

Rigidur<sup>®</sup> H-Gypsum Fibreboards  
to be used as load-bearing as well as stiffening boards  
in timber and dry wall constructions.  
European Technical Assessment (ETA)  
approved.



## Think positive – build healthily with Rigidur® H-Gypsum Fibreboards

Do you rate healthy living conditions and sustainability as key priorities while building? If so, using a combination of wood and gypsum building materials renders all possible benefits. The interactional advantages of these two natural materials for human well-being and the environment are striking. The combined positive qualities of wood used for construction together with gypsum fibreboards for surfaces ideally complement each other when building. And if you are searching for individuality, flexibility, a healthy home and sustainability from the basement upwards, you will be bound to be successful when using Rigidur gypsum fibreboard!

### Robust solutions that exhibit their strengths with timber construction

Rigidur gypsum fibreboards comprise highly compressed natural gypsum reinforced with select recycled paper fibres. Due to their distinctive structure, all Rigidur timber construction solutions are characterized by extremely hard, robust and very smooth surfaces. Furthermore Rigidur products are tested and certified for pollutants and environmental compatibility by the independent Institute for Building Biology (IBR) in Rosenheim, Germany. Together with matching Rigidur components, such as non-hazardous adhesives and fillers, this product has been awarded a seal of approval as a very safe

building material. You consequently have the best reasons to use Rigidur gypsum fibreboards as a reliable and safe drywall timber construction solution.

### Building biologically tested components using natural raw materials

Rigidur gypsum fibreboards comprise natural gypsum and paper fibres for reinforcement made from recycled material and are free from adhesives and binders. They have been tested by the independent Institute for Building Biology (IBR) in Rosenheim, Germany for pollutants as well as environmental compatibility and awarded a seal of approval as a very safe building material.



#### Thermal protection for well-being and energy saving

Contemporary thermal insulation provides combination of thermal protection and heat storage properties. While respective modern materials contribute to thermal insulation, Rigidur gypsum fibreboards provide temperature-compensation heat storing features thanks to their dense mass.



#### Very smooth surfaces for optimal design options

The extremely smooth, sealed surface of Rigidur gypsum fibreboards – with no protruding fibres nor signs of machining – is ideally suited to subsequent layers of paint for example, as no additional surface treatment is needed. In a similar way old wallpaper can be easily removed.



#### Interior and exterior sound insulation

The comparatively heavy weight of stable Rigidur gypsum fibreboards combined with modern insulation materials assures high-degree sound insulation for partitioning walls as well as for exterior walls of a building. The choice of an optional lamination used with Rigidur screed elements increases high-impact sound insulation.



#### For a cosy indoor climate

Rigidur gypsum fibreboards absorb excessive moisture from spaces such as bathrooms and kitchens and release it later when the ambient air is dry. This proven water vapour adsorption capacity is just as distinctive as that found in clay plasters which are well-known for their moisture balancing properties.



#### Robust very wear-resistant walls

Rigidur gypsum fibreboards feature high-degree surface hardness and as a consequence are not susceptible to everyday mechanical stress such as knocks and scratches.



#### Built-in fire safety for wooden buildings

In accordance with EN 13501-1, Rigidur gypsum fibreboards are classified as 'non-combustible'. As a result they effectively protect the inside construction of a home from fire resulting for example from neglect or technical defects. The water chemically bonded in gypsum crystal is released under intense heat, cooling the entire structure and hence ensuring protection against the spread of fire.



#### Fastening heavy loads made easy

Walls built from Rigidur gypsum fibreboards are extremely stable, enabling items to be safely and simply fastened. Cabinets, shelves or flat screens can easily be screwed onto walls with coarse thread screws without the need for laborious drilling.

