SLOVENSKI STANDARD

SIST EN 492:2005

01-marec-2005

Nadomeġļa:

SIST EN 492:1998

SIST EN 492:1998/A1:2000

SIST EN 492:1998/AC:2000

Vlaknato-cementne streġne ploġļe in fazonski kosi - Specifikacija za izdelek in preskusne metode

Fibre-cement slates and fittings - Product specification and test methods

Faserzement-Dachplatten und dazugehörige Formteile - Produktspezifikation und Prüfverfahren

Ardoises en fibres-ciment et leurs accessoires en fibres-ciment - Spécification du produit et méthodes d'essai

Ta slovenski standard je istoveten z: **EN 492:2004**

ICS:

91.060.20

91.100.40

SIST EN 492:2005 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 492

December 2004

ICS 91.100.40

Supersedes EN 492:1994

English version

Fibre-cement slates and fittings - Product specification and test methods

Ardoises en fibres-ciment et leurs accessoires en fibres-ciment - Spécification du produit et méthodes d'essai

Faserzement-Dachplatten und dazugehörige Formteile - Produktspezifikation und Prüfverfahren

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Ref. No. EN 492:2004: E

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Foreword

This document (EN 492:2004) 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of an identical text or by endorsement, at the latest by June 2005, and conflicting national standards shall be withdrawn at the latest by June 2005.

This document supersedes EN 492:1994.

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 and ZB, which is an integral part of this document.

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

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 Directives transposed into national legal requirements restricting the use of certain materials and to the related marking and labelling requirements.

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 standard, but also on the design, construction and installation of the components as a whole in relation to the environment and conditions of use.

1 Scope

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

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

It applies to fibre-cement slates with a height dimension *h* (see Clause 4) not exceeding 850 mm for overlapping assembly. For the purpose of this standard, fibre-cement slates have been classified according to their bending moment.

This document covers fibre-cement slates reinforced with fibres of different types as specified in 5.1.1.

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

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

ENV 1187:2002, *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.*

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.*

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
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 standard. Sampling levels and acceptance criteria are given in 6.3.2.

3.2
type test
test carried out to demonstrate conformity with the requirements of this standard 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

3.3
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.

3.4
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

3.5
upper face
face normally exposed to the weather

4 Symbols and abbreviations

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 (Annex B)

d Apparent density of the fibre-cement slate in grams per cubic centimetre

e Thickness of the fibre-cement slate in millimetres

F Load at rupture in newtons

h Dimension of the fibre-cement slate measured perpendicular to the line of fixing which is at or nearest to the horizontal plane of the roof (see Annex C, Figures C.1 and C.2), in millimetres

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

m Mass of the specimen after drying in grams

M Bending moment at rupture in newton metres per metre

M_{fi} Bending moment (average of both directions) at rupture of the specimen from the i^{th} pair tested after the type test (second lot) in newton metres per metre

M_{fci} Bending moment (average of both directions) at rupture of the specimen from the i^{th} pair tested for reference in the type test (first lot) in newton metres per metre

R Average ratio of the bending moments at rupture before and after the type test

R_i Individual ratio of the bending moments at rupture of the i^{th} pair of specimens before and after a type test

R_L Lower estimate of the mean of the ratios at 95% confidence level of the bending moments at rupture before and after the type test

s Standard deviation of the values in the appropriate calculation

V Volume of the specimen in cubic centimetres

x_o Actual result obtained when dry testing

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 slates 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.

Two types of fibre-reinforced cement slates and fittings are included in this standard:

- Type AT (Asbestos Technology) for products the formulation of which contains chrysotile asbestos,
- Type NT (Non-asbestos Technology) for products reinforced by other fibres and not containing 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 and pigments which are compatible with the composite may be added.

5.1.2 Appearance and finish

The exposed face of the fibre-cement slates may be with or without texture. The fibre-cement slates may be coloured or left in their natural colour. The fibre-cement slates may also receive adherent coloured or uncoloured coatings on their surface.

The fibre-cement slates may be supplied with holes for fixing.

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 fibre-cement slate as a durable element.

The fittings shall have a general appearance and finish compatible with the fibre-cement slates 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 shapes, sizes and configuration of edges.

NOTE See 5.6 for designation and information.

Fittings shall have nominal dimensions and shapes determined by the manufacturer and appropriate to the corresponding fibre-cement slates.

5.2.2 Thicknesses

The actual fibre-cement slate thickness determined in accordance with 7.2 shall be not less than that shown in Table 1.

