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European Technical Assessment

ETA-11/0137
of 04.11.2019

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

LIGNATUR-box element (LKE), -surface element (LFE) and -shell element (LSE)

Product family to which the construction product belongs

Prefabricated wood-based loadbearing stressed skin panels

Manufacturer

Lignatur AG
Herisauerstraße 30
9104 Waldstatt
Switzerland

Manufacturing plant

Lignatur AG
Herisauerstraße 30
9104 Waldstatt
Switzerland

This European Technical Assessment contains

26 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

ETAG 019, Prefabricated wood-based loadbearing stressed skin panels, edition November 2004, used according to Article 66 (3) of Regulation (EU) № 305/2011 as European Assessment Document.

This European Technical Assessment replaces

European Technical Assessment ETA-11/0137 of 20.06.2014.

Remarks

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

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full. However, partial reproduction may be made with the written consent of Austrian Institute of Construction Engineering. Any partial reproduction has to be identified as such.

Specific parts

1 Technical description of the product

1.1 General

This European Technical Assessment¹ (ETA) applies to the open and closed box load bearing stressed skin panels

LIGNATUR-box element (LKE) LIGNATUR-surface element (LFE) LIGNATUR-shell element (LSE)

LIGNATUR-elements are factory made large-size floor and roof elements in softwood. The LIGNATUR-elements have parallel skins and ribs at regular distances.

Type according to ETAG 019², Clause 2.1:

- Open or closed box type with skins rigidly bonded to the entire length of the ribs with an adhesive
- Without or with thermal insulation products not contributing to the structural characteristics of the stressed skin panels

Beside thermal insulation products the boxes can be provided with ballast weight. The ballast weight does not contribute to the structural characteristics of the stressed skin panels.

LIGNATUR-elements and the boards for its manufacturing correspond to the specifications given in the Annexes 1 and 2. The material characteristics, dimensions and tolerances of LIGNATUR-elements, not indicated in these Annexes, are given in the technical file³ of the European Technical Assessment.

Cladding, covering, rain and snow protection and connection to the structure as well as application of wood preservatives and flame retardants are not subject to the European Technical Assessment.

1.2 Components

1.2.1 Timber

Skins and ribs are made of softwood boards or softwood of rectangular cross section, i.e. visually or machine strength graded timber. Only technically dried wood is used.

Solid wood shall be classified according to EN 338.

¹ The ETA-11/0137 was firstly issued in 2011 as European technical approval with validity from 28.04.2011, amended in 2012 with validity from 19.11.2012, amended and converted in 2014 to the European Technical Assessment ETA-11/0137 of 20.06.2014 and 2019 amended to ETA-11/0137 of 04.11.2019.

² Reference documents are listed in Annex 6.

³ 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.

In longitudinal direction the softwood boards are jointed with finger joints, there are no butt joints. Between the ribs stiffeners are arranged at regular distances for stabilisation.

To improve the acoustic performance of the LIGNATUR-elements, the skin can be provided with a grid of holes or slots.

1.2.2 Adhesive

The skins and ribs are bonded by means of an adhesive to open or closed boxes. Directions of grain of skins and ribs are parallel.

The adhesive for bonding the LIGNATUR-elements and finger joints conforms to EN 15425 or EN 301.

1.2.3 Thermal insulation products

Thermal insulation products inserted into the LIGNATUR-elements such as mineral wool, wood fibre etc. conform to a harmonised European standard or a European Technical Assessment and shall be CE marked. Thermal insulation products do not contribute to the load bearing characteristics of the LIGNATUR-elements.

The thermal insulation products are not subject to the European Technical Assessment.

1.2.4 Ballast weight

Ballast weight inserted into the box elements such as concrete blocks, aggregates etc. does not contribute to the load bearing characteristics of the LIGNATUR-elements. Concrete blocks and aggregates conform to a harmonised European standard or a European Technical Assessment and shall be CE marked. For ballast weight with aggregates from calcium carbonate at least mineralogy, grain category, density as well as content of fines shall be given.