## Range overview



	Rigidur H 12.5	Rigidur H AK 12.5	Rigidur H 15	Rigidur H AK 15	Rigidur H 18
<b>Thickness</b>	12.5 mm	12.5 mm	15 mm	15 mm	18 mm
<b>Edge</b>					
<b>Size Joint [mm]</b>	1,245 x 2,000 2,500 2,750 3,000	1,249 x 2,000 2,540 2,750 3,000		1,249 x 2,000 2,540 2,750 3,000	Individual sizes available on request
<b>Size Adhesive joint [mm]</b>	1,249 x 2,000 2,500 2,540 2,610 2,630 2,750 3,000		1,249 x 2,000 2,540 2,750 3,000		Individual sizes available on request
<b>Maximum XXL size [mm]</b>	2,500 x 6,080	2,500 x 6,080	2,500 x 6,080	2,500 x 6,080	2,500 x 6,080

### Customized formats for individual home solutions

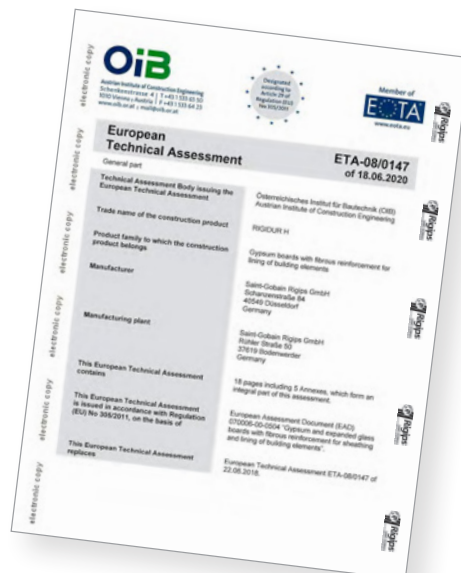
After a room's height has been defined, it is often the case that the required board lengths are rarely available as standard sizes. As part of our service, we custom-cut Rigidur fibreboards to the required lengths - to match room height - at no extra cost in accordance with the order volume. Simply contact us!

### XXL sizes: more surface with less seams

More and more customers are taking advantage of the option to minimize seam processing thanks to large sized boards. Rigidur gypsum fibreboards are manufactured up to 2.5 m x 6.0 m in size and finished precisely to customers dimensional requirements.

### Certified, statically effective panelling

Rigidur gypsum fibreboards are certified at European level for use as both reinforcing and load-bearing panelling for wooden components.



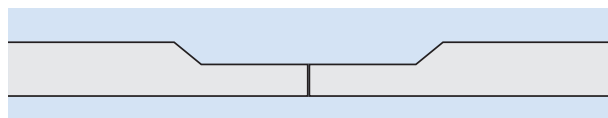




#### Securely fastened in no time at all

Rigidur gypsum fibreboards can be mounted onto wooden substructures simply and quickly with staples, making installation cost-effective. The staples can be used up to 1 cm from the board's edge without any problems. And the product is so stable that neither edges and corners chip nor do the staple crowns go through the fibreboard.

#### Rigidur gypsum tapered edge for perfect board junctions



Our tapered edge version facilitates the creation of flush board seams. Thanks to the tapered edges, small surface irregularities caused by offset edges are compensated for with subsequent grouting. When making calculations, figures do not need to be reduced for static applications when using Rigidur gypsum fibreboards with tapered edges.





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## European Technical Assessment

**ETA-08/0147**  
of 18.03.2022

General part

**Technical Assessment Body issuing the European Technical Assessment**

Österreichisches Institut für Bautechnik (OIB)  
Austrian Institute of Construction Engineering

**Trade name of the construction product**

RIGIDUR H

**Product family to which the construction product belongs**

Gypsum boards with fibrous reinforcement for lining of building elements

**Manufacturer**

Saint-Gobain Rigips GmbH  
Schanzenstraße 84  
40549 Düsseldorf  
Germany

**Manufacturing plant**

Saint-Gobain Rigips GmbH  
Rühler Straße 50  
37619 Bodenwerder  
Germany

**This European Technical Assessment contains**

19 pages including 6 Annexes, which form an integral part of this assessment.

**This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of**

European Assessment Document (EAD) 070006-00-0504 "Gypsum and expanded glass boards with fibrous reinforcement for sheathing and lining of building elements".

**This European Technical Assessment replaces**

European Technical Assessment ETA-08/0147 of 18.06.2020.



## Remarks

Translations of the European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

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### Specific parts

#### 1 Technical description of the product

This European Technical Assessment (ETA)<sup>1</sup> applies to the gypsum board with fibrous reinforcement for lining of building elements with trade name RIGIDUR H. RIGIDUR H is a flat rectangular board composed of gypsum, additives and reinforcement of recycled cellulose fibres. Board type according to EN 15283-2 is GF-C2-I-W2 or better. In addition, RIGIDUR H meets the requirements for board type DF according to EN 520.

