SLOVENSKI STANDARD
SIST EN 17468-2:2022

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Vlaknatocementni proizvodi - Ugotavljanje vlečne odpornosti in strižne trdnosti ter izračun upogibne trdnosti - 2. del: Valovite strešne plošče

Fibre-cement products - Determination of pull through and shear resistance and bending strength calculations - Part 2: Profiled sheets

Faserzementprodukte - Bestimmung des Durchzugs- und Querkraftwiderstandes und der Biegefestigkeit - Teil 2: Wellplatten

Produits en fibres-ciment - Détermination des calculs de résistance au déboutonnage, au cisaillement et à la flexion - Partie 2 : Plaques profilées

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ICS:

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

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Fibre-cement products - Determination of pull through and shear resistance and bending strength calculations - Part 2: Profiled sheets

Produits en fibres-ciment - Détermination des calculs de résistance au déboutonnage, au cisaillement et à la flexion - Partie 2 : Plaques profilées

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

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European foreword

This document (EN 17468-2:2022) 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of an identical text or by endorsement, at the latest by September 2022, and conflicting national standards shall be withdrawn at the latest by September 2022.

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

This document is part 2 of the EN 17468 series and deals with profiled sheets, whereas part 1 deals with flat sheets.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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Introduction

Different fibre-cement profiled sheets on the market are assessed for pull through resistance.

Fibre-cement profiled sheets have been evaluated for pull through and shear resistance by a number of test methods designed to simulate conditions of use.

The results from the different existing methods are not directly comparable.

This document establishes an agreed method for evaluation of the pull through resistance of fibre-cement profiled sheet products, based on the experiences obtained over the last number of years in different countries. The document is partly based on the French national standard NF P30-311.

This is a testing standard with no classifications, but this test procedure may be used by national regulators to set classifications for roof and wall assemblies.

The performance of an assembly constructed with these products depends not only on the properties of product as required by this document, but also on the design, construction and performance of an assembly to be assessed by appropriate methods such as calculations or testing.

1 Scope

This document specifies test methods for pull through (tension/compression testing for fasteners through the sheets) and shear resistance of fibre-cement profiled sheets according to EN 494. The results are only applicable to the fibre-cement product and not to the complete fixing assembly.

It applies only to products as delivered.

The field of application for pull through resistance is defined in 7.6.

The field of application for shear resistance is defined in 8.6.

NOTE For design purposes of fibre-cement profiled sheets in the final application, the failure modes pull-out and breaking of the fixings or substructure are not in the scope of this standard. They might become decisive and need to be tested or calculated according to the relevant design standards for fixings (e.g. Eurocode 3 for steel, Eurocode 5 for wood and Eurocode 9 for aluminium substructures) and compared with the results for pull-through and shear resistance.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 494:2012+A1:2015, *Fibre-cement profiled sheets and fittings - Product specification and test methods*

EN 1990, *Eurocode - Basis of structural design*

EN ISO 7500-1, *Metallic materials - Calibration and verification of static uniaxial testing machines - Part 1: Tension/compression testing machines - Calibration and verification of the force-measuring system (ISO 7500-1)*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
profiled sheet
as defined in EN 494

3.2
type test
test carried out to demonstrate conformity with the requirements of this document or for 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 delivered product, but is not required for each batch.

3.3
as delivered
same condition as the fibre-cement producer intends to supply the product after completing all aspects of the process including maturing and, when appropriate, painting

3.4
span
distance between the parallel support axes

3.5
lap
overlap
amount one sheet overlaps another at either the end (end lap) or the side (side lap)

4 Symbols and abbreviations

For the purpose of this document, the following symbols and abbreviations apply.

a	it can be the deformation or the pitch of the corrugation as defined in EN 494
b	dimension of the specimen as defined in EN 494
e	thickness of a sheet, in millimetres
e_m	average thickness of sheets, in millimetres
e_{nom}	nominal thickness of the sheet according to EN 494, in millimetres
E_m	bending modulus of elasticity
F	load
F_{ax}	pull through load at failure
$F_{ax,m}$	average pull through load at failure
F_{el}	load at the intersection of the test diagram and the 10 % reduced linear regression of the E modulus
$F_{el,i}$	load of test i at intersection of the test diagram and the 10 % reduced linear regression of the E modulus (see Figure 6)
$F_{max,i}$	breaking load of test i
F_v	shear load at failure
$F_{v,k}$	characteristic shear load at failure
$F_{v\perp}$	maximum shear load perpendicular to the corrugation
$F_{v\parallel}$	maximum shear load parallel to the corrugation
F_m	the average failure load for pull through/shear resistance
F_{vm}	average shear load at failure
$M_{i,test}$	bending moment at rupture as defined in EN 494 for test i with respect to the chosen test conditioning “test”, e.g. when the conditioning is “wet”, it reads: $M_{i,wet}$
h_t	dimension from the extreme top of the corrugation to the neutral axis
h_b	dimension from the extreme bottom of the corrugation to the neutral axis
k	statistical factor derived from EN 1990
I_{nom}	second moment of area, also known as area moment of inertia, of fibre-cement profiled sheets (nominal thickness)
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 as defined in EN 494; in millimetres