The ballast weight is not subject to the European Technical Assessment.

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

2.1 Intended use

The LIGNATUR-elements are intended to be used as load bearing or non-load bearing elements predominantly in floors and roofs. They may be used in a load bearing function or for load transmission stressed perpendicular as well as in plane of the element.

The product shall be subjected to static and quasi-static actions only.

The product is intended to be used in service classes 1 and 2 according to EN 1995-1-1. Members which are directly exposed to the weather shall be provided with an effective protection for the product in service.

2.2 General assumptions

The LIGNATUR-elements are manufactured in accordance with the provisions of the European Technical Assessment using the manufacturing process as identified in the inspection of the manufacturing plant by Österreichisches Institut für Bautechnik and laid down in the technical file.

The manufacturer shall ensure that the requirements in accordance with the Clauses 1, 2 and 3 as well as with the Annexes of the European Technical Assessment are made known to those who are concerned with design and execution of the works.

Design

The European Technical Assessment only applies to the manufacture and use of the LIGNATUR-elements. Verification of stability of the works including application of loads on the products is not subject to the European Technical Assessment.

The following conditions shall be observed:

- Design of the LIGNATUR-elements is carried out under the responsibility of an engineer experienced in such products.
- Design of the works shall account for the protection of the LIGNATUR-elements.
- In service, the LIGNATUR-elements are not exposed to detrimental moisture. The definitions of service classes 1 and 2 according to EN 1995-1-1 apply.
- The LIGNATUR-elements are installed correctly.

Design of the products may be according to EN 1995-1-1 and EN 1995-1-2, taking into account of Annexes 2 to 5 of the European Technical Assessment.

Standards and regulations in force at the place of use shall be considered.

Packaging, transport, storage, maintenance, replacement and repair

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

Installation

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Ducts and services shall as far as possible be arranged not to affect the performances of the LIGNATUR-elements. If there are ducts or services between the skins or passing through the product, their effect on the stability, the safety in case of fire and the building physics characteristics shall be taken into consideration. The same principles apply to holes cut for another purpose.

Cutting of ribs and cutting of slots in the skins shall be avoided as much as possible and always requires special attention and assessment.

2.3 Assumed working life

The provisions made in the European Technical Assessment (ETA) are based on an assumed intended working life of the LIGNATUR-elements of 50 years, when installed in the works, provided that the cross laminated timber elements are subject to appropriate installation, use and maintenance (see Clause 2.2). These provisions are based upon the current state of the art and the available knowledge and experience⁴.

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA nor by the Technical Assessment Body, but are regarded only as a means for choosing the appropriate products in relation to the expected economically reasonable working life of the works.

⁴ The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product can also be shorter than the assumed working life.

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 assessment methods

No	Essential characteristic	Product performance
Basic requirement for construction works 1: Mechanical resistance and stability ¹⁾		
1	Load bearing capacity	Annex 2
2	Serviceability	Annex 2
3	Moisture content	Annex 2
Basic requirement for construction works 2: Safety in case of fire		
4	Reaction to fire	Annex 2
5	Resistance to fire	Annex 2
Basic requirement for construction works 3: Hygiene, health and the environment		
6	Water vapour permeability and moisture resistance	Annex 2
7	Water tightness	No performance assessed.
8	Content, emission and/or release of dangerous substances	3.1.1 and Annex 2
Basic requirement for construction works 4: Safety and accessibility in use		
9	Slipperiness of floors	No performance assessed.
10	Impact resistance	Annex 2
Basic requirement for construction works 5: Protection against noise		
11	Airborne sound insulation	Annex 2
12	Impact sound insulation	Annex 2
13	Sound absorption	Annex 2
Basic requirement for construction works 6: Energy economy and heat retention		
14	Thermal resistance	Annex 2
15	Air permeability	Annex 2
16	Thermal inertia	Annex 2
¹⁾ These characteristics also relate to basic requirement for construction works 4.		