RIGIDUR H S<sub>d</sub> has an organic finish made of polymer dispersion, which leads to a reduced water vapour diffusion as specified in Annex 2.

The edges of the board can be produced sharp edged or formed, see Annex 1.

The nominal thickness of the gypsum board is between 12.5 mm and 18 mm. The length of the board varies between 400 mm and 6 080 mm and the width between 400 mm and 2 540 mm. The nominal density is 1 200 kg/m<sup>3</sup> and amounts to at least 1 000 kg/m<sup>3</sup> up to a maximum of 1350 kg/m<sup>3</sup>.

The gypsum board corresponds to the specifications given in Annex 2. The material characteristics, dimensions and tolerances of RIGIDUR H, not indicated in these Annex, are given in the technical file<sup>2</sup> of the European Technical Assessment.

#### 2 Specification of the intended use(s) in accordance with the applicable European Assessment Document

##### 2.1 Intended use

The gypsum boards are used as load-bearing and non load-bearing building components. They may be used as load-bearing as well as stiffening boards in timber and drywall constructions. In ceilings they may be used as non load-bearing boards only.

The gypsum boards may also be used for load-bearing and bracing applications under seismic action.

The gypsum boards are intended to be used in service classes 1 and 2 according to EN 1995-1-1<sup>3</sup>.

The substructure is not part of this European Technical Assessment.

<sup>1</sup> The ETA-08/0147 was firstly issued in 2008 as European technical approval with validity from 30.06.2008, extended in 2013 with validity from 30.06.2013, amended and converted in 2018 to the European Technical Assessment ETA-08/0147 of 22.06.2018, amended in 2020 to the European Technical Assessment ETA-08/0147 of 18.06.2020 and amended in 2022 to the European Technical Assessment ETA-08/0147 of 18.03.2022.

<sup>2</sup> The technical file of the European Technical Assessment is deposited at Österreichisches Institut für Bautechnik and, in so far as is relevant to the tasks of the notified product certification body involved in the assessment and verification of constancy of performance procedure, is handed over to the notified product certification body.

<sup>3</sup> Reference documents are listed in Annex 6.





### 3 Performance of the product and reference to the methods used for its assessment

#### 3.1 Essential characteristics of the product

**Table 1: Essential characteristics of the product and product performance**

№	Essential characteristic	Product performance
Basic requirement for construction works 1: Mechanical resistance and stability <sup>1)</sup>		
1	Bending strength <sup>2) 3)</sup>	Annex 2
2	Shear strength <sup>2) 3)</sup>	Annex 2
3	Compression strength <sup>3)</sup>	Annex 2
4	Tension strength <sup>3)</sup>	Annex 2
5	Mechanical characteristics at increased moisture content	Annex 2
6	Racking strength and stiffness	Annex 2
7	Density	Annex 2
8	Creep and duration of the load	Annex 2
9	Dimensions	Annex 2
10	Dimensional stability	Annex 2
11	Surface hardness	Annex 2
12	Embedment strength of dowel-type fasteners (staples, nails, screws) in boards	Annex 2
13	Head pull-through resistance of dowel-type fasteners in boards	Annex 2
14	Structure and cohesion of the core at high temperature	Annex 2
15	Seismic resistance	Annex 2
Basic requirement for construction works 2: Safety in case of fire		
16	Reaction to fire	Annex 2
Basic requirement for construction works 3: Hygiene, health and the environment		
17	Water vapour permeability – Water vapour transmission	Annex 2
18	Water absorption of board surface	Annex 2
19	Water absorption of board	Annex 2
Basic requirement for construction works 4: Safety and accessibility in use		
20	Hard body impact resistance	Annex 2
Basic requirement for construction works 6: Energy economy and heat retention		
21	Thermal conductivity	Annex 2
1)	This characteristic also relates to basic requirement for construction works 4.	
2)	Load bearing capacity and stiffness regarding mechanical actions perpendicular to the gypsum board.	
3)	Load bearing capacity and stiffness regarding mechanical actions in plane of the gypsum board.	

