# SLOVENSKI STANDARD
# SIST EN 494:2013

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**Nadomešča:**
**SIST EN 494:2005+A3:2007**

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**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



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



**Ta slovenski standard je istoveten z:** **EN 494:2012**

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**ICS:**

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| 91.060.20 | Strehe | Roofs |
| 91.100.40 | Cementni izdelki, ojačani z vlakni | Products in fibre-reinforced cement |

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EUROPEAN STANDARD

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

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

Faserzement-Wellplatten und dazugehörige Formteile - Produktspezifikation und Prüfverfahren

This European Standard was approved by CEN on 11 August 2012.

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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 CEN-CENELEC Management Centre has the same status as the official versions.



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

**Management Centre: Avenue Marnix 17, B-1000 Brussels**

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## Foreword

This document (EN 494:2012) 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 NBN.

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of an identical text or by endorsement, at the latest by April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 494:2004+A3:2007.

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.

In comparison to the previous edition, the following paragraphs have been changed or added: 3.10, 3.11,5.1.1, Table 2, 5.3.3.1, 5.3.3.4, 5.6.3, Table 6, 6.3.2, 7.4.2.1 and Annex ZA.



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, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## 1 Scope

This European Standard 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 European Standard, fibre-cement profiled sheets are classified according to their height of corrugation and their mechanical characteristics.

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

This European Standard 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, after agreement, to curved sheets for specific applications.



## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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*

CEN/TS 1187 *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 tests*

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

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

EN 15057, *Fibre cement profiled sheets — Impact resistance test method*

EN ISO 1716, *Reaction to fire tests for products — Determination of the gross heat of combustion (calorific value) (ISO 1716)*

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*

ISO 3951-1, *Sampling procedures for inspection by variables — Part 1: Specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection for a single quality characteristic and a single AQL*

## 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

Note 1 to entry: The corrugations are defined by their pitch $a$ and their height $h$.

**3.2**
**acceptance test**
test to establish whether a batch of sheets, drawn either from continuous production or from a consignment, conforms to a specification

Note 1 to entry: 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

Note 1 to entry: 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



Note 1 to entry: 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 2 to entry: 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**
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**
reverse of the upper face

**3.10**
**N.T.**
fibre-cement slates and fittings of type NT cover products made using a non-asbestos technology

**3.11**
**ambient laboratory conditions**
ambient laboratory conditions are a temperature of (23 ± 5) °C and a relative humidity of (50 ± 20) %

## 4 Symbols and abbreviations

$a$ 1. pitch of the corrugations in millimetres

2. one of the coefficients of the regression line (Annex C)

$b$ 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)

$d$ apparent density of the sheet in grams per cubic centimetres

$e$ thickness of the sheet in millimetres

$f$ increase in deflection between applying 20 % and 70 % of the specified load in the breaking load test in millimetres



$F$ load at rupture from either the breaking load test or the bending moment test in newtons



$F_s$ load at rupture per metre width from the breaking load test in newtons

$h$ height of the corrugations in millimetres

$h_{od}$ height of the edge of the descending corrugation in millimetres

$h_{om}$ height of the edge of the ascending corrugation in millimetres

$l$ length of the sheet in millimetres

$l_s$ 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

$L_1$ upper estimate of the mean breaking load or bending moment at 95 % confidence level

$L_2$ lower estimate of the mean breaking load or bending moment at 95 % confidence level

$m$ mass of the specimen after drying in grams

$M$ bending moment at rupture per metre length from the bending moment test in newton metres per metre

$R_L$ ratio of estimate $L_2$ to estimate $L_1$

$s_1$ standard deviation of the specimens with mean $X_1$

$s_2$ standard deviation of the specimens with mean $X_2$

$V$ volume of the test specimen in cubic centimetres

$x_o$ actual result obtained when dry testing

$w$ width of the sheet in millimetres

$X_1$ mean value of the test results (bending strength or bending moment) of the control specimens (first lot) for a type test

$X_2$ 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

$y_o$ 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 of cement or other pozzolanic material reinforced by fibres. The cement shall comply with EN 197-1 or an agreed technical specification.

This European Standard covers fibre-reinforced cement profiled sheets and fittings of type NT.

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 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 tolerances

### 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 Categorisation 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 — Categorisation 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.

**Table 2 — Minimum individual thickness**

| Category | $h$ (mm) | Minimum individual thickness (mm) |
|---|---|---|
| A | 15 to 30 | 4,0 |
| B | 25 to 45 | 5,0 |
| C | 40 to 80 | 5,2 |
| D | 60 to 120 | 5,5 |
| 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 | ± 1,5 mm |
| 75 mm < $a \leq 180$ mm | ± 2,0 mm |
| 180 mm < $a \leq 260$ mm | ± 2,5 mm |
| 260 mm < $a$ | ± 3,0 mm |



b) on the height $h$:

| $h$ | Tolerances |
|---|---|
| 15 mm $\leq h \leq$ 45 mm | ± 2,0 mm |
| 45 mm $\leq h \leq$ 150 mm | ± 3,0 mm |

c) on the length $l$ : ± 10 mm;

d) on the width $w$ : $^{+10}_{-5}$ mm;

e) on nominal thickness $e$:

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

f) on the squareness of the sheet:

Out of squareness ≤ 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.

### 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.

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 (N/m) | |
|---|---|---|---|
| | | Class 1 | Class 2 |
| 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 A special Class 3 is allowed in Category A with a minimum breaking load of 750 N/m. | | | |

#### 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:

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



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.

**Table 4 — Minimum bending moment**

| Category | *h* (mm) | Minimum bending moment per metre length at rupture (Nm/m) | | |
|---|---|---|---|---|
| | | Length > 0,9 m | | Length ≤ 0,9 m |
| | | Class X | Class Y | |
| 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. | | | | |

#### 5.3.3.4 Impact resistance

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



### 5.3.4 Water impermeability

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



## 5.4 Durability requirements

### 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.