Deutsches Institut für Bautechnik

Zulassungsstelle für Bauprodukte und Bauarten

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Authorised and notified according to Article 10 of the Council Directive of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products (89/106/EEC)

Deutsches Institut für Bautechnik

DIBt

Mitglied der EOTA
Member of EOTA

European Technical Approval ETA-13/0609

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung *Trade name*		FERMACELL Powerpanel HD
Zulassungsinhaber *Holder of approval*		Fermacell GmbH Düsseldorfer Landstraße 395 47259 Duisburg DEUTSCHLAND
Zulassungsgegenstand und Verwendungszweck *Generic type and use of construction product*		Spezialbauplatte "FERMACELL Powerpanel HD" für tragende und nicht-tragende Bekleidungungen im Innen- und Außenbereich *Special board "Fermacell Powerpanel HD" for structural and non-structural internal and exterior linings*
Geltungsdauer: *Validity:*	vom *from* bis *to*	26 June 2013 26 June 2018
Herstellwerk *Manufacturing plant*		Werk 10

Diese Zulassung umfasst *This Approval contains*	13 Seiten einschließlich 2 Anhänge *13 pages including 2 annexes*

I LEGAL BASES AND GENERAL CONDITIONS

1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:

- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by Council Directive 93/68/EEC[2] and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council[3];
- *Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998[4], as amended by Article 2 of the law of 8 November 2011[5];*
- Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC[6].

2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.

3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.

4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.

5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.

6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

1 Official Journal of the European Communities L 40, 11 February 1989, p. 12
2 Official Journal of the European Communities L 220, 30 August 1993, p. 1
3 Official Journal of the European Union L 284, 31 October 2003, p. 25
4 *Bundesgesetzblatt Teil I 1998*, p. 812
5 *Bundesgesetzblatt Teil I 2011*, p. 2178
6 Official Journal of the European Communities L 17, 20 January 1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product/ products and intended use

1.1 Definition of the construction product

The special board "Fermacell Powerpanel HD" is a specific board made of cement according to EN 197-1[7], light weight aggregates, additions, admixtures and coated glass fibres (in form of glass fibre meshes and chopped glass fibres).

The surfaces of the special board are not coated.

The boards are manufactured with a nominal thickness of 15 mm and by a size of 1250 mm x 3000 mm.

The special board "Fermacell Powerpanel HD" shows a water absorption less than 25 % by mass.

The special board "Fermacell Powerpanel HD" is a non-combustible construction material (class A1 according to EN 13501-1[8]).

1.2 Intended use

The special board "Fermacell Powerpanel HD" may be used for non-structural applications e.g. as lining and also for structural applications for the planking and lining of walls, for stiffening timber framed walls.

The field of application of the special board "Fermacell Powerpanel HD" used for structural applications are the service classes 1 and 2 according to EN 1995-1-1[9] and the service class 3 according to EN 1995-1-1 but without outdoor exposure.

For the durability and corrosion protection of the fasteners and the timber the regulations at the place of use are valid.

The durability of the special board "FERMACELL Powerpanel HD" is classified into category A, B, C and D according to EN 12467[10].

The provisions made in this European technical approval are based on an assumed working life of the special board "Fermacell Powerpanel HD" of 50 years, provided that the conditions laid down in section(s) 4.2 / 5.1/ 5.2 for the packaging / transport / storage / installation / use / maintenance / repair are met. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

2 Characteristics of the product and methods of verification

2.1 Mechanical resistance and stability

2.1.1 Thickness

The thickness of the special board "Fermacell Powerpanel HD" shall be be determined according to EN 12467[10], clause 7.2 for large size sheets and shall be (15,0 ± 1,5) mm.

2.1.2 Applied quantity and solid content of surface coating

The special board "Fermacell Powerpanel HD" is not coated.

7	EN 197-1	Cement - Part 1: Composition, specifications and conformity criteria for common cements
8	EN 13501-1	Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests
9	EN 1995-1-1	Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings
10	EN 12467	Fibre-cement flat sheets - Product specification and test methods

2.1.3 Length and width

The length and width of special board "Fermacell Powerpanel HD" shall be determined according to EN 12467[10], clause 7.2 for large size sheets.

The tolerances on length and width shall be in accordance with table 1.

Table 1: Length and width including tolerances of the special board "Fermacell Powerpanel HD"

width	length
1250 mm ± 3,75 mm	1000 mm ± 3 mm
	2600 mm ± 5 mm
	3000 mm ± 5 mm

2.1.4 Straightness of edges

The straightness of edges shall be determined according to EN 12467[10], clause 7.2.3.3. The edges shall be straight and the deviation shall not be greater than 0,1 %.