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## **3.2 Assessment methods**

### **3.2.1 General**

The assessment of the essential characteristics in Clause 3.1 of the gypsum boards for the intended use, and in relation to the requirements for mechanical resistance and stability, for safety in case of fire, for hygiene, health and the environment, for safety and accessibility in use and for energy economy and heat retention in use in the sense of the basic requirements for construction works № 1, 2, 3, 4 and 6 of Regulation (EU) № 305/2011 has been made in accordance with the European Assessment Document EAD 070006-00-0504, "Gypsum and expanded glass boards with fibrous reinforcement for sheathing and lining of building elements".

### **3.2.2 Identification**

The European Technical Assessment for the gypsum boards is issued on the basis of agreed data that identify the assessed product. Changes to materials, to composition, to characteristics of the product, or to the production process could result in these deposited data being incorrect. Österreichisches Institut für Bautechnik should be notified before the changes are implemented, as an amendment of the European Technical Assessment is possibly necessary.

## **4 Assessment and verification of constancy of performance (thereinafter AVCP) system applied, with reference to its legal base**

### **4.1 System of assessment and verification of constancy of performance**

According to Commission Decision 95/467/EC the system of assessment and verification of constancy of performance to be applied to "RIGIDUR H" is System 3. System 3 is detailed in Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, Annex, 1.4., and provides for the following items

- (a) The manufacturer shall carry out factory production control.
- (b) The notified laboratory shall assess the performance on the basis of testing (based on sampling carried out by the manufacturer), calculation, tabulated values or descriptive documentation of the construction product.

### **4.2 AVCP for construction products for which a European Technical Assessment has been issued**

Notified bodies undertaking tasks under System 3 shall consider the European Technical Assessment issued for the construction product in question as the assessment of the performance of that product. Notified bodies shall therefore not undertake the tasks referred to in point 4.1 (b).

## **5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document**

### **5.1 Tasks for the manufacturer**

#### **5.1.1 Factory production control**

In the manufacturing plant the manufacturer shall establish and continuously maintain a factory production control. All procedures and specifications adopted by the manufacturer shall be documented in a systematic manner. The factory production control shall ensure the constancy of performances of the gypsum boards with regard to the essential characteristics.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the control plan. The incoming raw materials shall be subject to controls by the manufacturer before acceptance. Check of incoming materials shall include control of inspection documents presented by the manufacturer of the raw materials.

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The frequencies of controls conducted during manufacturing and on the finalised product are defined by taking account of the manufacturing process of the product and are laid down in the control plan.

The results of factory production control are recorded and evaluated. The records include at least the following data:

- Designation of the product, basic materials and components
- Type of control or test
- Date of manufacture of the product and date of testing of the product or basic materials or components
- Results of controls and tests and, if appropriate, comparison with requirements
- Name and signature of person responsible for factory production control

The records shall be kept at least for ten years time after the construction product has been placed on the market. On request they shall be presented to Österreichisches Institut für Bautechnik.

#### 5.1.2 Declaration of performance

The manufacturer is responsible for preparing the declaration of performance. When all the criteria of the assessment and verification of constancy of performance are met, the manufacturer shall issue a declaration of performance.





Issued in Vienna on 18.03.2022  
by Österreichisches Institut für Bautechnik

The original document is signed by:

**Rainer Mikulits**  
Managing Director



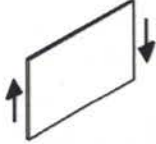
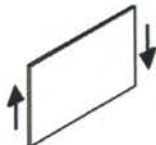




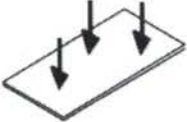
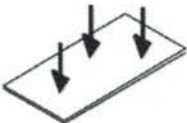
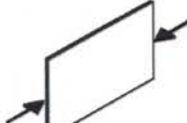