3.1.1 Hygiene, health and the environment

The release of dangerous substances is determined according to Guideline for European Technical Approval ETAG 019, "Prefabricated wood-based loadbearing stressed skin panels", Edition November 2004, used as European Assessment Document. No dangerous substances is the performance of LIGNATUR-elements in this respect.

NOTE In addition to the specific clauses relating to dangerous substances contained in the European Technical Assessment, 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 Regulation, these requirements need also to be complied with, when and where they apply.

3.2 Assessment methods

3.2.1 General

The assessment of the essential characteristics in Clause 3.1 of the LIGNATUR-elements 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, for protection against noise and for energy economy and heat retention in use in the sense of the basic requirements for construction works № 1 to 6 of Regulation (EU) № 305/2011 has been made in accordance with Guideline for European Technical Approval ETAG 019, "Prefabricated wood-based loadbearing stressed skin panels", Edition November 2004, used as European Assessment Document.

3.2.2 Identification

The European Technical Assessment for the LIGNATUR-elements 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 (thereafter AVCP) system applied, with reference to its legal base

4.1 System of assessment and verification of constancy of performance

According to Commission Decision 2000/447/EC the system of assessment and verification of constancy of performance to be applied to the LIGNATUR-elements is System 1. System 1 is detailed in Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, Annex, 1.2., and provides for the following items

- (a) The manufacturer shall carry out
 - (i) factory production control;
 - (ii) further testing of samples taken at the manufacturing plant by the manufacturer in accordance with a prescribed test plan⁵;
- (b) The notified product certification body shall decide on the issuing, restriction, suspension or withdrawal of the certificate of constancy of performance of the construction product on the basis of the outcome of the following assessments and verifications carried out by that body:
 - (i) an assessment of the performance of the construction product carried out on the basis of testing (including sampling), calculation, tabulated values or descriptive documentation of the product;
 - (ii) initial inspection of the manufacturing plant and of factory production control;
 - (iii) continuous surveillance, assessment and evaluation of factory production control.

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

Notified bodies undertaking tasks under System 1 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)(i).

⁵ The prescribed test plan has been deposited with Österreichisches Institut für Bautechnik and is handed over only to the notified product certification body involved in the procedure for the assessment and verification of constancy of performance. The prescribed test plan is also referred to as control plan.

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 specification adopted by the manufacturer shall be documented in a systematic manner. The factory production control shall ensure the constancy of performances of the LIGNATUR-elements 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.

The frequencies of controls conducted during manufacturing and on the assembled 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 and shall be presented to the notified product certification body involved in continuous surveillance. 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, including the certificate of conformity issued by the notified product certification body, the manufacturer shall draw up a declaration of performance.

5.2 Tasks for the notified product certification body

5.2.1 Initial inspection of the manufacturing plant and of factory production control

The notified product certification body shall verify the ability of the manufacturer for a continuous and orderly manufacturing of the LIGNATUR-elements according to the European Technical Assessment. In particular the following items shall be appropriately considered

- Personnel and equipment
- The suitability of the factory production control established by the manufacturer
- Full implementation of the control plan

5.2.2 Continuous surveillance, assessment and evaluation of factory production control

The notified product certification body shall visit the factory at least once a year for routine inspection. In particular the following items shall be appropriately considered

- The manufacturing process including personnel and equipment
- The factory production control
- The implementation of the control plan

The results of continuous surveillance are made available on demand by the notified product certification body to Österreichisches Institut für Bautechnik. When the provisions of the European Technical Assessment and the control plan are no longer fulfilled, the certificate of constancy of performance is withdrawn by the notified product certification body.

