SLOVENSKI STANDARD
SIST EN 12467:2002

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Vlaknatocementne ravne plogļ e - Specifikacije in preskusne metode

Fibre-cement flat sheets - Product specifications and test methods

Faserzement-Tafeln - Produktspezifikationen und Prüfverfahren

Plaques planes en fibres-ciment - Spécifications du produit et méthodes d'essai

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91.100.40	Cementni izdelki, ojaļ ani z vlakni	Products in fibre-reinforced cement

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Fibre-cement flat sheets - Product specifications and test methods

Plaques planes en fibres-ciment - Spécifications du produit et méthodes d'essai

Faserzement-Tafeln - Produktspezifikationen und Prüfverfahren

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

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 128 "Roof covering products for discontinuous laying and products for wall cladding", the secretariat of which is held by IBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2000, and conflicting national standards shall be withdrawn at the latest by December 2000.

A distinction has been made between product appraisal (type tests) and routine quality control requirements (acceptance tests).

Attention is drawn to the need for observance of EU and/or EFTA and national legal requirements restricting the use of certain materials e.g. asbestos and to the related marking and labelling requirements.

The performance of a building part constructed with these sheets depends not only on the properties of the product as required by this standard, but also on the design, construction and performance of the component as a whole in relation to the environment and conditions of use.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European standard specifies the technical requirements and establishes methods of inspection and test as well as acceptance conditions for fibre-cement flat sheets, siding shingles and planks (later referred to as sheets) having an apparent density greater than 1,0 kg/dm³ for one or more of the following uses:

- Internal wall and ceiling finishes
- External wall and ceiling finishes
- Roofing underlayers.

This standard covers sheets reinforced with fibres of different types as specified in 5.1.1.

This standard does not cover sheets designed for fire protection purposes.

Composite fibre-cement sheets that influence acoustical and thermal properties significantly are not covered, nor are requirements concerning adhered applications.

This standard does not include calculations with regard to works, design requirements, installation techniques, wind uplift and rainproofing of the installed sheets.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ENV 197-1:1992	Cement – Part 1: Composition, specifications and conformity criteria for common cements
EN ISO 9001	Quality systems - Model for quality assurance in design, development, production, installation and servicing (ISO 9001: 1994)
EN ISO 9002	Quality systems - Model for quality assurance in production, installation and servicing (ISO 9002 : 1994)
ISO 390:1993	Products in fibre-reinforced cement - Sampling and inspection
ISO 2602:1980	Statistical interpretation of test results - Estimation of the mean - Confidence interval
ISO 2859-1:1989	Sampling procedures for inspection by attributes - Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection
ISO 3951:1989	Sampling procedures and charts for inspection by variables for percent nonconforming.

3 Definitions

For the purposes of this standard the following definitions apply

3.1 acceptance test

Test to establish whether a batch of sheets conforms to a specification. The test is performed on samples drawn either from continuous production or from a consignment [ISO 390].

NOTE: Test methods, specifications and limit values are specified in this standard. Sampling levels and acceptance criteria are specified in 6.1.2.

3.2 type test

Test carried out for the approval of a new product and/or when a fundamental change is made in formulation and/or method of manufacture the effects of which cannot be predicted on the basis of previous experience.

The test is performed on the as delivered product; it is required to demonstrate conformity of the generic product to a specification but is not required for each production batch.

3.3 acceptable quality level (AQL)

In a sampling plan, the quality level which corresponds to a specified, relatively high probability of acceptance.

It is the maximum percent defective (or maximum number of defects per 100 units) that for purposes of sampling inspection can be considered satisfactory as a process average.

NOTE: A sampling scheme with an AQL of 4% means that batches containing up to 4% defective items have a high probability of acceptance.

3.4 apparent density

The density based on the external dimensions of the sample to calculate the volume. This is an average density of material and pores.

3.5 as-delivered

The same condition as the producer intends to supply the product after completing all aspects of the process including maturing and, when appropriate, painting.

3.6 upper face

Face normally exposed to the weather.

3.7 textured sheets

Sheets which have a relief pattern embossed or applied as a coating on their upper face before delivery.