BWR	Essential characteristic	Assessment method	Level / Class / Description		
<b>1</b>	<b>Mechanical resistance and stability</b>				
	<b>Bending strength <sup>1)</sup></b>				
	Thickness		12.5 mm	15 mm	18 mm
	Bending strength perpendicular to the gypsum board $f_{m,90,k}$ 	EAD 070006-00-0504 2.2.1	5.50 N/mm <sup>2</sup>	5.00 N/mm <sup>2</sup>	3.00 N/mm <sup>2</sup>
	Bending modulus of elasticity perpendicular to the gypsum board $E_{m,90,mean}$ 	EAD 070006-00-0504 2.2.1	4 500 N/mm <sup>2</sup>	4 500 N/mm <sup>2</sup>	3 600 N/mm <sup>2</sup>
	Bending strength in plane of the gypsum board $f_{m,0,k}$ 	EAD 070006-00-0504 2.2.1	4.50 N/mm <sup>2</sup>	4.30 N/mm <sup>2</sup>	3.80 N/mm <sup>2</sup>
	Bending modulus of elasticity in plane of the gypsum board $E_{m,0,mean}$ 	EAD 070006-00-0504 2.2.1	3 500 N/mm <sup>2</sup>	3 500 N/mm <sup>2</sup>	3 350 N/mm <sup>2</sup>
<sup>1)</sup> each direction = direction of manufacturing procedure and direction perpendicular to manufacturing procedure					
<b>RIGIDUR H</b>			Annex 2		
Product characteristics			of European Technical Assessment ETA-08/0147 of 18.03.2022		



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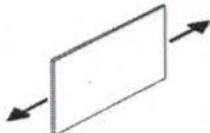
BWR	Essential characteristic	Assessment method	Level / Class / Description		
	<b>Shear strength <sup>1)</sup></b>				
	Thickness		12.5 mm	15 mm	18 mm
	Shear strength perpendicular to the gypsum board $f_{r,k}$ 	EAD 070006-00-0504 2.2.2	1.20 N/mm <sup>2</sup>	1.20 N/mm <sup>2</sup>	0.80 N/mm <sup>2</sup>
	Shear modulus perpendicular to the gypsum board $G_{r, mean}$ 	EAD 070006-00-0504 2.2.2	650 N/mm <sup>2</sup>	650 N/mm <sup>2</sup>	650 N/mm <sup>2</sup>
	Shear strength in plane of the gypsum board $f_{v,k}$ 	EAD 070006-00-0504 2.2.2	2.30 N/mm <sup>2</sup>	2.30 N/mm <sup>2</sup>	2.30 N/mm <sup>2</sup>
	Shear modulus in plane of the gypsum board $G_{v, mean}$ 	EAD 070006-00-0504 2.2.2	1 300 N/mm <sup>2</sup>	1 200 N/mm <sup>2</sup>	1 200 N/mm <sup>2</sup>
<sup>1)</sup> each direction = direction of manufacturing procedure and direction perpendicular to manufacturing procedure					
<b>RIGIDUR H</b>			Annex 2		
Product characteristics			of European Technical Assessment ETA-08/0147 of 18.03.2022		

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BWR	Essential characteristic	Assessment method	Level / Class / Description		
<b>Compression strength</b> <sup>1)</sup>					
Thickness			12.5 mm	15 mm	18 mm
Compression strength perpendicular to the gypsum board $f_{c,90,k}$ 		EAD 070006-00-0504 2.2.3	6.00 N/mm <sup>2</sup>	5.90 N/mm <sup>2</sup>	5.30 N/mm <sup>2</sup>
Compression modulus of elasticity perpendicular to the gypsum board $E_{c,90,mean}$ 		EAD 070006-00-0504 2.2.3	300 N/mm <sup>2</sup>	300 N/mm <sup>2</sup>	300 N/mm <sup>2</sup>
Compression strength in plane of the gypsum board $f_{c,0,k}$ 		EAD 070006-00-0504 2.2.3	9.00 N/mm <sup>2</sup>	7.20 N/mm <sup>2</sup>	5.75 N/mm <sup>2</sup>
Compression modulus of elasticity in plane of the gypsum board $E_{c,0,mean}$ 		EAD 070006-00-0504 2.2.3	4 500 N/mm <sup>2</sup>	3 000 N/mm <sup>2</sup>	3 000 N/mm <sup>2</sup>
<sup>1)</sup> each direction = direction of manufacturing procedure and direction perpendicular to manufacturing procedure					
<b>RIGIDUR H</b>			Annex 2		
Product characteristics			of European Technical Assessment ETA-08/0147 of 18.03.2022		



