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Fibre-reinforced plastic composites — Declaration of raw material characteristics — Part 4: Additional requirements for fabrics

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Foreword

This document (prEN xxxx-4:2010) has been prepared by Technical Committee CEN/TC 249 “Plastics”, the secretariat of which is held by NBN.

This document is a working document.

prEN xxx consists of the following parts, under the general title *Fibre-reinforced plastic composites — Declaration of raw material characteristics*:

- Part 1: General requirements
- Part 2: Additional requirements for resin, curing systems, additives and modifiers
- Part 3: Additional requirements for fibres
- Part 4: Additional requirements for fabrics (this part)
- Part 5: Additional requirements for core materials

1 Scope

This part of the standard specifies the minimum information to be declared for fabrics to be used for the manufacturing of composites products.

These specific declaration requirements are in addition to the general requirements given in part 1 of this standard (i.e. prEN xxx-1).

The declaration includes requirements for the certificate of analysis (CoA). The purpose of the CoA is to verify that material properties and quality conforms to the declared values.

This part of the standard is applicable to unidirectional and multiaxial fabric material.

2 Normative references

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

EN xxxx-1:2010, *Fibre-reinforced plastic composites — Declaration of raw material characteristics — Part 1: General requirements*

EN ISO 291, *Plastics — Standard atmospheres for conditioning and testing* (ISO 291:2008)

EN 13473-1, *Reinforcement — Specifications for multi-axial multi-ply fabrics — Part 1: Designation*

EN 13473-2, *Reinforcement — Specifications for multi-axial multi-ply fabrics — Part 2: Methods of test and general requirements*

EN ISO 1889, *Reinforcement yarns — Determination of linear density* (ISO 1889:2009)

EN ISO 3344, *Reinforcement products — Determination of moisture content* (ISO 3344:1997)

EN ISO 10548, *Carbon fibre — Determination of size content* (ISO 10548:2002)

EN ISO 4921, *Knitting — Basic concepts — Vocabulary* (ISO 4921:2000)

ISO 1887, *Textile glass — Determination of combustible matter content*

ISO 3374, *Reinforcement products — Mats and fabrics — Determination of mass per unit area*

ISO 5025, *Reinforcement products — Woven fabrics — Determination of width and length*

3 Terms and definitions

3.1 Definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
fabric
a material constructed of interlaced yarns, fibres, or filaments, usually a planar structure.

NOTE Nonwovens can be included in this classification

3.1.2
structural fibre
the load carrying fibre in the fabric

3.2 Abbreviation

BIAX : bi-axial

BIDI : bi-directional (0° and 90°)

PENTAX : fibres in five directions

QUAD : fibres in four directions

TRIAX : three-axial, fibre in three directions

UD : uni-directional, fibre in one direction

4 Content of a declaration

A declaration for the fabrics shall consist of information given in part 1 and part 4 (this part) of this standard, i.e. EN xxx-a and EN xxx-4.

5 Additional declaration requirements

5.1 General

The additional requirements for fabrics are given below.

All declaration requirements, i.e. requirements in EN xxx-1 and this part (i.e. EN xxx-4), and application dependant requirements as agreed between manufacturer/supplier and customer, shall be declared by the manufacturer as information to the customer, and the following apply:

- if the property given has reference to a test standard or test method, this test standard or test method shall be used;
- the values given shall be in accordance with the test standard given;
- the tolerances shall be given. If the tolerances are stated in the test standard these apply, if not these shall be specified;
- the clarification of the terms nominal, minimum and maximum test values is given in Annex A;

— if the test environment is not clearly stated in the specific test standard, the standard atmosphere conditioning and testing shall be carried out in accordance with EN ISO 291;

— the manufacturer shall be responsible for the performance and results of all tests required for the declaration.

5.2 Declaration for fabrics with continuous fibre

5.2.1 Declaration for unidirectional and multiaxial fabrics

5.2.1.1 Properties of fabrics

The additional declaration requirements for fabrics are listed below. The requirements shall be given in accordance with the test standards stated in Table 1 and including the tolerances.

The following additional declaration requirements a) to j) apply for all fabrics independent on application:

a) Identification; (name/number/code used by the manufacturer for identification purposes);

NOTE Any change in the processing card, thread tension etc. shall be reflected in the identification.

b) Fabric type (i.e UD, BIDI, BIAX, QUAD, Pentax, etc.);

c) Fibre orientations (layer number 1 facing inwards against the centre of the roll) [°];

d) Total nominal area weight [kg/m^2];

e) Dimensions (length and width) [mm];

f) Defects;

g) Moisture content [%];

h) Loss of ignition;

i) Core Tube outer diameter [mm];

j) Marking.

5.2.1.2 Properties of structural fibre

The additional declaration requirements for structural fibre are listed below. The requirements shall be given in accordance with the test standards stated in Table 2 and including the tolerances.