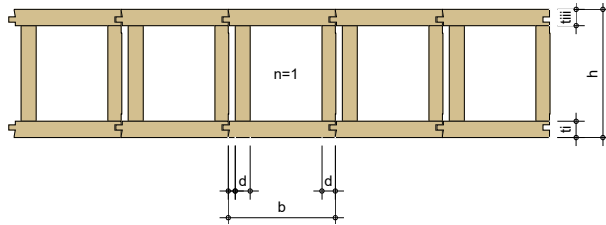
Issued in Vienna on 04.11.2019
by Österreichisches Institut für Bautechnik

The original document is signed by:

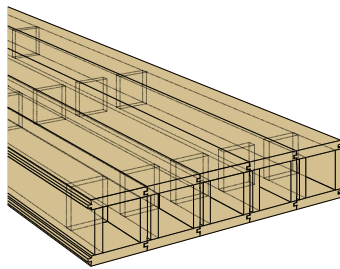
Rainer Mikulits
Managing Director

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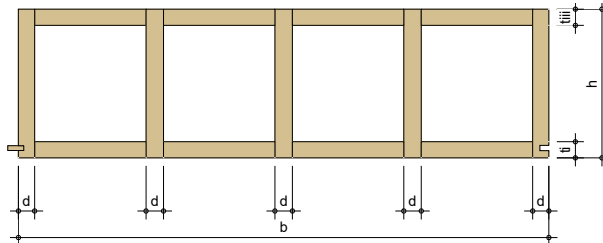
LIGNATUR – box element (LKE)



Height h	≤ 400 mm
Width b	≤ 250 mm
Thickness of ribs d	27 mm – 33 mm
Thickness skin ti	25 mm – 82 mm
Thickness skin tiii	25 mm – 82 mm
Number of boxes n	1
Length L	≤ 18 m
Spacing of stiffeners	≤ 1.2 m

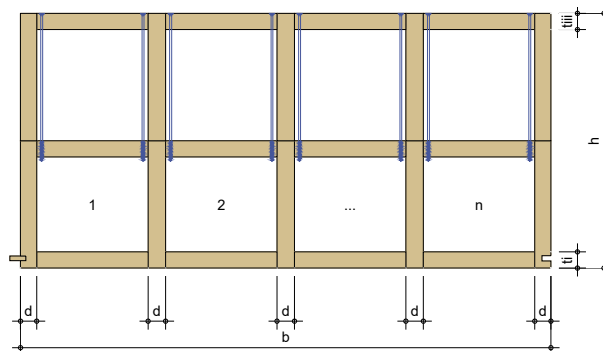


LIGNATUR – surface element (LFE)



Height h	≤ 360 mm
Width b	≤ 1 000 mm
Thickness of ribs d	27 mm – 80 mm
Thickness skin ti	25 mm – 82 mm
Thickness skin tiii	25 mm – 82 mm
Number of boxes n	≤ 4
Length L	≤ 18 m
Spacing of stiffeners	≤ 1.2 m

or



Height h	> 360 – 600 mm
Width b	≤ 1 000 mm
Thickness of ribs d	27 mm – 80 mm
Thickness skin ti	25 mm – 82 mm
Thickness skin tiii	25 mm – 82 mm
Number of boxes n	≤ 4
Length L	≤ 18 m
Spacing of stiffeners	≤ 1.2 m

LIGNATUR-elements

Product specification

Annex 1

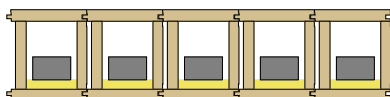
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 ETA-11/0137 of 04.11.2019

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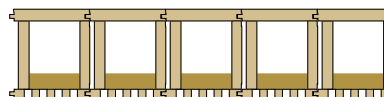
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Examples of assemblies of LIGNATUR – box elements (LKE)

