing					References	
6.4	Are the characteristics tested in accordance with the announced "application / function" combination(s) (see the relevant harmonised standard(s))						
6.5	Are there documented specifications concerning the results for final inspection and testing? What are they?						
6.6	Do the required test results comply with the characteristics declared in the document accompanying the CE marking?						
6.7	Are the requirements on the announced tolerances fulfilled for each product?						
6.8	Are there documented procedures which define what shall be done in case of non-conformance of the final product with the specified requirements?						
6.9	Are there appropriate records which document that a product has been tested and is in conformance with the specified requirements?						
6.10	Is it possible through these records to identify the accredited persons responsible for testing final products and for releasing the products for the market?						
Evaluation:					A	B	C
Verification / conclusion:							

7	Control of inspection, measuring and test equipment	References
7.1	Are there defined procedures to control, calibrate and maintain the equipment used to provide evidence of the conformance of the products with the specified requirements?	
7.2	Are inspection, measuring and test equipment calibrated and adjusted against equipment having a known and valid relationship to nationally or internationally recognized standards?	
Evaluation:		A B C
Verification / conclusion:		

8	Handling of non-conform products	References
8.1	Are there documented procedures to ensure that non-conforming products cannot be inadvertently used or delivered?	
8.2	In particular, are non-conforming products identified, documented and segregated from the rest of the production?	
8.3	Are there documented procedures which define responsibilities for the examination of non-conforming products and who has the authority to take decision concerning them?	
Evaluation:		A B C
Verification / conclusion:		

9	Corrective actions	
9.1	Are there documented procedures to implement proper corrective and preventive actions concerning non-conformity?	
9.2I	If so, are these procedures implemented and the corrective or preventive actions recorded (mainly these concerning consumers complaints)?	
9.3	Have corrective actions been carried out from the previous audit? With what result?	
Evaluation:		A B C
Verification / conclusion:		

10	Handling, storage and packaging	References
10.1	Are the methods described which ensure that the product is protected during handling, storage and packaging?	
10.2	Are handling, storage and packaging methods and means appropriate to prevent final products from being damaged or from deterioration?	
10.3	Is the labelling of final products in conformance with the provisions of the harmonised standards?	
Evaluation:		A B C
Verification / conclusion:		

11	Control of quality records	References
11.1	Are quality records legible and retained for at least 10 years so as to be easily available on request?	
Evaluation:		A B C
Verification / conclusion:		

12	Personnel	
12.1	Does the manufacturer ensure that the personnel involved in the process is suitably trained?	
12.2	Are the job descriptions and responsibilities of the operators specified in the manual?	
Evaluation:		A B C
Verification / conclusion:		

13	Withdrawal of certificates	References
13.1	Have temporary or final withdrawals been pronounced? If so, what practical measures have been defined and implemented?	
Evaluation:		A B C
Verification / conclusion:		

Assessment results

Current scope of registration:	
The management system is effective and fulfills the requirements:	<input type="checkbox"/> Yes <input type="checkbox"/> Only partly – see corrective action plan <input type="checkbox"/> No – see corrective action plan

Activities of the customer	
Corrective actions:	<input type="checkbox"/> Corrective actions not necessary <input type="checkbox"/> Corrective actions will be implemented and reviewed for effectiveness

Non conformities identified during an audit shall be rectified with evidence of effectiveness within defined time lines otherwise certificates may be put on hold or be withdrawn.

Activities of SINTEF	
Type of next assessment:	<input type="checkbox"/> initial certification <input type="checkbox"/> re- certification <input type="checkbox"/> FPC - CE-marking
Next assessment data: (non-binding estimate of person days)	Planned date for next assessment: (week or month, if appropriate)
Next sampling data: (non-binding estimate of person days)	Planned date for next sampling: (week or month, if appropriate)
Additional remarks:	

With reference to NorGeoSpec 2012 revision1, the audit team recommends to the NCB:
<input type="checkbox"/> Issuance of the certificate <input type="checkbox"/> Issuance of the certificate as soon as implementation of corrective actions has been demonstrated

Please remember to notify the NCB about any significant change to your management system at your earliest convenience. Together we will then coordinate appropriate measures to maintain your current certification.