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BWR	Essential characteristic	Assessment method	Level / Class / Description		
<b>Tension strength <sup>1)</sup></b>					
Thickness			12.5 mm	15 mm	18 mm
Tension strength in plane of the gypsum board $f_{t,0,k}$ 		EAD 070006-00-0504 2.2.4	2.20 N/mm <sup>2</sup>	2.00 N/mm <sup>2</sup>	1.60 N/mm <sup>2</sup>
Tension modulus of elasticity in plane of the gypsum board $E_{t,0,mean}$ 		EAD 070006-00-0504 2.2.4	4 500 N/mm <sup>2</sup>	2 500 N/mm <sup>2</sup>	2 500 N/mm <sup>2</sup>
<sup>1)</sup> each direction = direction of manufacturing procedure and direction perpendicular to manufacturing procedure					
<b>RIGIDUR H</b>			Annex 2		
Product characteristics			of European Technical Assessment ETA-08/0147 of 18.03.2022		

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BWR	Essential characteristic	Assessment method	Level / Class / Description
	<b>Mechanical characteristics at increased moisture content</b>	EAD 070006-00-0504 2.2.5	Reduction factor for loss of racking strength and stiffness: $k_{red} = 0.65$
	<b>Racking strength and stiffness</b>	EN 594	Calculation acc. to EN 1995-1-1
	<b>Density</b>	EN 15283-2	$1\ 000\ \text{kg/m}^3 \leq \rho \leq 1\ 350\ \text{kg/m}^3$ Nominal density $1\ 200\ \text{kg/m}^3$
	<b>Creep and duration of load</b>	EAD 070006-01-0504 2.2.8	Annex 3
	<b>Dimensions</b>	EN 15283-2	board thickness $\leq 18\ \text{mm}$ : t: $\pm 0.5\ \text{mm}$ b: $+0/-4\ \text{mm}$ l: $+0/-5\ \text{mm}$ squareness: $\leq 2.5\ \text{mm/m}$
	<b>Dimensional stability</b>		
	Shrinkage and swelling	EN 318	per 30 % variation in rel. humidity: $\leq 0.45\ \text{mm/m}$
	Moisture content during service shall not change to such an extent that adverse deformation will occur.		
	<b>Surface hardness</b>	EN 15283-2	Pass for board type GF-I
	<b>Embedment strength</b>	EAD 070006-00-0504 2.2.12	Annex 4
	<b>Head pull-through parameter</b>	EAD 070006-00-0504 2.2.13	Annex 4
	<b>Structure and cohesion of the core at high temperature</b>	EAD 070006-00-0504 2.2.14	Pass for board type F
	<b>Seismic resistance</b>	EAD 070006-00-0504 2.2.15	Annex 5

**RIGIDUR H**

Annex 2

Product characteristics

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BWR	Essential characteristic	Assessment method	Level / Class / Description	
<b>2</b>	<b>Safety in case of fire</b>			
	<b>Reaction to fire</b>			
	RIGIDUR H, RIGIDUR H <sub>s,d</sub> ρ ≥ 1200 kg/m <sup>3</sup>	EN 13501-1	Euroclass A2-s1, d0	
<b>3</b>	<b>Hygiene, health and environment</b>			
	<b>Water vapour permeability – water vapour transmission</b>		water vapour resistance factor, μ	water vapour diffusion-equivalent air layer thickness s <sub>d</sub> in m
	– RIGIDUR H 12.5 mm ρ = 1237 kg/m <sup>3</sup>	EN ISO 12572	19	0.24
	– RIGIDUR H 15 mm ρ = 1253 kg/m <sup>3</sup>	EN ISO 12572	19	0.29
	– RIGIDUR H 18 mm ρ = 1222 kg/m <sup>3</sup>	EN ISO 12572	19	0.34
	– RIGIDUR H SD 12.5 mm ρ = 1237 kg/m <sup>3</sup>	EN ISO 12572	1423	4.6
	<b>Water absorption</b>		Pass for board type GF-W2	
	– board surface	EN 15283-2	< 30 %	
	– board	EN 15283-2		
	<b>Hard body impact resistance</b>	EN 1128	IR = 27 mm/mm	
<b>6</b>	<b>Energy economy and heat retention</b>			
	<b>Thermal conductivity, λ<sub>10,dry</sub></b>	EN 12664	0.202 W/(m·K)	
<b>RIGIDUR H</b>		Annex 2		
Product characteristics		of European Technical Assessment ETA-08/0147 of 18.03.2022		





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**Fasteners**

Fasteners for the connection of the gypsum boards with the substructure shall be nails, screws or staples with a zinc coating or made of stainless steel with a diameter  $1.5 \text{ mm} \leq d \leq 4.0 \text{ mm}$ .

