
Vlaknato-cementne valovite strešne plošče in fazonski kosi - Specifikacija za izdelek in preskusne metode

Fibre-cement profiled sheets and fittings - Product specification and test methods

Faserzement-Wellplatten und dazugehörige Formteile - Produktspezifikation und Prüfverfahren

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

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**Fibre-cement profiled sheets and fittings - Product specification
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Spécifications du produit et méthodes d'essaiFaserzement-Wellplatten und dazugehörige Formteile -
Produktspezifikation und Prüfverfahren

This European Standard was approved by CEN on 3 March 2004 and includes Amendment 1 approved by CEN on 20 July 2005, Amendment 2 approved by CEN on 14 August 2006 and Amendment 3 approved by CEN on 8 February 2007.

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Foreword

This document (EN 494:2004+A3:2007) 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/BIN.

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of an identical text or by endorsement, at the latest by September 2007, and conflicting national standards shall be withdrawn at the latest by September 2007.

This document includes Amendment 1, approved by CEN on 2005-07-20, Amendment 2, approved by CEN on 2006-08-14 and Amendment 3, approved by CEN on 2007-02-08.

This document supersedes $\boxed{A_3}$ EN 494:2004 $\boxed{A_3}$.

The start and finish of text introduced or altered by amendment is indicated in the text by tags $\boxed{A_1}$ $\boxed{A_1}$, $\boxed{A_2}$ $\boxed{A_2}$ and $\boxed{A_3}$ $\boxed{A_3}$.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA which is an integral part of this document.

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

The performance of a roof or another building part constructed with these products depends not only on the properties of the product as required by this document, but also on the design, construction and installation of the components 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, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This document specifies the technical requirements and establishes methods of control and test as well as acceptance conditions for fibre-cement profiled sheets and their fibre-cement fittings for one or more of the following uses:

- roofing,
- internal wall finishes,
- external wall and ceiling finishes.

For the purpose of this document fibre-cement profiled sheets are classified according to their height of corrugation and their mechanical characteristics.

This document covers fibre-cement profiled sheets reinforced with fibres of different type as specified in 5.1.1, with and without factory applied coating.

This document does not include calculations with regard to works, design requirements, installation techniques, wind uplift or rain proofing of the installed sheets.

NOTE Some of these requirements can be applied to curved sheets, after agreement between manufacturer and purchaser.

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2 Normative references

SIST EN 494:2005+A3:2007

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 197-1, *Cement — Part 1: Composition, specifications and conformity criteria for common cements*

ENV 1187^[A3] *deleted text* ^[A3], *Test methods for external fire exposure to roofs*

EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using test data from reaction to fire test*

^[A3] EN 13501-5, *Fire classification of construction products and building elements — Part 5: Classification using data from external fire exposure to roofs test* ^[A3]

^[A2] EN 13823, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item* ^[A2]

^[A3] EN 15057, *Fibre cement profiled sheets — Impact resistance test method* ^[A3]

^[A2] EN ISO 1716, *Reaction to fire tests for building products — Determination of the heat of combustion (ISO 1716:2002)* ^[A2]

ISO 390, *Products in fibre-reinforced cement — Sampling and inspection*

ISO 2602, *Statistical interpretation of test results — Estimation of the mean — Confidence interval*

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

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ISO 3951, *Sampling procedures and charts for inspection by variables for percent non-conforming*

3 Terms and definitions

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

3.1**profiled sheet**

component the cross section of which consists of corrugations as in the examples shown in Figures A.1 to A.7. The corrugations are defined by their pitch a and their height h

3.2**acceptance test**

test to establish whether a batch of products conforms to a specification. The test is performed on samples drawn either from continuous production or from a consignment

NOTE Test methods and specification limit values are specified in this document. Sampling levels and acceptance criteria are given in 6.3.2.

3.3**type test**

test carried out to demonstrate conformity with the requirements of this document or 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, but is not required for each production batch

3.4**acceptable quality level (AQL)**

quality level which in a sampling plan 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.