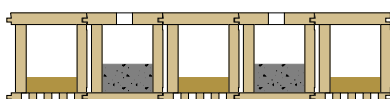
Airborne and impact sound insulation



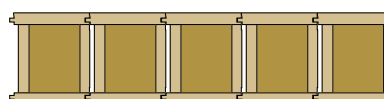
Sound absorption



Airborne and impact sound insulation and sound absorption

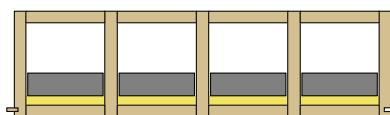


Thermal insulation

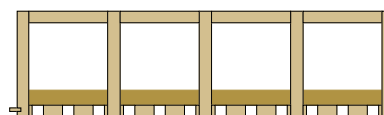


Examples of assemblies of LIGNATUR – surface elements (LFE)

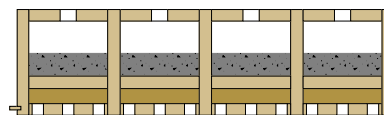
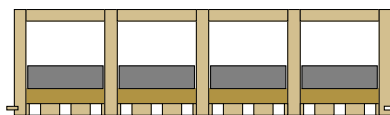
Airborne and impact sound insulation



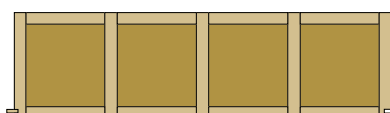
Sound absorption



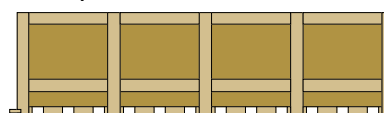
Airborne and impact sound insulation and sound absorption



Thermal insulation

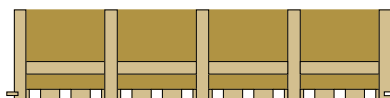


Thermal insulation and sound absorption



Example of an assembly of LIGNATUR – shell elements (LSE)

Sound absorption



LIGNATUR-elements	Annex 1 of European Technical Assessment ETA-11/0137 of 04.11.2019
Product specification	

Table 2: Product characteristics of LIGNATUR-elements

BWR	Essential characteristic	Assessment method	Level / Class / Description
1	Mechanical resistance and stability		
	Load bearing capacity and serviceability – Exemplary load bearing capacity (bending, shear) – Floor, exemplary serviceability for deflection $w = l / 600$ – Roof, exemplary serviceability for deflection $w = l / 300$	EN 1995-1-1 (Eurocode 5) ¹⁾	Example, see Figure 1 Example, see Figure 2 Example, see Figure 3
	Moisture content	EN 13183-1	10 %

¹⁾ The load bearing capacity is determined by calculation according to EN 1995-1-1, applying the characteristic values of softwood strength class C24 according to EN 338.

- g Permanent load (self-weight of LIGNATUR-element considered in calculation)
- q_N, q_A Imposed loads
- s Snow load
- $\gamma = 1$ Partial safety coefficient for serviceability