4 Symbols and abbreviations

a Nominal length or width of the sheet

b 1. Dimension of the specimen (length or width) measured parallel to the test machine supports, in millimetres

2. One of the coefficients of the regression line (see annex B)

d Apparent density of the sheet in grams per cubic centimetre

e Thickness of the sheet, in millimetres

F Breaking load, in newtons

l Length, in millimetres

l_s Span between the centres of the test machine supports in the bending strength test, in millimetres

m Mass of the specimen after drying, in grams

MOR Modulus of rupture, in megapascals

MOR_{fi} Modulus of rupture of the i^{th} exposed specimen after the type test

MOR_{fci} Modulus of rupture of the i^{th} unexposed reference specimen

MR_i Individual ratio of the modulus of rupture of the i^{th} pair of exposed and unexposed specimens

R Average ratio of the modulus of rupture of exposed and unexposed specimens

R_L Lower estimate of the mean of the ratios at 95% confidence level of the modulus of rupture of exposed and unexposed specimens

s Standard deviation of the values in the appropriate calculation

V Volume of the specimen, in cubic centimetres

w Width, in millimetres

x_{std} Minimum value to be used as the specification for the dry method of test. This value is calculated at the 97,5% lower confidence level from the value specified for the wet method of test in this standard (see annex B)

y_{std} Minimum value specified in the standard for wet testing (see annex B)

x_o Actual result obtained when dry testing (see annex B)

y_0 Value calculated from the value obtained from a specimen tested dry, which is the estimate at the 97,5% lower confidence level of the value expected from a specimen tested wet (see annex B).

5 Requirements for flat sheets

5.1 General requirements

5.1.1 Composition

Sheets shall consist essentially of cement or a calcium silicate formed by a chemical reaction of a siliceous and a calcareous material, reinforced by fibres. The cement shall comply with relevant national standards of CEN members and/or ENV 197-1:1992.

Two types of fibre-reinforced sheets are included in this standard :

- Type AT (Asbestos Technology) for sheets the formulation of which contains chrysotile asbestos.

- Type NT (Non-Asbestos Technology) for sheets the formulation of which does not contain asbestos.

The reinforcing fibres shall be one or more of the following forms :

- discrete elements randomly dispersed;
- continuous strands or tapes;
- nets or webs.

Process aids, fillers, aggregates and pigments may be added.

5.1.2 Appearance and finish

The upper face of the sheets can be with or without texture. The sheets can be coloured or left in their natural colour. The sheets can also receive adherent coloured or uncoloured coatings on their surface. Variations of the surface appearance which do not impair the fitness for purpose of the sheets are permitted.

NOTE: The sheets can be supplied holed for fixing and/or cut to size.

5.2 Classification

Sheets covered by this standard are divided into

- two types in accordance with their composition (see 5.1.1);

- three *categories* in accordance with their weather resistance (see below);

- five *classes* in accordance with their bending strength (see 5.4.3);

- two groups of sizes in accordance with their method of installation (see 5.2.4);

- two levels in accordance with their dimensional tolerances (see 5.3.4).

Type tests for each *category* are specified in table 8 (6.1.3).

5.2.1 Category A

Sheets which are intended for applications where they may be subjected to heat, high moisture and severe frost.

5.2.2 Category B

Sheets which are intended for applications where they may be subjected to heat, moisture and occasional frost, e.g. where they are either protected from or not subjected to severe weathering conditions.

5.2.3 Category C

Sheets which are intended for applications where they may be subjected to heat and moisture but not to frost.

5.2.4 Groups of sizes

5.2.4.1 Small size sheets

Sheets for which the method of installation includes horizontal overlap. Their dimensions are generally such as their area is < 0,4 m² and have a length/width relation ≤ 3.

5.2.4.2 Large size sheets

Sheets which do not correspond to indicators for small size sheets. Large sheets may be declared as "small size sheets" provided tolerances for that kind of sheets apply and are specified in the manufacturer's literature.

5.3 Dimensions and tolerances

5.3.1 General

There are two levels of tolerances for length, width, straightness and squareness of edges. Sheets have to comply with the requirements of the same level for the four sets of tolerances.

5.3.2 Nominal length and width

The manufacturer shall specify the nominal length and width of the sheets.

NOTE : Sheets are normally available in nominal lengths up to 3 000 mm and nominal width up to 1 250 mm. Greater nominal lengths and widths may be supplied.

Sheets slightly larger than the nominal dimensions (oversize sheets) may be supplied for applications where the sheet is required to be cut by the user.

5.3.3 Thickness

The manufacturer shall specify the nominal thickness of the sheets.

For non textured sheets the nominal thickness refers to the average thickness. For textured sheets the nominal thickness refers to the maximum thickness. The nominal thickness of textured sheets cannot be used for the calculation of mechanical performance.