Date:

Auditor: NAME

Annex C: 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 3rd 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 (**see Annex J, First contact checklist**).

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 whether the request should be refused or compliance with NorGeoSpec should be declared.

3. Certification phase

In this phase, the Technical committee 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 D: Scope of testing for Quality Product Certificate (QPC)

The properties which must be tested for the Product Quality Certification are listed in Tables 1-2 and described in the clause "Performance assessment (Lifetime > 25 years) 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
Mass per unit area ¹⁾	EN ISO 9864	g/m ²	± 10 %	± 10 %	± 10 %
Dimensions	-- ²⁾	mm	n.r.	n.r.	± 10 %
MECHANICAL TESTS					
Tensile strength	EN ISO 10319 ³⁾	kN/m	-10 %	-10 %	-5 %
Elongation at max. load	EN ISO 10319	%	-20 %	-20 %	± 20 %
Strength at 2, 5, 10% strain	EN ISO 10319	kN/m	---	---	-20 %
Static puncture test	EN ISO 12236	kN	-10 %	-10 %	n.r.
Dynamic perforation resistance	EN ISO 13433	mm	+25 %	+25 %	n.r.
HYDRAULIC TESTS					
Permeability normal to the plane without load	EN ISO 11058	mm/s	-30 %	-30 %	-30 % ⁴⁾
Characteristic opening size	EN 12956	µm	±30 %	±30 %	n.r.

1) We regard the plus/minus 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). Test procedure see Annex H: Test procedure-dimensions of geogrids .

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

4) Voluntary

n.r. = not required

Performance assessment (Lifetime > 25 years)

If a product lifetime of > 25 years is to be certified for a producer, the producer must provide a product-lifetime estimate for his product or product family.

- the product-lifetime estimate should be made by an expert recognised by the NCB
- the tests forming the basis of the product-lifetime estimate 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, Performance Tests.
- the tests forming the basis of the product-lifetime estimate must have been carried out in laboratories which are accredited in accordance with EN ISO 17025 and 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: Performance tests

CHARACTERISTIC	STANDARD	REQUIREMENTS
Resistance to weathering	EN 12224	RF _w
chemical resistance ¹⁾	EN 12447 EN 13438 EN 14030	RF _{ch}
Tensile creep and creep rupture	EN 13431	RF _{cr}
Damage during installation	Annex I	RF _{id}
Direct shear test ²⁾	EN ISO 12957	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 types representative of the product group.

Annex E: Sampling and sampling procedure

General

Samples are taken in accordance with EN ISO 9862 – Geosynthetics: Sampling and preparation of test specimens. Two A-samples (A1 and A1.1) and a 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 A1 and B are sent to the NorGeoSpec-approved laboratory selected by the NCB. Sample A1.1 is used for Quality Assurance purposes between the laboratories approved by NorGeoSpec. Different laboratories carry out comparison tests on the sample. 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 (A1, A1.1 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 which is 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

Unannounced random product sampling

The selection of products for random sampling may be based upon information as to which products have already 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 6
n > 10	at least 8 or 80 % of n ²⁾	at least 8, minimum 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 F: Environmental declaration

Environmental declaration ¹⁾

The producer must provide a signed statement of the potential impact of his product on the environment when installed.

Note: As a minimum, the statement should contain information on water-soluble and water-leachable additives such as processing agents, avivages (finishing agents), stabilizers, preservatives for avivages, fillers, plasticisers etc.

Additionally, the producer may provide statements on the following environmental indicators

Table 4: Environmental indicators ²⁾

INDICATOR	UNIT
Global warming	XX kg CO ₂ equiv.
Energy use	XX kWh
Recycled materials ³⁾	XX %

1) Until the introduction of a harmonised European approach on environmental impact, the producer must provide a statement on the potential impact of his product on the environment when installed.

