SLOVENSKI STANDARD
SIST EN 17468-1:2022

01-junij-2022

Vlaknatocementni proizvodi - Ugotavljanje vlečne odpornosti in strižne trdnosti ter izračun upogibne trdnosti - 1. del: Ravne plošče

Fibre cement products - Determination of pull through and shear resistance and bending strength calculations - Part 1: Flat sheets

Faserzementprodukte - Bestimmung des Durchzugs- und Querkraftwiderstandes und der Biegefestigkeit - Teil 1: Tafeln

Produits en fibres-ciment - Détermination des calculs de résistance à la traversée de la tête, au cisaillement et à la flexion - Partie 1 : Plaques planes

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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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English Version

Fibre cement products - Determination of pull through and shear resistance and bending strength calculations - Part 1: Flat sheets

Produits en fibres-ciment - Détermination des calculs de résistance au déboutonnage, au cisaillement et à la flexion - Partie 1 : Plaques planes

Faserzementprodukte - Bestimmung des Durchzugs- und Querkraftwiderstandes und der Biegefestigkeit - Teil 1: Tafeln

This European Standard was approved by CEN on 13 March 2022.

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

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Contents

Page

European foreword

This document (EN 17468-1:2022) 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of an identical text or by endorsement, at the latest by October 2022, and conflicting national standards shall be withdrawn at the latest by October 2022.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 also proposes rules and equations to calculate characteristic bending strength to fit into the safety concept of the Eurocode.

This document is Part 1, dealing with flat sheets, whereas Part 2 deals with profiled 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.

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

Introduction

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

Fibre-cement flat sheets have been evaluated, for pull through 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 and shear resistance of fibre-cement flat sheet products, based on the experiences obtained over the last number of years in different countries.

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 the assembly.

1 Scope

The document establishes an agreed method for evaluation of pull through resistance (tension/compression for fasteners through the sheets), shear resistance, bending strength and bending modulus of elasticity and suggests an approved safety concept of fibre-cement flat sheets for internal and external wall and ceiling finishes based on the experiences obtained over the last number of years in different countries. The results are only applicable to the fibre-cement product and not to the complete fixing assembly.

NOTE 1 For design purposes of fibre-cement flat sheets in the final application, the failure modes pull-out and breaking of the fixing 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. EN 14592) or ETA and substructure (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.

The results are also applicable for:

— Coated or uncoated sheets manufactured at the same production facility as the tested sheets provided that the sheets are of the same type, have at least the same declared class according to EN 12467:2012+A2:2018, Table 6 and at least the same nominal thickness.

— The test method can be applied to textured or non-textured fibre-cement flat sheets. The results of non-textured sheets are only applicable for textured sheets if the nominal minimum thickness of the textured sheet is at least the nominal thickness of the non-textured sheet.

— The same type of fixing head or washer assembly where applicable if the diameter of the fixing head or washer is 0 mm to 2 mm larger than in the test.

— The Shore A hardness of the sealing washer, where applicable, is ± 5 that of the washer used in the test, given that the washer thickness is at least as thick, the washer material at least as strong and the shape (dome or flat) of the washer equal to what has been tested.

NOTE 2

A) For pull-through resistance, if the diameter of the drilled hole through the fibre-cement sheet is 0 mm to 2 mm smaller or equal than in the test up to the diameter of the shank of the fastener, providing, during the test there is the required clearance hole around the shank of the fastener.

B) For shear resistance, if the diameter of the drilled hole is equal to what has been tested.

It applies only to products as delivered.

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 12467:2012+A2:2018, *Fibre-cement flat sheets - 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
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.

3.2
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

3.3
span
distance between the parallel support axes

4 Symbols and abbreviations

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

a	deformation
b	width of test piece, in millimetres
d_H	diameter of the fastener or fastener assembly (washer)
$d_{support}$	diameter of the supporting ring
e	thickness of the sheet, in millimetres
e_{nom}	nominal thickness of the sheet according to EN 12467
e_m	average thickness of a sheet
F	force, in newtons (load)
F_{el}	elastic bending load, in newtons
F_{ax}	load pull through, in the axis of the fastener
F_v	breaking load shear, in newtons
f_k	characteristic bending strength
f_{k05}	5 % quantile with 75 % confidence level of the bending strength for the condition as tested
f_m	average bending strength
$f_{el\ m}$	average elastic bending strength