3.5**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**short sheet**

sheet having a length less than or equal to 0,9 m

3.7**long sheet**

sheet having a length greater than 0,9 m

3.8**upper face**

face normally exposed to the weather

3.9**under face**

the reverse of the upper face

4 Symbols and abbreviations

<i>a</i>	1. Pitch of the corrugations in millimetres 2. One of the coefficients of the regression line (Annex C)
<i>b</i>	1. Dimension of the specimen parallel to the supports in either the breaking load test or the bending moment test in millimetres 2. One of the coefficients of the regression line (Annex C)
<i>d</i>	Apparent density of the sheet in grams per cubic centimetres
<i>e</i>	Thickness of the sheet in millimetres
<i>f</i>	Increase in deflection between applying 20% and 70% of the specified load in the breaking load test in millimetres
<i>F</i>	Load at rupture from either the breaking load test or the bending moment test in newtons
<i>F_S</i>	Load at rupture per metre width from the breaking load test in newtons
<i>h</i>	Height of the corrugations in millimetres
<i>h_{od}</i>	Height of the edge of the descending corrugation in millimetres
<i>h_{om}</i>	Height of the edge of the ascending corrugation in millimetres
<i>l</i>	Length of the sheet in millimetres
<i>l_S</i>	Clear span between the supports in the breaking load test or span between the centre of the supports in the bending moment test in millimetres
<i>L₁</i>	Upper estimate of the mean breaking load or bending moment at 95% confidence level
<i>L₂</i>	Lower estimate of the mean breaking load or bending moment at 95% confidence level
<i>m</i>	Mass of the specimen after drying in grams
<i>M</i>	Bending moment at rupture per metre length from the bending moment test in newton metres per metre
<i>R_L</i>	Ratio of estimate <i>L₂</i> to estimate <i>L₁</i>
<i>s₁</i>	Standard deviation of the specimens with mean <i>X₁</i>
<i>s₂</i>	Standard deviation of the specimens with mean <i>X₂</i>
<i>V</i>	Volume of the test specimen in cubic centimetres
<i>x₀</i>	Actual result obtained when dry testing
<i>w</i>	Width of the sheet in millimetres
<i>X₁</i>	Mean value of the test results (bending strength or bending moment) of the control specimens (first lot) for a type test

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X_2	Mean value of the test results (bending strength or bending moment) of the specimens after a type test
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 y_{std} specified for the wet method of test in this document
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
y_{std}	Minimum value specified in the standard for wet testing.

5 Product requirements**5.1 General****5.1.1 Composition**

Fibre-cement profiled sheets and fittings shall consist essentially of cement or a calcium silicate formed by chemical reaction of a siliceous and a calcareous material, reinforced by fibres. The cement shall comply with EN 197-1 or with technical specifications relevant in the country of use.

A1 This European Standard covers fibre-reinforced cement profiled sheets and fittings of type NT (Non-asbestos Technology). **A1**

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

- discrete elements randomly dispersed; [SIST EN 494:2005+A3:2007](https://standards.iteh.ai/catalog/standards/sist/c9c8e456-2965-4b9d-b8f7-96b32d1ccc00/sist-en-494-2005a3-2007)
- continuous strands or tapes; [96b32d1ccc00/sist-en-494-2005a3-2007](https://standards.iteh.ai/catalog/standards/sist/c9c8e456-2965-4b9d-b8f7-96b32d1ccc00/sist-en-494-2005a3-2007)
- nets or webs.

Process aids, fillers and pigments which are compatible with the composite may be added.

5.1.2 Appearance and finish

The sheets may be left with their natural colour, or colouring matters may be added in the composition; they may also receive adherent coloured or uncoloured coatings on their surface.

Variations of the surface appearance which do not impair the characteristics of the sheets as defined in this document are permitted.

On exposure, the surface and/or its coating will be affected by weathering which may vary with site, location, aspect, pitch of roof and duration of exposure. Any deterioration in this respect shall not detract from the minimum mechanical and physical characteristics as specified in this document or from the function of the sheet as a durable element.

Edges shall be straight and clean.

Sheets may have mitred or pre-mitred corner(s) and/or may be predrilled for fixing.

The fittings shall have a general appearance and finish compatible with the sheets with which they are to be used. They may be supplied with holes for fixing.

5.2 Dimensions and tolerance

5.2.1 General

The manufacturer shall specify the nominal dimensions.

NOTE See 5.7 for designation and information.

Fittings shall have nominal dimensions and shapes determined by the manufacturer and appropriate to the corresponding corrugated section sheets.

5.2.2 Categorization by height of profile

The sheets are divided into five categories, depending on the nominal height of the corrugations, according to Table 1 (examples of profiles are shown in Figures A.1 to A.7).

Table 1 – Categorization by height of profile

Category	h (mm)
A	15 to 30
B	25 to 45
C	40 to 80
D	60 to 120
E	90 to 150

5.2.3 Thickness

The thickness of the sheets shall either:

- be approximately constant across the width of the profile, as shown in Figure A.8a or
- vary regularly from the crowns and valleys to the flanks of the corrugations, as shown in Figure A.8b.

When measured in accordance with 7.2.1.3 the minimum individual thickness for each category shall be as specified in Table 2.

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Table 2 – Minimum individual thickness

Category	h (mm)	Minimum individual thickness (mm)	
		Length > 0,9 m	Length ≤ 0,9 m
A	15 to 30	4,0	3,5
B	25 to 45	5,0	4,0
C	40 to 80	5,2	4,0
D	60 to 120	5,5	5,0
E	90 to 150	6,0	-

NOTE A special Class Z is allowed in Category A with a minimum individual thickness of 3,5 mm.