$l_{min,long}$	the minimum edge distance longitudinal to the direction of the corrugation
$l_{min,perp}$	the minimum edge distance perpendicular to the direction of the corrugation
f	bending strength at rupture
f_{BL}	bending strength in the longitudinal direction, from breaking load testing
f_{BM}	bending strength in the transverse direction, from bending moment testing
$f_{BL,k}$	characteristic bending strength in the longitudinal direction, from breaking load testing
$f_{BL,0.5}$	5 % quantile of the bending strength in the longitudinal direction
f_{el}	bending strength by the load $F_{el,i}$ at the intersection of the test diagram and the 10 % reduced linear regression of the E modulus (see Figure 6)
$f_{el,mean}$	mean value of the yield strength
$f_{BL,el,mean}$	mean value of the yield strength in the longitudinal direction
$f_{BM,k}$	characteristic bending strength in the transverse direction, from bending moment testing
$f_{BM,0.5}$	5 % quantile of the bending strength in the transverse direction
$f_{BM,el,mean}$	mean value of the yield strength in the transverse direction
f_k	characteristic bending strength
f_d	design bending strength
$f_{BL,d}$	design bending strength in the longitudinal direction, from breaking load testing
$f_{BM,d}$	design bending strength in the transverse direction, from bending moment testing
$f_{0.5}$	5 % quantile of the maximum bending strength
R^2	in statistics, the coefficient of determination “R squared”, is the proportion of the variance in the dependent variable that is predictable from the independent variable(s)
R_i	mean quotient of the modulus of rupture of exposed and unexposed specimen, where “i” shall stand for either of the following testing options: 1) testing freeze-thaw, 2) soak-dry and 3) warm-water according to EN 494
$R_{L,i}$	mean quotient of the modulus of rupture of exposed and unexposed specimen at 95 % confidence level as defined in EN 494, where “i” shall stand for either of the following testing options: 1) freeze-thaw, 2) soak-dry and 3) warm-water according to EN 494
R_k	characteristic resistance
$R_{ax,k}$	characteristic pull through resistance
$R_{ax,m}$	average pull through resistance
$R_{v,k}$	characteristic shear resistance
$R_{v,m}$	average shear resistance
$R_{v,k\perp}$	characteristic shear resistance perpendicular to the corrugation
$R_{v,m\perp}$	average shear resistance perpendicular to the corrugation
$R_{v,k\parallel}$	characteristic shear resistance parallel to the corrugation
$R_{v,m\parallel}$	average shear resistance parallel to the corrugation
R_d	design value pull through/shear resistance
s	estimate of the standard deviation

$W_{nom,BL}$	section modulus corresponding to the breaking load
$W_{nom,BM}$	section modulus corresponding to the bending moment
α	ageing factor gained by multiplication of the three mean quotients of the modulus of rupture R_i from the warm water, soak dry and freeze thaw type tests in EN 494
γ_M	partial safety factor for a component property under consideration of model uncertainties and size deviations
γ	confidence level (%)
γ_F	partial factor for the dead load (γ_F = 1,35)
κ_{wet}	correction factor “kappa wet” to take into consideration different test conditions

5 Product requirements

5.1 Composition

The test method is applicable to fibre-cement profiled sheets manufactured in accordance with EN 494.

5.2 Appearance and finish

The appearance and finish shall be evaluated as defined in EN 494.

6 Sampling procedure

6.1 Sampling method

Take an adequate number of full size sheets drawn at random from a consignment of sheets or, in the case of continuous production, from a production batch. All test specimens used on the test assembly shall be from the same consignment or production batch. The size of the batch is chosen by the manufacturer up to a maximum of one week’s production.

6.2 Type testing

The pull through resistance and shear resistance tests, for fibre-cement profiled sheets, are type tests.

For continuous production the type test shall be repeated at least once every year.

6.3 Preparation of test specimens

6.3.1 Preparation of the test specimens for the pull through test

Cut 2 samples from a minimum of 10 profiled sheets to a length of (625 ± 5) mm and a width of 2 corrugations ± 5 mm. For each test, the 2 samples should be taken from the same sheet. For crown fixings, the test specimens shall comprise one crown and two valleys, with the crown central in the width of the test specimen. For valley fixings, the test specimen should comprise one valley and two crowns, with the valley central in the width of the test specimen.

The specimens should be stored for 7 days ± 1 day in ambient laboratory conditions followed by 24 h immersion in water.

The normal conditioning is 7 days at 23 °C / 50 % RH followed by 24 h under water, the same as the conditioning for type testing breaking load and bending moment in accordance with EN 494. Other conditions may be used provided that for design appropriate correction factors are introduced to recalculate the measured values to the wet conditioning. A factor κ_{wet} (Kappa wet) is used for calculation of the design values (see 9.2.2 Formula (21)) in wet condition.