k	statistic factor according to EN 1990
κ_{wet}	conversion factor for fibre-cement products or test results that need to be applied to results tested in "dry conditions" as specified in EN 12467 and shall be valid for environmental applications, where fibre-cement can become totally water soaked (e.g. façade or roof application)
l_s	span between supports, in millimetres
$l_{min,long}$	the minimum edge distance longitudinal to the direction of the production
$l_{min,perp}$	the minimum edge distance perpendicular to the direction of the production
n	number of samples
R	characteristic force
$R_{k,ax}$	characteristic pull through resistance
$R_{k,v}$	characteristic shear resistance
$R_{d,ax}$	design value pull through resistance
$R_{d,v}$	design value shear resistance
κ_{wet}	"kappa" factor for reducing the bending strength climatic (23 °C, 50 % RH.) to wet condition
α	multiplication of ageing factors, product R_i
s	estimate of the standard deviation
γ	confidence level (%)
γ_M	partial safety factor for a component property under consideration of model uncertainties and size deviations
R_i	mean quotient of the modulus of rupture of exposed and unexposed specimen, where "$_i$" shall stand for testing 1 freeze–thaw, 2 soak-dry and 3 warm-water according to EN 12467
$R_{L,i}$	mean quotient of the modulus of rupture of exposed and unexposed specimen at 95 % confidence level as defined in EN 12467, where "$_i$" shall stand for testing: 1 freeze–thaw, 2 soak-dry and 3 warm-water according to EN 12467

5 Product requirements

5.1 Composition

Fibre-cement flat sheets shall have a composition according to EN 12467.

5.2 Appearance and finish

The appearance and finish shall be evaluated as defined in EN 12467.

6 Sampling procedure

6.1 Sampling method

Take an adequate number of full size sheets (minimum 10) 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 are type tests.

6.3 Preparation of test specimens

— Cut 10 samples from 10 different flat sheets to (400 ± 5) mm × (400 ± 5) mm for the pull through tests.

— Cut 10 samples from 10 different flat sheets to (250 ± 5) mm × (250 ± 5) mm for the shear tests.

— The specimens shall be stored under normal climatic conditions of 23 ± 5 °C and a relative air humidity of 50 ± 20 % RH (23/50) until equilibrium of mass. The equilibrium of mass under climate at 23 °C and 50 % RH is reached if the mass has a lower difference than 0,1 % in weighting with an interval of 24 h. As EN 12467:2012+A2:2018, 3.10.

— The sheets shall be pre-drilled using a drill bit of nominal diameter as specified by the manufacturer. Self-drilling screws of a nominal diameter/size can also be used as specified by the manufacturer. For sheets category A and B (EN 12467), the specimens for pull through resistance and shear resistance should be stored prior to the test between 7 and 14 days in ambient laboratory conditions followed by 24 h immersion in water for sheets with thickness ≤ 20 mm or 48 h for sheets with thickness > 20 mm.

— The specimens shall be tested immediately upon removal from the water. For sheets category C and D (EN 12467), the specimens for pull through resistance and shear resistance should be stored prior to the test between 7 and 14 days in ambient laboratory conditions and relevant cases shall be tested immediately upon removal from the conditioning room.

— The conditioning described above is the normal conditioning. It is the same as the conditioning for type testing of bending strength depending the category in accordance with EN 12467. For sheets category A and B (EN 12467) the specimens for pull through resistance and shear resistance may be tested similar to category C and D provided that for design appropriate correction factors are introduced to recalculate the measured values to the corresponding wet condition described above. A factor κ_{wet} (Kappa wet) is used for calculation of the design values (see Formula (12) in 9.2) in wet condition.

The sheets can be pre-drilled before or after conditioning.

7 Test method for the determination of pull through resistance

7.1 Principle

The pull through resistance is determined by the maximum load F_{ax} (in N) required to pull the fastener through the test sheet. The test device simulates a fibre-cement flat sheet fixing to a rail.

7.2 Tensile testing machine

The test rig shall be essentially composed of a vertical-uniaxial class-1 tensile testing machine as per EN ISO 7500-1 with force capacity appropriate to delivering the loading required (for example: 10 kN), featuring the following main components:

— A clamping device to fix the sample to the machine.

— A connector to enable the force to be applied.

— A representative rail (geometry and strength of the material) has to be used.

— Metal ring diameter depending on the results of the pretesting with rings in the given range.

A minimum of five pre-tests (with middle fixing) per diameter of the supporting ring shall be carried out using different diameters starting from a large diameter and stepwise reducing until the failure mode is pull through. Ring diameters are to be selected from the following range 60, 90, 120, 150, 180, 210, 240, 270, 300, 330, 350 (all in mm). The diameter to be used for the main tests (middle, edge and corner) shall be chosen as follows.

— Failure mode shall be pull through (bending failure shall be excluded).

— Diameter of the failure cone shall be at least 10 mm smaller than the diameter of the supporting ring.

— The main tests shall be done with the largest diameter, at which the failure mode is pull through.

NOTE When testing undercut anchors, it is recommended to deviate by selection the ring diameter with 1/3 of the largest planned centre distance of the fastening.

— Possibilities for different mounting arrangements (see Figure 1):

a) Fastener mounted in the middle of the specimen (centre fixing); section view.

b) Fastener mounted in the middle of one edge of the specimen with a minimum distance according to the installation at the construction site (edge fixing); section view.

c) Plan view for a) and b).

d) Fastener mounted in the corner of the specimen with a minimum edge distance according to the installation at the construction site (corner fixing); section view.

e) Fastener mounted in the corner of the specimen with a minimum edge distance according to the installation at the construction site (corner fixing); plan view.