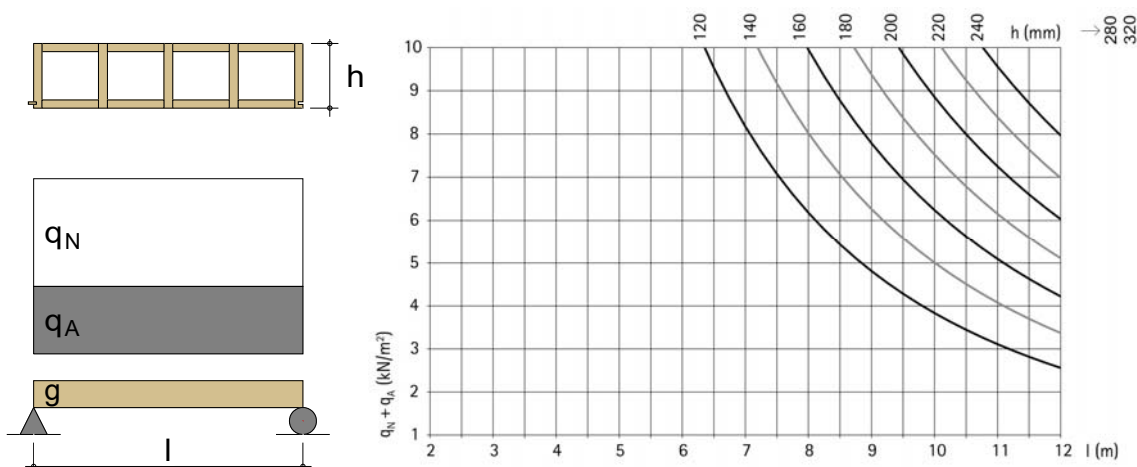


Figure 1: Exemplary load bearing capacity for bending and shear ($t_i = 31 \text{ mm}$, $t_{jii} = 31 \text{ mm}$, $d = 31 \text{ mm}$)

LIGNATUR-elements	Annex 2
Characteristic data of LIGNATUR-elements	of European Technical Assessment ETA-11/0137 of 04.11.2019

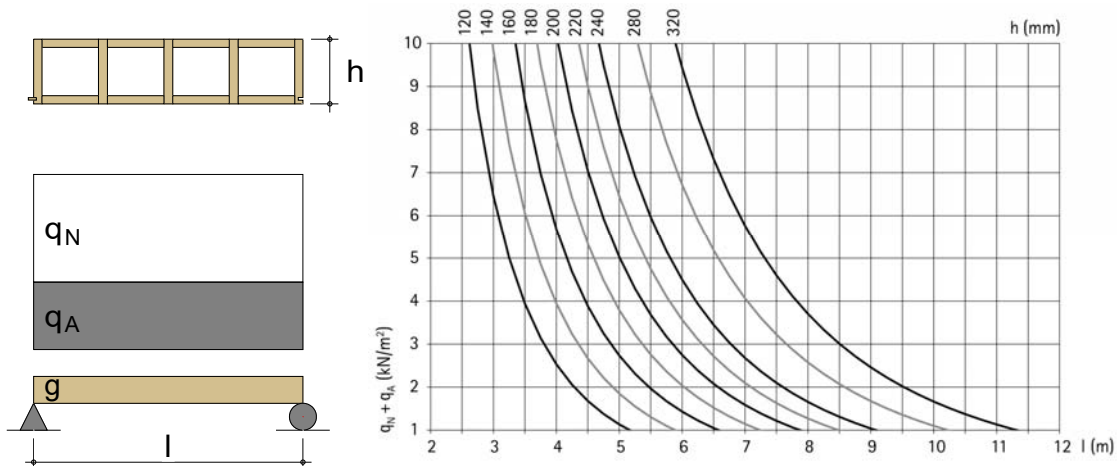


Figure 2: Floor, exemplary serviceability for deflection $w = l / 600$ ($t_i = 31 \text{ mm}$, $t_{iii} = 31 \text{ mm}$, $d = 31 \text{ mm}$)