Head diameter of the nails shall be  $d_{\text{head}} \geq 1.68 d$  and back width of staples  $b_R > 5.88 d$ .

The distance of the fasteners from the unstressed edge of the gypsum board shall be at least  $5 d$  and from the stressed edge at least  $7 d$ .

**Embedment strength  $f_{h,k}$**

The embedment strength of the fasteners in gypsum boards of thickness 12.5, 15 and 18 mm and for  $\rho \geq 1100 \text{ kg/m}^3$  can be calculated by

$$f_{h,k} = 127 d^{-0.7}$$

with

$d$  ... diameter of the fastener and for  $d \leq 4.0 \text{ mm}$

**Load-bearing capacity of gypsum board - wood connections in shear**

For single shear connections with predominantly short-time loading parallel to the edge of the board, the characteristic value of the load-bearing capacity of fasteners  $F_{v,Rk}$  for gypsum boards with full edge may be determined according to clause 8.2.2 of EN 1995-1-1.

The part of the rope effect in the load-bearing capacity  $F_{ax,Rk}/4$  according to the Johansen theory shall be limited to 50 % for staple and nail connections. For staple connections with  $d \geq 1.8 \text{ mm}$  and panel thicknesses  $t \geq 15 \text{ mm}$   $F_{ax,Rk}/4$  must not be taken into account.

The withdrawal resistance for staples can be calculated as follows

$$F_{ax,Rk} = \min \left\{ \begin{array}{l} 2 \cdot f_{ax,k} \cdot d \cdot t_{pen} \\ f_{head,k} \cdot d \cdot b_R \end{array} \right.$$

with

$f_{ax,k}$  characteristic value of withdrawal strength out of wood in  $[\text{N/mm}^2]$

$f_{head,k}$  head-pull-through parameter in  $[\text{N/mm}^2]$

$d$  diameter of the staple in  $[\text{mm}]$

$t_{pen}$  penetration depth on the side of the staple tip or length of the resinated part of the shaft in the component with the staple tip in  $[\text{mm}]$

$b_R$  staple width in  $[\text{mm}]$

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The slip modulus  $K_{ser}$  for shear stresses per shear joint of dowel-type fasteners or per connection unit with staples may be calculated according to Table A.4.1.

**Table A.4.1 Slip modulus  $K_{ser}$  per shear joint and connection unit with staples**

Fastener	$K_{ser}$ in N/mm <sup>2</sup>
Staples	$\rho_m^{1.5} \cdot d^{0.8} / 40$
Nails (non-predrilled)	$\rho_m^{1.5} \cdot d^{0.8} / 30$
Screws	$\rho_m^{1.5} \cdot d / 23$

with

$d$  diameter of the fastener in [mm]

$\rho_m = (\rho_{m,1} \cdot \rho_{m,2})^{0.5}$  geometric mean value of the mean density of the gypsum boards and the mean density of the timber component to be connected in [kg/m<sup>3</sup>]

Racking strength of wall panels

The design value of the racking strength of each wall panel  $F_{i,v,Rd}$  may be calculated as

$$F_{i,v,Rd} = f_{v,0,d} \cdot b_i \cdot c_i \text{ [N]}$$

with

$f_{v,0,d}$  design value of the length-related shear strength of a wall panel in [N/mm]

$b_i$  width of the wall panel in [mm]

and

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

with

$$b_0 = h/2$$

$h$  height of the wall in [mm].

The design value of the length-related shear strength  $f_{v,0,d}$  of a wall panel may be calculated taking into account the load-bearing capacity of the connection and the gypsum boards as well as buckling of the panel according to

$$f_{v,0,d} = n_{BepI} \cdot \min \left\{ \begin{array}{l} k_{v1} \cdot \frac{F_{v,Rd}}{s} \\ k_{v1} \cdot k_{v2} \cdot f_{t,d} \cdot t \\ k_{v1} \cdot k_{v2} \cdot f_{v,d} \cdot 35 \cdot \frac{t^2}{b_{net}} \end{array} \right.$$

whereas the lowest value is decisive.