Sheets are normally available in thickness from 3 mm to 30 mm.

NOTE: Thicker sheets may be supplied.

5.3.4 Tolerances on nominal dimensions [1]

5.3.4.1 on length and width

Table 1 - Tolerance on nominal dimensions in accordance with value and level

Nominal dimension a	Level I	Level II
$a \leq 600$ mm	± 3 mm	± 4 mm
600 mm $< a \leq 1\,000$ mm	± 3 mm	± 5 mm
1 000 mm $< a \leq 1\,600$ mm	± 0,3% a	± 0,5% a
1 600 mm $< a$	± 5 mm	± 8 mm
a is the nominal width or length		

These tolerances are not applicable to oversize sheets.
The method of measurement is given in 7.2.3.1.

5.3.4.2 on thickness

- for non-textured sheets:

Table 2 - Tolerance on thickness for non-textured sheets

$e \leq 6$ mm	± 0,6 mm
6 mm $< e \leq 20$ mm	± 10 % e
$e > 20$ mm	± 2 mm

For sheets without texture the maximum difference between extreme values of the thickness measurements within one sheet shall not exceed 10% of the maximum measured value.

- for textured sheets:

Table 3 - Tolerance on thickness for textured sheets

$e \leq 6$ mm	- 0,6 mm + 0,9 mm
6 mm $< e \leq 20$ mm	- 10% e + 15% e
$e > 20$ mm	- 2 mm + 3 mm

For textured sheets the maximum difference between extreme values of the eight thickness measurements within one sheet shall not exceed 15% of the maximum measured value.

[1] For certain applications, tighter tolerances are required and have to be agreed on between the manufacturer and the purchaser.

The method of measurement is given in 7.2.3.2.

5.3.5 Tolerances on shape [2]

5.3.5.1 Straightness of edges

Tolerances are applicable only to large size sheets

The tolerance on the straightness of edges is defined as a percentage of the length of the edge of the relevant dimensions (length or width).

Table 4 - Tolerance on straightness of edges

Level I	Level II
0,1%	0,3%

The method of measurement is given in 7.2.3.3. These tolerances are not applicable for oversize sheets.

5.3.5.2 Squareness of edges

The tolerance on squareness of sheets is for

Table 5 - Tolerance on squareness of edges

Level I	Level II
2 mm/m	4 mm/m

The method of measurement is given in 7.2.3.4.

These tolerances are not applicable for oversize sheets.

5.4 Physical requirements and characteristics

5.4.1 General

Mechanical and material properties are normally determined on sheets as delivered. The results shall be identified as applying to coated or uncoated material.

NOTE: See 6.1 for statistic interpretation.

5.4.2 Apparent density

The manufacturer shall specify in his literature the minimum apparent density for each category of sheet. When tested in accordance with the method specified in 7.3.1 the density shall be not less than this value.

[2] For certain applications, tighter tolerances are required and have to be agreed on between the manufacturer and the purchaser.

5.4.3 Mechanical characteristics

Bending strength

When tested as specified in 7.3.2 the minimum modulus of rupture of the sheets, expressed in megapascals shall be as specified in table 6. The *MOR* shall be the average of the values obtained from testing the samples in both directions.

NOTE: For non-homogeneous *e.g. coated sheets* table 6 refers to the apparent *MOR.*

Category A and B sheet strengths are specified in the wet condition.

Category C sheet strengths are specified in the ambient condition.

The minimum modulus of rupture of the sheets in the weaker direction shall be not less than 70% of the specified value for the average of the two directions. This requirement does not apply to textured sheets.

Table 6 - Minimum modulus of rupture (MOR)

Min. *MOR* in the wet condition MPa		Min. *MOR* in the ambient condition MPa	
Classes	Category A & B	Classes	Category C
1	4	1	4
2	7	2	7
3	13	3	10
4	18	4	16
5	24	5	22
NOTE 1: Where manufacturers state minimum product *MOR* this shall be at the 4% acceptable quality level (AQL) as are the values in table 6. NOTE 2: For textured sheets the *MOR* cannot be used for calculating mechanical performance.			

5.4.4 Other characteristics

The manufacturer shall provide such technical data as is necessary to confirm the suitability of the product for any particular recommended application.

5.4.5 Water impermeability for categories A & B

When tested in accordance with 7.3.3 traces of moisture may appear on the under surface of the sheet, but in no instance shall there be any formation of drops of water.