2.1.5 Squareness of edges

The squareness of edges shall be determined according to EN 12467[10], clause 7.2.3.4. The edges shall be square and the deviation shall not be greater than 2 mm/m.

2.1.6 Density

The density of the special board "Fermacell Powerpanel HD" tested according to EN 12467[10], clause 7.3.1, shall be at least 850 kg/m³ and must not exceed 1050 kg/m³.

2.1.7 Moisture content

The moisture content shall be determined according to EN 322[11] by storing the specimens at a standard climate (20 °C / 65 % air humidity). The moisture content of the special boards "Fermacell Powerpanel HD" shall be declared and shall not be greater than 13 % by mass under standard climate conditions (20/65).

2.1.8 Water impermeability

The boards, tested according to EN 12467[10], clause 7.3.3, are water impermeable.

2.1.9 Dimensional stability

The dimensional stability shall be determined on the basis of the shrinkage and swelling behaviour of the board. The shrinkage and swelling have to be determined according to EN 318[12].

The relative change in length (dimensions of swelling and shrinking in the plane of the board), tested according to EN 318[12], is

in the range between 65 % and 30 % relative air humidity: -0,40 mm/m,

in the range between 65 % and 85 % relative air humidity: 0,16 mm/m.

The relative change in thickness, tested according to EN 318[12], is

in the range between 65 % and 30 % relative air humidity: -0,1 %,

in the range between 65 % and 85 % relative air humidity: 0,0 %.

[11] EN 322 Wood-based panels; determination of moisture content

[12] EN 318 Wood-based panels - Determination of dimensional changes associated with changes in relative humidity

2.1.10 Modification factor

Values of the modification factor k_{mod} for duration of load and for moisture content to estimate the design value R_d of a resistance (load-carrying capacity) according to EN 1995-1-1 of the special board "Fermacell Powerpanel HD" are indicated in Annex 1, clause 2.

2.1.11 Deformation factor

Values of the deformation factor k_{def} of the special board "Fermacell Powerpanel HD" are indicated in Annex1, clause 2.

2.1.12 Mechanical strength and stiffness properties

The characteristic strength values and the mean stiffness values of the special board "FERMACELL Powerpanel HD", are given in Annex 2.

The bending strength of the special board "Fermacell Powerpanel HD" shall be determined according to EN 310[13] perpendicular to the plane and plane to the plane on specimens with a width w of 300 mm and a length l of 400 mm with a span L_A of 350 mm. The bending strength for both loading directions (top side and bottom side) shall be at least 2,7 N/mm².

The bending modulus of elasticity perpendicular to the plane shall be at least 4200 N/mm² and plane to the plane shall be at least 4100 N/mm².

2.1.13 Impact resistance

The value of the impact resistance of the special board "FERMACELL Powerpanel HD", tested according to EN 1128[14], is at least IR = 12,5 mm/mm.

2.2 Saftey in case of fire

2.2.1 Reaction to fire

The special boards "Fermacell Powerpanel HD" have been tested and classified in accordance with EN 13501-1[8]. It is considered to satisfy the requirements for class A1of DIN EN 13501-1[8].

2.3 Hygiene, health and environment

2.3.1 Content and/or release of dangerous substances

The product does not contain dangerous substances listed in EOTA TR 034 (Version endorsed at TB level - 71. meeting, agenda item 8.3.5).

In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

2.3.2 Vapour permeability

The value of the vapour permeability of special board "Fermacell Powerpanel HD", tested according to EN ISO 12572[15], amounts to

- μ = 37 (Dry Cup)
- μ = 32 (Wet Cup).

2.4 Protection against noise

Not relevant.

13	EN 310	Wood-based panels; determination of modulus of elasticity in bending and of bending strength
14	EN 1128	Cement-bounded particle boards - Determination of hard body impact resistance
15	EN ISO 12572	Hygrothermal performance of building materials and products - Determination of water vapour transmission properties

2.5 Energy economy and heat retention

2.5.1 Thermal conductivity

The value of thermal conductivity $\lambda_{10,tr}$ of special board "Fermacell Powerpanel HD", tested according to EN 12664[16], amounts to $\lambda_{10,tr} \leq 0{,}30$ W/mK.

2.5.2 Air permeability

The special board "Fermacell Powerpanel HD" is airtight.

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the Decision 98/437/EC of the European Commission[17], system 3 of the attestation of conformity applies.