The following additional declaration requirements a) to j) apply for all structural fibre independent of application:

a) Identification (fibre name/number/code used by the manufacturer for identification purposes);

b) Layer number;

1) The actual layer number where the fibre is used in the fabric;

2) Layer number one is facing inwards on the roll.

c) Fibre manufacturer;

d) Fibre material type (information about orientation must be given the case multiple material types are used);

e) Area weight (the area weight of the structural fibres in respective orientation and layer) [kg/m^2];

f) Sizing type and amount [wt %];

g) Defines the sizing applied to the fibre with respect to type and product identification;

h) The size identification shall refer to a revision number or date of modification if number/code is the same for different versions of the size formulation;

i) Fibre batch number (present only at delivery);

j) Maximum gap between fibre bundles measured at stitch/knit point [mm].

5.2.1.3 Properties of stabilizing/support material

The additional declaration requirements for stabilizing/support material are listed below. The requirements shall be given in accordance with the test standards stated in Table 3 and including the tolerances.

The following additional declaration requirements a) to g) apply for all stabilizing/support material independent on application:

a) Material identification (name/number/code for identification purpose);

b) Manufacturer of stabilizing/support material;

c) Fibre material type (Information about orientation shall be given);

d) Area weight [kg/m^2];

e) Sizing/binder type and amount [wt.%];

f) Linear density [g/km] (Tex);

g) Material batch number (present only at delivery).

5.2.1.4 Properties of assembly material/method

The additional declaration requirements for assembly material/method are listed below. The requirements shall be given in accordance with the test standards stated in Table 4 and including the tolerances.

The following additional declaration requirements a) to k) apply for all assembly material/method independent on application:

a) Material identification;

NOTE If setup or production machine have any influence on the product it shall be identified in the identification.

b) Manufacturer of assembly material;

c) Fabric assembly method (i.e. adhesive, knitting, stitching, etc.);

d) Assembly material type (i.e. Polyester yarn, thermoplastic adhesive, etc.);

e) Information about orientation (if applicable);

f) Area weight (weight of the assembly material only) [kg/m2];

g) Assembly stitching or knitting pattern;

h) Stitch or knit length [mm];

NOTE Defined as the distance between individual needle travel from stitch point to stitch point along the length of the reinforcement.

i) Space between stitches/needles (gauge) [mm];

NOTE Defined as the distance between the individual needles along the width of the reinforcement

j) Tension on stitching/Knitting yarn [N];

k) Material batch number; (present only at delivery).

NOTE Traceable fibre information

5.2.2 Declaration for woven roving fabric

(Not implemented yet).

5.3 Declaration for fabrics with discontinuous fibre

(Not implemented yet).

5.4 Declaration for additional process/material

The additional declaration requirements for additional process/material are listed below. The requirements shall be given in accordance with the test standards stated in Table 5 and including the tolerances.

The following additional declaration requirements a) to f) apply for all additional process/material independent on application:

a) Additional material identification (name/number/core for material identification purpose);

b) Additional material type;

NOTE Defines the type of the additional material (urethane, polyester, glass, etc). Information about orientation shall be given if applicable

c) Additional process;

NOTE This is the processes affecting the fabric like toughting, Z-pinning, etc.

d) Additional area weight [kg/m^2];

NOTE The area weight of additional material applied to the fabric only (individual materials). In the case of multiple additional materials, all must be defined separately

e) Material batch number (present only at delivery);

f) Traceable fibre information.

6 Content of Certificate of Analysis (CoA)

6.1 General

Certificate of analysis (CoA) shall be delivered on request. The certificate shall verify that the delivered batch is within the agreed number of declared values. The relevant test methods used to obtain batch data shall be the same as used for the declaration.

Each sheet of the CoA for the different constituents shall be clearly marked with identification and batch number and also clearly marked with identification and batch number of the fabric.

6.2 CoA for fabric with continuous fibre

6.2.1 CoA for multiaxial fabric

6.2.1.1 CoA for fabric

The certificate of analysis for fabric, with reference to relevant items given in 5.2.1.1, is given in Table 1 for the application independent fabric properties.

Table 1 — CoA properties for application independent fabric

Ref. no 5.2.1.1	Property	Declared value with tolerances (% or range)	CoA Test result	Unit	Test method	CoA Content [a]
c)	Fibre orientations			[°C]	EN 13473-1	O
d)	Total area weight			[kg/m^2]	EN 3374	●
e)	Fabric dimensions			[m]	ISO 5025	O
f)	Defects				EN 13473-2	O
g)	Moisture content			[%]	EN ISO 3344	O
h)	Loss of ignition				ISO 1887	O

[a] ● - Compulsory
O - Optional

6.2.1.2 CoA for structural fibre

The certificate of analysis for structural fibre, with reference to relevant items given in 5.2.1.2, is given in Table 2 for the application independent structural fibre properties.