The nominal thickness shall be specified by the manufacturer.

The nominal thickness of the fittings shall be not less than the corresponding nominal thickness of the fibre-cement slates with which the fittings are to be used.

5.2.3 Tolerances on nominal dimensions

The maximum dimensional variation when measured as specified in 7.2 shall be as follows:

Length and width: ± 3 mm

Thickness: $^{+25}_{-10}$ % of the nominal value.

For fittings that replace fibre-cement slates (e.g. ventilation fibre-cement slates) the tolerances shall be the same as those on the fibre-cement slates.

For other fittings (e.g. ridges) the tolerances shall be specified by the manufacturer.

5.3 Physical requirements and characteristics for fibre-cement slates

5.3.1 General

Mechanical and material properties are determined on products as delivered, wherever practicable. The results shall be identified as applying to coated or uncoated material.

NOTE See 6.3 for statistical interpretation.

5.3.2 Apparent density

The manufacturer's literature shall specify the minimum apparent density of the fibre-cement slates. The fibre-cement slates 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

When tested in accordance with 7.3.2, the fibre-cement slates shall have a minimum average bending moments per metre width in newton metres per metre as specified in Table 1.

The minimum bending moment at rupture in the weaker direction shall be not less than 60% of the values specified in Table 1 for the average in both directions.

Table 1 — Minimum bending moment per metre and minimum thickness

h (mm)	min. *e*[a] (mm)	Minimum bending moment, average of the two directions	
		Class A (Nm/m)	Class B (Nm/m)
$h \leq 350$	2,8	25	35
$350 < h \leq 450$	3,0	30	45
$450 < h \leq 600$	3,5	35	50
$600 < h \leq 850$	4,0	45	60
NOTE 1 The following special classes are also available: Class AS: For mild climatic conditions lower bending moments than above are permissible for fibre-cement slates of $h \leq 450$ mm with a minimum equivalent to the numerical value of $h/20$; Class BS: When higher bending moments are required for batten spacings ≥ 250 mm, the required minimum should be equivalent to the numerical value of h/5.			
NOTE 2 All classes are suitable for laying on three or more battens or directly onto a continuous rigid roof surface but only Classes B and BS are suitable for laying on two battens.			
NOTE 3 For cladding applications of fibre-cement slates, Class A is sufficient.			
[a] *e* being the arithmetic mean of four measurements (according to 7.2.4).			

5.3.4 Water impermeability

When tested in accordance with 7.3.3, traces of moisture may appear on the under surface of the fibre-cement slate, 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. 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

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 0,75.

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 slates shall not be of such degree as to affect their performance in use.

(a) Water tightness is assessed according to 5.3.4.

(b) Warping and bowing are visually assessed.

5.4.4 Warm water

When tested in accordance with 7.3.4, after 56 days at 60°C, the ratio R_L as defined in 7.3.4.4 shall be not less than 0,75.

5.4.5 Soak-dry

When tested in accordance with 7.3.5, after 50 soak-dry cycles the ratio R_L as defined in 7.3.5.4 shall be not less than 0,75.

5.5 Fire and safety

5.5.1 External fire performance

When subject to regulatory requirements, the external fire performance of the slates shall be declared in accordance with 7.5.1.

5.5.2 Reaction to fire

When subject to regulatory requirements, the reaction to fire of the slates or fittings shall be declared in accordance with 7.5.2.

5.5.3 Release of dangerous substances

5.5.3.1 Release of asbestos

Two types of fibre reinforced cement slates exist: Type "AT" and Type "NT" as defined in 5.1.1. The relevant type of slate or fitting shall be declared in the information accompanying the marking (see 5.6).

For product Type AT a declaration of the asbestos content shall be made by the manufacturer.

5.5.3.2 Release of other dangerous substances

For products containing substance(s) defined in Council Directive 76/769/EEC, the content shall be declared by the manufacturer. This applies to substances contained in the original formulation or created during the manufacturing process. In addition see Annex ZA.

5.6 Product information

The designation of the fibre-cement slate shall include at least the following:

— type of product (see 5.1.1);

— name of the fibre-cement slate;

— class (see Table 1);

— height (*h*), size and shape.

The manufacturer shall include the following in his literature:

a) designation of the fibre-cement slate as above;

b) nominal values for

— thickness,

— length and width;

c) minimum apparent density;

d) information relevant to the handling and installation.