In addition, according to the Decision 2001/596/EC of the European Commission[18] system 3 of the attestation of conformity applies with regard to reaction to fire.

This system of attestation of conformity is defined as follows:

System 3: Declaration of conformity of the product by the manufacturer on the basis of:

(a) Tasks for the manufacturer:
  (1) factory production control;

(b) Tasks for the approved body:
  (2) initial type-testing of the product.

Note: Approved bodies are also referred to as "notified bodies".

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use raw and constituent materials stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the control plan which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik.[19]

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

16 EN 12664 Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Dry and moist products with medium and low thermal resistance

17 Official Journal of the European Communities L 194/39 of 10.07.1998

18 Official Journal of the European Communities L 209/33 of 2.8.2001

19 The control plan is a confidential part of the European technical approval and only handed over to the approved body/bodies involved in the procedure of attestation of conformity. See section 3.2.2.

3.2.1.2 Other tasks for the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of special board "Fermacell Powerpanel HD" in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

3.2.2 Tasks for the approved bodies

The approved body shall perform the

- initial type-testing of the product,

in accordance with the provisions laid down in the control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

3.3 CE marking

The CE marking shall be affixed on the special board "Fermacell Powerpanel HD" on a label attached to it, on its packaging or on the accompanying commercial documents.

The letters "CE" shall be accompanied by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- the number of the European technical approval: ETA-13/0609
- application: "Cement-bonded board" for structural applications
- trade name of the construction product: "Special board 'Fermacell Powerpanel HD'"
- Information on regulated characteristics
  - Size (width or length and thickness)
    Thickness: 15 mm
    Width and length: 1250 x X mm
  - Density X kg/m³
  - Bending strength perpendicular to the plane ($\beta_{B,90}$) 2,1 N/mm²
  - Modulus of elasticity perpendicular to the plane ($E_{B,90}$) 4200 N/mm²
  - Bending strength in plane to the plane ($\beta_{B,0}$) 2,1 N/mm²
  - Modulus of elasticity in plane to the plane ($E_{B,0}$) 4100 N/mm²
  - Reaction to fire class Class A1 according to EN 13501-1

In case of non-structural applications the following marking is possible:

- the name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- the number of the European technical approval: ETA-13/0609
- application: "Cement-bonded board" for non-structural applications
- trade name of the construction product: "Special board 'Fermacell Powerpanel HD'"
- Information on regulated characteristics
  - Size (width or length and thickness)
    Thickness: 15 mm
    Width and length: 1250 x X mm
  - Reaction to fire class Class A1 according to EN 13501-1

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

The special boards "Fermacell Powerpanel HD" are manufactured on the basis of agreed data deposited with Deutsches Institut für Bautechnik.

The European technical approval is issued for the product on the basis of agreed data/information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

4.2 Design, calculation and execution of building components

The design, calculation and execution of building components which are manufactured using the special board "Fermacell Powerpanel HD" can take place according to EN 1995-1-1[9] and EN 1993-1 1[20] accomplished by Annex 1.

The data of this European technical approval including Annex 2 and if necessary the references in valid additional national regulations are to be considered.

4.3 Installation

The fasteners used to attach the special board "Fermacell Powerpanel HD" to the substructure shall be suitable nails, screws, staples or rivets with adequate corrosion protection. The following conditions shall be observed:

- Nails according to EN 14592[21] shall have a diameter 2,0 mm ≤ d ≤ 3,0 mm
- Screws according to EN 14592[21] or based on a European technical approval shall have a diameter 3,8 mm ≤ d ≤ 4,0 mm
- Staples according to EN 14592 or based on a European technical approval shall have a wire diameter 1,5 mm ≤ d ≤ 1,8 mm.

Annex 1 contains details for calculation of fastenings.

The distances from the unstressed edge $a_{4,c}$ of special board "Fermacell Powerpanel HD" shall be at least 5·d for nails, 4·d for screws and 10·d for staples.

From the stressed edge $a_{4,t}$ of special board "Fermacell Powerpanel HD" the distances shall be at least 7·d for nails and screws and 10·d for staples.

The spacing a_1 of nails and screws shall be at least 20·d and of staples at least 40·d. The maximum spacing along the edges of the sheathing panels shall be in accordance to EN 1995-1-1[9].

[20] EN 1993-1-1 Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings
[21] EN 14592 Timber structures - Dowel-type fasteners - Requirements

5 Indications to the manufacturer

5.1 Packaging, transport and storage

During transport and storage of the special board "Fermacell Powerpanel HD" and the components manufactured by using the present boards shall be protected against damaging and inadequate moisture, e. g. due to precipitation or high construction moisture (all-round covering of the boards or components by means of a foil).