The customer may require CoA specific for the fibres used in the fabric. Such a request shall be agreed between supplier and customer prior to order.

Table 2 — CoA properties for application independent structural fibre

Ref. no 5.2.1.2	Property	Declared value with tolerances (% or range)	CoA Test result	Unit	Test method	CoA Content [a]
e)	Area weight for each layer			[kg/m^2]	Process card	●
f)	Sizing type and amount			[wt.%]	EN ISO 10548	O
g)	Fibre batch number					●
h)	Max gap between fibre bundles			[mm]		O

[a] ● - Compulsory
O - Optional

6.2.1.3 CoA for stabilising/support material

The certificate of analysis for stabilising/support material, with reference to relevant items given in 5.2.1.3, is given in Table 3 for the application independent stabilising/support material properties.

Table 3 — CoA properties for application independent stabilising/support material

Ref. no 5.2.1.3	Property	Declared value with tolerances (% or range)	CoA Test result	Unit	Test method	CoA Content [a]
d)	Area weight			[kg/m^2]	Process card	●
e)	Sizing/binder type and amount					O
f)	Linear density				EN ISO 1889	O
g)	Batch number					●

[a] ● - Compulsory
O - Optional

6.2.1.4 CoA for assembly material

The certificate of analysis for assembly material, with reference to relevant items given in 5.2.1.4, is given in Table 4 for the application independent assembly material properties.

Table 4 — CoA properties for application independent assembly material

Ref. no 5.2.1.4	Property	Declared value with tolerances (% or range)	CoA Test result	Unit	Test method	CoA Content [a]
e)	Area weight			[kg/m^2]	Process card	●
f)	Assembly stitching/knitting pattern				EN ISO 4921	O
g)	Stitch/knit length			[mm]	Process card	O
h)	Space between stitches/needles			[mm]	Process card	O
j)	Material batch number					●

[a] ● - Compulsory
O - Optional

6.2.2 CoA for woven fabric

(Not implemented yet).

6.3 CoA for fabric for discontinuous fibre

(Not implemented yet).

6.4 CoA for additional process/material

The certificate of analysis for additional process/material, with reference to relevant items given in 5.4, is given in Table 5 for the application independent additional process/material properties.

Table 5 — CoA properties for application independent additional material

Ref. no 5.4	Property	Declared value with tolerances (% or range)	CoA Test result	Unit	Test method	CoA Content [a]
d)	Area weight			[kg/m^2]	Process card	●
e)	Material batch number					●

[a] ● - Compulsory
O - Optional

Annex A
(informativ)

Clarification of nominal, maximum and minimum test values

A.1 General

The requested properties as given in this part of the standard EN xxx (i.e. EN xxxx-y), are given as nominal values with upper and lower limits, maximum values and/or minimum values. The purpose of this annex is to clarify the nomenclature and the associated values.

A.2 Clarification of nominal value

Nominal value means that the properties of the material will have a mean value equal to the declared value. The mean value is based on all measured values of all batches of the manufacturer. The material delivered to the customer is normally only a fraction of the totally produced material. This may result in that the actual value on the property of the delivered material has a mean value lower or higher than the declared value. However, the mean value of the property of the delivered material shall not be outside the declared tolerance limits in order to be delivered according to the declared properties. These tolerances include inaccuracy in the measurement itself.

A.3 Clarification of minimum and maximum value

Minimum value and maximum value means the mean value minus (-) and plus (+) two standard deviations, respectively.

The minimum and maximum value is based on all measured values of all batches of the manufacturer. The delivered materials have a 97,6 % probability of being within the minimum and maximum values, thus having 2,4 % probability of being outside the minimum and maximum value. This implies that part of or all of the delivered material may belong to the fraction which is outside the minimum and maximum values. In order to avoid this, an agreement between the manufacturer and customer stating that no material shall have properties above or below the declared minimum and maximum values, i.e guaranteed minimum or maximum values.

A.4 Guaranteed minimum and maximum value

Guaranteed minimum and maximum value mean that no delivered material has properties below or above these values. When destructive testing is needed the mean value of the tested material (within the same batch) shall be within the declared minimum and maximum value for that particular test if guaranteed values have been agreed. In case a guaranteed value is not agreed, a sample test may have any value and still be within the specified range.

A.5 Extent of testing

The extent of testing involved for a CoA has to be agreed between the supplier and the customer. For a resin material it is normal to obtain the properties from the batch. For core and fibre material, several of the tests are destructive tests and have to be performed on undelivered material.

For core plates, destructive testing for mechanical properties can be performed in the lower range of density, while non destructive tests, (dimensions and density) may be performed on every plate or a selection.

The extent of testing of fibre material is similar as for core material, where typical values are obtained from one or more bobbins or an agreed selection.