2) Information in accordance with environmental indicators should be based on ISO 14025 "Environmental labels and declarations" and ISO 21930 "Environmental declaration of building products".

3) In accordance with definitions given in the application standards EN 13249 – 13257, EN 13265 or EN 15381

Annex G: 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

CHARACTERISTIC	STANDARD	UNIT	FUNCTION		
			Filtration	Separation	Reinforcement
Mass per unit area	EN ISO 9864	g/m ²	+	+	+
Dimensions	Annex H ¹⁾	mm	---	---	+
MECHANICAL TESTS					
Tensile strength	EN ISO 10319	kN/m	+ ¹⁾	+ ¹⁾	+
Elongation at max. load	EN ISO 10319	%	+ ¹⁾	+ ¹⁾	+
Strength at 2, 5, 10% strain	EN ISO 10319	kN/m	---	---	+
Static-puncture test	EN ISO 12236	kN	+ ¹⁾	+ ¹⁾	---
Dynamic perforation resistance	EN ISO 13433	mm	+ ¹⁾	+ ¹⁾	---
HYDRAULIC TESTS					
Permeability normal to the plane without load	EN ISO 11058	mm/s	+ ¹⁾	+ ¹⁾	+ ²⁾
Characteristic opening size	EN 12956	µm	+ ¹⁾	+ ¹⁾	---

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

2) Voluntary

Performance assessment

The assessment of product lifetime 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 pre-determined values

Annex H: Test procedure for the determination of the dimensions

Test principle

The test method is used to determine the geometry – length of the elements in machine and transverse directions, dimensions of the grid apertures – and is only to be used for geogrids (GGR).

Test set-up

The test set-up must allow measurement of the width of elements in both machine and transverse directions, and of the dimensions of the grid apertures, to an accuracy of ± 0.5 mm.

Test pieces

Cut at least 5 test pieces (dimensions min. 200 x 200 mm) spaced over the full width of the sample.

The test pieces must be conditioned under standard-climate conditions in accordance with ISO 554 ($20 \pm 2^\circ\text{C}$, RH $65 \pm 5\%$).

Testing

The dimensions of a product are determined by photographing with a ruler of appropriate accuracy.

Annex I: Test procedure damage during installation

Test procedure for damage during installation

Additional to the index tests in accordance with EN ISO 10722 large scale tests have to be carry out to determining the reduction factor for damage during installation.

The testing procedure for large scale tests for determining the reduction factor damage during installation 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 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 the 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 (300 x 200 mm plus 100 mm in each direction) must be evenly distributed over the loaded area. The edges of the 10 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 D_{pr} 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 guideline 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 J: 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, characteristic of the polymer used, which need to be carried out.

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 long-term behaviour of a product range.

Table 1: Test identification of characteristic properties (Fingerprint)

NO.	PROPERTY	STANDARD	RAW MATERIAL ²⁾					REQUIREMENT
			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 radiation 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 – Quality Product Specification (QPS) Function: Separation and Filtration – road and other trafficked areas

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1. General

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

- Separation and filtration,

in areas covered by the Application Standards EN 13249 – EN 13257, EN 13265 and EN 15381.

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.

In all cases in which specifications are available, the products must be specified.

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

- Quality Product Specification (QPS).

The NCB is the prime contact of the manufacturer, or the manufacturer's authorized representative. The NCB administrates the procedures of both "Quality Product Certification" and "Quality 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 guideline for selection of the relevant specification profile. The separation function is always used in conjunction with filtration; accordingly the 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: Quality 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 Quality 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 Quality Product Specification (QPS) is valid for a 2 year period, provided that the rules as defined in this document are followed.

The NorGeoSpec 2012 Product Certificate state:

- the name of the NCB which has issued the QPC.

Function: separation and filtration

- the profile number of the product.