The packaging of the special board "Fermacell Powerpanel HD" shall be marked permanently by the manufacturer in accordance to EN 12467.

5.2 Use, maintenance, repair

Damaged special boards "Fermacell Powerpanel HD" or walls having been manufactured by using these boards shall not be used or installed.

Where components are produced on site by using the special board "Fermacell Powerpanel HD" the moisture of the wood substructure must not increase inadequately until installation of the special boards (protection against precipitation or very high building moisture).

Uwe Bender
Head of Department

beglaubigt:
Schröder

Deutsches Institut für Bautechnik DIBt

Special board "FERMACELL Powerpanel HD" **Annex 1**

Describing notes for design and calculation

1. Design, calculation and execution of building components which are manufactured by using the special board "FERMACELL Powerpanel HD" can take place considering Annex 2 and the regulations in the following marks according to EN 1995-1-1.

   Additional national regulations are to be considered. For design and calculation the characteristic strength values and values of stiffness indicated in Annex 2 and the regulations according to the following marks shall be considered.

2. As design data of the modification factor k_{mod} the following values are valid:

Load-duration class	Service class 1	Service class 2	Service class 3*
Permanent action	0,60	0,60	0,50
Long-term action	0,70	0,70	0,55
Medium-term action	0,80	0,80	0,65
Short-term action	0,90	0,90	0,70
Instantaneous action	1,10	1,10	0,90

* without outdoor exposure

As design data of the deformation parameter k_{def} the following values are valid:

Load-duration class	Service class 1	Service class 2	Service class 3*
Permanent action	6,0	5,0	4,0

* without outdoor exposure

3. The characteristic embedment strength can be determined using the equation:

   $f_{h,1,k} = 37 \cdot d^{-0,5}$ (N/mm²)

   where:

   d is the nominal diameter of the fastener in mm.

   The characteristic value of the pull-through resistance, determined according to EN 1383, is for

   - nails with diameter 2,0 mm ≤ d ≤ 3,0 mm and a head diameter $d_k \geq 4,6$ mm — $F_{ax,head,Rk} = 600$ N
   - screws with diameter 3,8 mm ≤ d ≤ 4,0 mm and a head diameter $d_k \geq 7,0$ mm — $F_{ax,head,Rk} = 800$ N
   - staples with diameter 1,5 mm ≤ d ≤ 1,8 mm and a width of the staple crown $b_R \geq 11,0$ mm — $F_{ax,head,Rk} = 500$ N

   As design data of the slip modulus K_{ser} per shear plane per fastener under service load for fasteners in panel-timber connections the following values are valid:

Fastener Type	K_{ser} in N/mm
Nails (without pre-drilling)	$0,6 \cdot \rho_m^{1,5} \cdot d^{0,8} / 30$
Screws	$0,4 \cdot \rho_m^{1,5} \cdot d / 23$
Staples	$1,4 \cdot \rho_m^{1,5} \cdot d^{0,8} / 80$

   where:

   d is the nominal diameter of the fastener in mm;

   ρ_m is the mean density of the timber in kg/m³.

If the pointside penetration is at least 12·d the characteristic value of the lateral load-carrying capacity of panel-timber connections with nails or staples for each shear joint $F_{v,Rk}$ can be determined simplifying as follows:

$$F_{v,Rk} = K \cdot \sqrt{2 \cdot M_{y,k} \cdot f_{h,1,k} \cdot d} + \frac{F_{ax,k}}{4} \qquad (N)$$

where:

K $1{,}2 \cdot d^{-0,5}$ with d in mm

d is the nominal diameter of the fastener in mm;

$M_{y,k}$ is the characteristic fastener yield moment in Nmm;

$f_{h,1,k}$ is the characteristic embedment strength of the panel in N/mm²;

$F_{ax,k}$ is the characteristic axial withdrawal capacity of the fastener in N.

The second term in the equation for $F_{v,Rk}$ is the contribution from the rope effect which can only be considered for nails and screws with predominantly actions on structures parallel to the edge of the special boards "Fermacell Powerpanel HD". For staple connections the contribution from the rope effect should be taken as zero.

The design value for staple connections with load perpendicular to edge of the board the characteristic value of the lateral load-carrying capacity $F_{v,Rk}$ is to be reduced by a factor of 0,75.