6 Evaluation of conformity

6.1 General

The conformity of products with the requirements of this standard shall be demonstrated by:

— initial type testing; and

— factory production control by the manufacturer.

6.2 Type testing

6.2.1 General

Type tests shall be carried out on products as delivered. If several formats or sizes of the same nominal thickness are being produced from the same composition and by the same production method, type tests only need to be carried out on one size of each nominal thickness.

All characteristics listed in Table 2 shall be subject to initial type testing, except reaction to fire Class A1 without testing and external fire performance “deemed to satisfy” products.

6.2.2 Initial type testing

Initial type testing shall be performed to demonstrate conformity to this standard. Tests previously performed in accordance with the provisions of this standard (same product, same characteristic(s), test method, sampling procedure, same attestation of conformity, etc.) may be taken into account. In addition, initial type testing shall be performed for the approval of a new product, or a fundamental change in formulation or method of manufacture, the effects of which cannot be predicted on the basis of previous experience.

The results of all type tests shall be recorded and held by the manufacturer for at least 5 years.

6.2.3 Further type testing

Whenever a change occurs in the fibre-cement slate design, the raw material or supplier of components, or the production process, which would change significantly one or more of the characteristics, the type test shall be performed for the appropriate characteristic(s).

Table 2 — Number of slates and fittings and compliance criteria

Characteristic	Requirement	Assessment method	Number of samples	Compliance criteria
Mechanical resistance (slates)	5.3.3	7.3.2	Inspection S3 as per ISO 390	5.3.3 Table 1 apply 4% AQL
Density (slates)	5.3.2	7.3.1	7.3.1	5.3.2 and 7.3.1
External fire performance (slates)	5.5.1	7.5.1	7.5.1	7.5.1
Reaction to fire (slates and fittings)	5.5.2	7.5.2	7.5.2	7.5.2
Water impermeability (slates)	5.3.4	7.3.3	3 test slates	5.3.4
Dimensional variations (slates and fittings)	5.2	7.2	Inspection S3 as per ISO 390	5.2.2 and 5.2.3
Release of dangerous substances (slates and fittings)	5.5.3	5.5.3	-	5.5.3
Warm water (slates)	5.4.4	7.3.4	10 samples	5.4.4 and 7.3.4.4
Soak/Dry (slates)	5.4.5	7.3.5	10 samples	5.4.5 and 7.3.5.4
Freeze-Thaw (slates)	5.4.2	7.4.1	10 samples	5.4.2 and 7.4.1.4
Heat-Rain (slates)	5.4.3	7.4.2	11 samples	5.4.3 and 7.4.2.4

6.3 Factory Production Control (FPC)

6.3.1 General

The manufacturer shall establish, document and maintain a FPC system to ensure that the products placed on the market conform with the stated performance characteristics. The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product.

A manufacturer who has established a Quality Management System according to EN ISO 9001 is considered to satisfy the above requirements.

The results of inspections, tests or assessments requiring action shall be recorded, as shall the action(s) taken.

6.3.2 Acceptance tests

The specifications of acceptance tests apply to the product as delivered, but may be carried out at an earlier stage of maturity.

Sampling from continuous production testing

— on the base sheet prior to coating,

— in conditions other than in Table 4,

is acceptable provided that it has been statistically established (see Annex B) that compliance with the requirements given in Table 1 is ensured.

Acceptance tests can also be used to confirm that a batch of slates or fittings conforms with the standard, e.g. in conjunction with type tests or for receiving inspection.

The tests include the:

— measurement of dimensions - length, width and thickness - (methods specified in 7.2);

— measurement of apparent density (slates only, method specified in 7.3.1);

— measurement of mechanical characteristics - bending strength - (slates only, method specified in 7.3.2).

Each limit of specification, for the characteristics in Table 3, shall be subject to an AQL of 4%. The sampling schemes provided in ISO 390, with an AQL of 4% and an inspection level S_3, ensure that for large batches approximately 95% of the items fulfil the requirements.

Table 3 – Minimum sampling schemes

Fibre-cement slates	
Length Width Thickness	ISO 2859-1 Inspection by attribute Double sampling AQL 4% Level S_1
Apparent density Bending moment	ISO 3951 Inspection by variable; method s or σ AQL 4% Level S_3
Fittings	
Length Width Thickness	The same as for the dimensional characteristics of fibre-cement slates

6.3.3 Equipment

All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.

6.3.4 Raw materials and components

The specification of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring conformity.

6.3.5 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of all of the characteristics are maintained.