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with

- $n_{BepI}$  number of cladded sides of the wall element (cladding on one side  $n_{BepI}=1$ ; cladding on both sides  $n_{BepI}=2$ , only if the planking and the fasteners are of the same type and the same dimensions)
- $k_{v1}$  factor taking into account the arrangement and type of connection of the panels ( $k_{v1}=1.0$  for panel edges that are rigid in shear on all sides and  $k_{v1}=0.66$  for panels with free panel edges)
- $k_{v2}$  factor taking into account the deviations of the load-bearing behavior from the conditions of the ideal calculation model ( $k_{v2}=0.33$  for wall panels cladded on one side and  $k_{v2}=0.5$  for wall panels cladded on both sides)
- $F_{v,Rd}$  design value of the load-bearing capacity of shearing off a fastener
- $f_{t,d}$  design value of the tensile strength of the boards
- $f_{v,d}$  design value of the shear strength of the boards
- $s$  spacing of fasteners
- $b_{net}$  distance between the vertical studs
- $t$  thickness of the board

Different to EN 1995-1-1 the design value of the load-bearing capacity of shearing off a fastener  $F_{v,Rd}$  must not be increased by a factor of 1.2 for the fasteners along the edges of a single board.

Head pull-through parameter  $f_{head,k}$

The head pull-through parameter  $f_{head,k}$  for selected tested fasteners are given in Table A.4.2.

**Table A.4.2 Head pull-through parameter for tested fasteners**

Fastener	Dimensions	Head pull-through parameter $f_{head,k}$	
		t = ≤ 15 mm	t = 18 mm
Staple	d = 1.53 mm, b <sub>R</sub> = 11.25 mm	30.1 N/mm <sup>2</sup>	45.4 N/mm <sup>2</sup>
Staple	d = 2.0 mm, b <sub>R</sub> = 11.76 mm	16.3 N/mm <sup>2</sup>	30.5 N/mm <sup>2</sup>
Nail	d = 2.1 mm, d <sub>head</sub> = 4.6 mm	25.9 N/mm <sup>2</sup>	42.3 N/mm <sup>2</sup>
Nail	d = 2.8 mm, d <sub>head</sub> = 6.7 mm	14.2 N/mm <sup>2</sup>	20.7 N/mm <sup>2</sup>
Screw	d = 3.5 mm, d <sub>head</sub> = 5.9 mm	19.8 N/mm <sup>2</sup>	29.0 N/mm <sup>2</sup>

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**Table A.5.1 Ductility factor  $\mu$  for different board thicknesses, fastener types and minimum edge distances**

Board thickness	Type of fastener	edge distance	ductility factor $\mu$
12.5 mm	staples d = 1.53 mm, l = 45 mm	$a_{4,c} = 5 d$	5.9
12.5 mm	staples d = 1.8 mm, l = 45 mm	$a_{4,c} = 5 d$	9.0
12.5 mm	profiled nails d = 2.5 mm, l = 45 mm	$a_{4,c} = 5 d$	11.7
15 mm	staples d = 1.53 mm, l = 50 mm	$a_{4,c} = 5 d$	2.0
15 mm	staples d = 1.8 mm, l = 50 mm	$a_{4,c} = 5 d$	8.9
15 mm	profiled nails d = 2.5 mm, l = 45 mm	$a_{4,c} = 5 d$	10.9
18 mm	staples d = 1.8 mm, l = 50 mm	$a_{4,c} = 5 d$	17.5
18 mm	profiled nails d = 2.5 mm, l = 45 mm	$a_{4,c} = 5 d$	13.4

**Design considerations for RIGIDUR H**

According to EN 1998-1, Clause 8.3(3)P a ductility factor of 4 must be reached for structures of ductility class M and a ductility factor of 6 must be reached for structures of ductility class H whereas the load-bearing capacity must not decrease by more than 20 %.

Therefore the constructions with staples may be assigned to ductility class DCM with a behaviour coefficient q of 2.5 and the constructions with profiled nails may be assigned to ductility class DCH with a behaviour coefficient q of 4.

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