Annex A: Required values – Quality Product Specification

Table 1: Required values – Quality Product Specification

Function: separation and filtration							
CHARACTERISTIC	UNIT	MAXIMUM TOLERANCE ¹⁾	REQUIRED²⁾ VALUES CORRESPONDING TO 95% CONFIDENCE LIMIT				
			SPECIFICATION PROFILES				
			1	2	3	4	5
Min. tensile strength	kN/m	-10 %	6	10	15	20	26
Min. tensile strain at max. load	%	-20 %	15	20	25	30	35
Max. cone drop diameter	mm	+25 %	42	36	27	21	12
Min. energy index	kN/m		1.2	2.1	3.2	4.5	6.5
Min. velocity index	10 ⁻³ m/s	-30 %	3	3	3	3	3
Max. char. Opening size, O ₉₀	mm	±30 %	0.2	0.2	0.2	0.15	0.15
Max. tolerance for mass per unit area			±12 %	±12 %	±10 %	±10 %	±10 %
Max. tolerance for static puncture strength			-10 %				

1) The tolerance shall be stated by the manufacturer, this table gives the maximum allowable tolerance in the accompanying document to the CE-mark

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

Strength and strain properties, 95% confidence limits

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

$$F_{MD,95} = \{F_{MD} - T_{F,MD}\}, \quad F_{CMD,95} = \{F_{CMD} - T_{F,CMD}\}$$

$$\varepsilon_{MD,95} = \{\varepsilon_{MD} - T_{\varepsilon,MD}\}, \quad \varepsilon_{CMD,95} = \{\varepsilon_{CMD} - T_{\varepsilon,CMD}\}$$

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 accounted for. The 95% confidence limits for the average characteristics are then calculated as:

$$F_{a,95} = 1/2 \cdot \{F_{MD,95} + F_{CMD,95}\}, \quad [F_{a,95} \leq 1/2 \cdot (1+U) \cdot \text{Min}(F_{MD,95}, F_{CMD,95})]$$

$$\varepsilon_{a,95} = 1/2 \cdot \{\varepsilon_{MD,95} + \varepsilon_{CMD,95}\}$$

Strain energy index, 95% confidence limit

The strain energy index R is defined as the product of the maximum tensile strength multiplied with 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 manufacturers are not obligated to state the tolerance value for the strain energy index R. TR is therefore estimated on basis of the tolerances for strength and strain. The average tolerances in machine and cross machine direction are calculated as:

$$T_{F,a} = 1/2 (T_{F,MD} + T_{F,CMD}), \quad T_{\varepsilon,a} = 1/2 (T_{\varepsilon,MD} + T_{\varepsilon,CMD})$$

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

$$F_a = 1/2 \cdot \{F_{MD} + F_{CMD}\}, \quad F_a \leq 1/2 \cdot (1+U) \cdot \text{Min}(F_{MD}, F_{CMD})$$

$$\varepsilon_a = 1/2 \cdot \{\varepsilon_{MD} + \varepsilon_{CMD}\}$$

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 with the following formula³⁾:

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

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 done with the tolerances in engineering units

Annex B: Guidelines for selection of specification profile

The selection of specification profile may be 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 done.

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 $> 1,5 \times$ max. 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 relevant specification profile can be made according to Table 2.

Table 2: Selection of relevant specification profile

SUBSOIL	CONSTRUCTION CONDITIONS	TRAFFIC	MAXIMUM GRAIN SIZE (D_{MAX}) IN FILL MATERIAL (MM)			
			$d_{max} < 63$	$63 < d_{max} < 200$	$200 < d_{max} < 500$	$d_{max} > 500$
Soft	Normal	High	3	4	5	5
		Normal	3	4	4	5
	Favourable	High	3	3	--	--
		Normal	2	3		
Firm	Normal	High	2	3	3	4
		Normal	2	2	3	3
	Favourable	High	2	2	--	--
		Normal	2 ¹⁾	2		

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