4. The design value of the length-based shear strength $f_{v,0,d}$ for diaphragms assembled from "FERMACELL Powerpanel HD" special boards should be taken under consideration of the load-carrying capacity of the connection and the panels and the shear buckling of the sheet as the minimum value calculated from the following expressions:

$$f_{v,0,d} = \min \begin{cases} k_{v1} \cdot F_{v,Rd}/s \\ k_{v1} \cdot k_{v2} \cdot f_{t,d} \cdot t_i \\ k_{v1} \cdot k_{v2} \cdot f_{v,d} \cdot 35 \cdot t_i^2/b_{net} \end{cases} \qquad (N/mm)$$

where:

$F_{v,Rd}$ is the design value of lateral load-carrying capacity of panel-timber connection;

s is the fastener spacing;

k_{v1} factor considering the panel arrangement and the connection of the sheathing edges with k_{v1} = 1.0 for constant connection of sheathing and frame members along the perimeter of every sheet and with k_{v2} = 0,66 for constructions with free, unconnected sheathing edges perpendicular to the frame members;

k_{v2} factor taking into account additional stresses on the sheet with k_{v2} = 0.33 for sheathing only on one side and k_{v2} = 0.5 for sheathing on both sides;

$f_{t,d}$ is the design value of tension strength of the sheet;

t_i is the thickness of the sheet;

$f_{v,d}$ is the design value of shear strength in plane of the sheet;

b_{net} is the clear distance between studs.

In deviation from EN 1995-1-1 for fasteners along the edges of an individual sheet, the design lateral load-carrying capacity $F_{v,Rd}$ may not be increased by a factor of 1,2.

The design racking resistance of each wall panel should be calculated from

$$F_{i,v,0,d} = f_{v,0,d} \cdot b_i \cdot c_i \qquad (N)$$

where:

$f_{v,0,d}$ is the design value oft the length-based shear strength for diaphragms;

b_i is the wall panel width.

and

$$c_i = \begin{cases} 1 & \text{for} \quad b_i \geq b_0 \\ \dfrac{b_i}{b_0} & \text{for} \quad b_i < b_0 \end{cases}$$

where:

b_0 = h/2

h is the height of the wall.

The stress caused by geometrical and structural imperfections may be disregarded at the verification of wall diaphragms, provided that:

- the length of the wall is at least h/3
- the width of each sheet is at least h/4
- the wall is directly supported in a stiff supporting structure

and

the ratio $q_{z,k}/q_{x,k}$ is less or equal 15

where:

$q_{x,k}$ is the horizontal short-term wind load perpendicular to the wall that has to be stiffened in kN/m

$q_{z,k}$ is the permanent vertical load on the head binder of the wall that has to be stiffened in kN/m.

Using "Fermacell Powerpanel HD" special boards, vertical frame members under compressive or bending stress in the plane of wall, floor or roof diaphragms are sufficiently secured against buckling without verification, provided that:

- for diaphragms with sheets on both sides the frame members are continuously connected to the stiffening panels and the distance of the vertical frame members is less than 50-times the thickness of the sheathing
- for diaphragms with sheets only on one side additionally the vertical frame members must be designed with rectangular cross-section and an aspect ratio of h/b ≤ 4.

Loads perpendicular to the diaphragms shall be verified.

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Special board "FERMACELL Powerpanel HD" **Annex 2**

Characteristic values of strength and values of stiffness

Type of stress		Nominal thickness 15 mm
Characteristic values of strength [N/mm²]		
Stress perpendicular to the plane of the board		
Bending	$f_{m,90,k}$	2,1
Compression	$f_{c,90,k}$	10,0
Shear	$f_{r,k}$	1,3
Stress in plane of the board		
Bending	$f_{m,k}$	2,1
Tension	$f_{t,k}$	0,7
Compression	$f_{c,k}$	9,7
Shear	$f_{v,k}$	3,0
Stiffness values [N/mm²]		
Stress perpendicular to the plane of the board		
Bending modulus of elasticity	$E_{m,90,mean}$	4200
Compressive modulus of elasticity	$E_{c,mean}$	3900
Shear modulus	$G_{r,mean}$	2400
Stress in plane of the board		
Bending modulus of elasticity	$E_{m,mean}$	4100
Tension modulus of elasticity	$E_{t,mean}$	4200
Compressive modulus of elasticity	$E_{c,mean}$	6700
Shear modulus	G_{mean}	2500
Density [kg/m³]		
Density	ρ_{mean}	950

As partial safety factor of the special board “FERMACELL Powerpanel HD” γ_M = 1,7 is recommended.