5.2.4 Tolerances on nominal dimensions

5.2.4.1 Profiled sheets

When measured in accordance with 7.2 the allowable dimensional variations shall be as follows:

a) on the pitch a :

a	Tolerances
$a \leq 75$ mm	$\pm 1,5$ mm
75 mm < $a \leq 180$ mm	$\pm 2,0$ mm
180 mm < $a \leq 260$ mm	$\pm 2,5$ mm
260 mm < a	$\pm 3,0$ mm

b) on the height h :

h	Tolerances
15 mm ≤ h ≤ 45 mm	$\pm 2,0$ mm
45 mm ≤ h ≤ 150 mm	$\pm 3,0$ mm

c) on the length l : ± 10 mm

d) on the width w : $\begin{matrix} +10 \\ -5 \end{matrix}$ mm

e) on nominal thickness e :

The average thickness measured in accordance with 7.2.1.3 shall be within $\pm 10\%$ and not more than $\pm 0,6$ mm of the nominal thickness.

f) on the squareness of the sheet:

Out of squareness $\leq 6,0$ mm.

g) on the height of edges:

This tolerance applies only for sheets having a rising edge on one side and a descending edge on the other side, and where it is required by the installation technique in order to ensure weather tightness and/or geometrical fit.

The producer shall use the tolerances specified in installation standards or regulations or if none are given, he shall specify them in his literature.

5.2.4.2 Fittings

When measured in accordance with 7.2, the tolerances on nominal dimensions shall be as follows:

a) on length and width ± 10 mm

b) on the average thickness ± 1 mm

NOTE Installation standards or regulations can specify tolerances on other dimensions.

5.3 Physical requirements and characteristics for fibre-cement profiled sheets

5.3.1 General

Mechanical and material properties are determined for products as delivered, whenever practical. The results shall be identified as applying to coated or uncoated products.

NOTE See 6.3 for statistical interpretation.

5.3.2 Apparent density

The manufacturer's literature shall specify the minimum apparent density of the sheets. The sheet shall have an apparent density equal to or greater than that specified by the manufacturer when tested in accordance with 7.3.1.

5.3.3 Mechanical characteristics

5.3.3.1 Breaking load

There are two classes for sheets of length greater than 0,9 m depending on the minimum breaking load for each category. For sheets in Category C of length greater than 0,9 m and less than 1,25 m, there is a third class.

When tested in accordance with 7.3.2.1, the sheets shall have a breaking load, for a span of 1,1 m, at least equal to the values specified in Table 3.

Table 3 – Minimum breaking load

Category	h (mm)	Minimum breaking loads per metre width for a span of 1,1 m for sheets length > 0,9 m	
		Class 1 (N/m)	Class 2 (N/m)
A	15 to 30	1400	1250
B	25 to 45	2 500	2 000
C	40 to 80	4 250	3 500
D	60 to 120	7 000	5 500
E	90 to 150	12 500	8 500

NOTE 1 A special Class 3 is allowed in Category A with a minimum breaking load of 750 N/m.

NOTE 2 A special Class 3 with a minimum breaking load per metre with of 2 200 N/m is allowed in Category C for sheets of length greater than 0,9 m and less than 1,25 m.

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5.3.3.2 Deflection

When tested in accordance with 7.3.2.1, the increase in deflection of sheets of length greater than 0,90 m measured between applying 20% and 70% of the minimum load specified for their class (see Figure A.24) shall not exceed:

$$f \leq 0,7 \times 10^{-3} \times l_s^2/h$$

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where:

f is the increase in deflection, in millimetres;

l_s is the clear span, in millimetres;

h is the nominal height of corrugation, in millimetres.

5.3.3.3 Bending moment

When tested in accordance with 7.3.2.2, the minimum bending moment per metre length at rupture of the sheets shall be as specified in Table 4.

5.3.3.4 Impact resistance


Where required, impact resistance shall be determined in accordance with EN 15057. 

Table 4 – Minimum bending moment

Category	h (mm)	Minimum bending moment per metre length at rupture		
		Length > 0,9 m		Length ≤ 0,9 m (Nm/m)
		Class X (Nm/m)	Class Y (Nm/m)	
A	15 to 30	40	30	25
B	25 to 45	55	40	30
C	40 to 80	55	40	30
D	60 to 120	55	45	40
E	90 to 150	55	45	-

NOTE A special Class Z is allowed in Category A with a minimum bending moment of 20 Nm/m.

5.3.4 Water impermeability

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

5.4 Durability requirements SIST EN 494:2005+A3:2007

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5.4.1 General

Mechanical and material properties are normally determined for as delivered products. The results shall be identified as applying to coated or uncoated material. The performance of the coating in the tests specified in 5.4.2 and 5.4.3 shall not be considered in the assessment of the product.

5.4.2 Freeze-thaw

5.4.2.1 Freeze-thaw - Fibre cement profiled sheets

When tested in accordance with 7.4.1, after 100 freeze-thaw cycles, the ratio R_L as defined in 7.4.1.4 shall be not less than 0,70.

5.4.2.2 Freeze-thaw - Fibre cement fittings

When tested as specified in 7.4.3, any visible alteration shall not be of such a degree as to affect the performance in use.

5.4.3 Heat-rain

When tested in accordance with 7.4.2, after 50 heat-rain cycles any visible cracks, delamination or other defects in the fibre-cement sheets shall not be of such degree as to affect their performance in use.

(a) Water tightness is assessed according to 5.3.4.