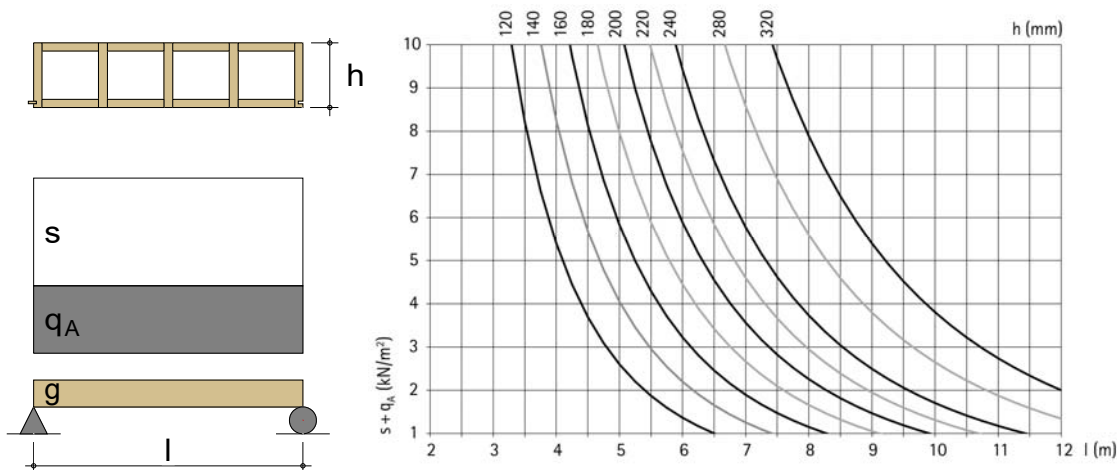


Figure 3: Roof, exemplary serviceability for deflection $w = l / 300$ ($t_i = 31 \text{ mm}$, $t_{iii} = 31 \text{ mm}$, $d = 31 \text{ mm}$)

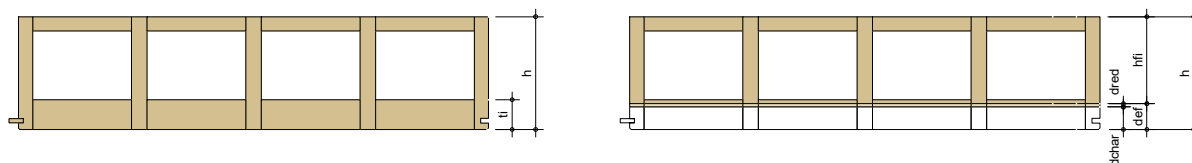
LIGNATUR-elements	Annex 2 of European Technical Assessment ETA-11/0137 of 04.11.2019
Characteristic data of LIGNATUR-elements	

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Resistance to fire is calculated with the residual cross section according to EC 5.

Charring rate of standard LIGNATUR-elements

The charring rate for elements made of spruce wood is 0.8 mm/min. The effective charring depths for determination of the residual cross section are:



Standard element

$$d_{ef} = d_{char} + d_{red} = t \cdot \beta_1 + 7 \text{ mm}$$

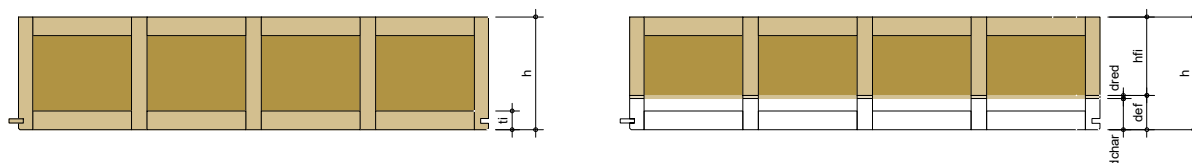
d_{ef} effective charring depth for determination of residual cross section

d_{char} depth of charred layer after required fire resistance time

t required fire resistance time

$\beta_1 = 0.8 \text{ mm/min}$ charring rate

$d_{red} = 7 \text{ mm}$... depth of layer for consideration of strength loss in areas adjacent to the charred layer



Standard elements with thermal insulation product of wood fibre

$$d_{ef} = d_{char} + d_{red} = t_1 \cdot \beta_1 + t_2 \cdot \beta_2 + 7 \text{ mm}$$

d_{ef} effective charring depth for determination of residual cross section

d_{char} depth of charred layer after required fire resistance time

$t = t_1 + t_2$ required fire resistance time

t_1 charring time in the area of the skin

t_2 charring time in the area of the thermal insulation product of wood fibre

$\beta_1 = 0.8 \text{ mm/min}$ charring rate

$\beta_2 = 0.9 \cdot \sqrt{\frac{450}{\rho_{iso}}}$ mm/min charring rate for thermal insulation product of wood fibre or

$\beta_2 = 1.6 \text{ mm/min}$ charring rate for thermal insulation product of mineral fibre (reaction to fire class A2-s1, d0 or better)

ρ_{iso} density of thermal insulation product of wood fibre

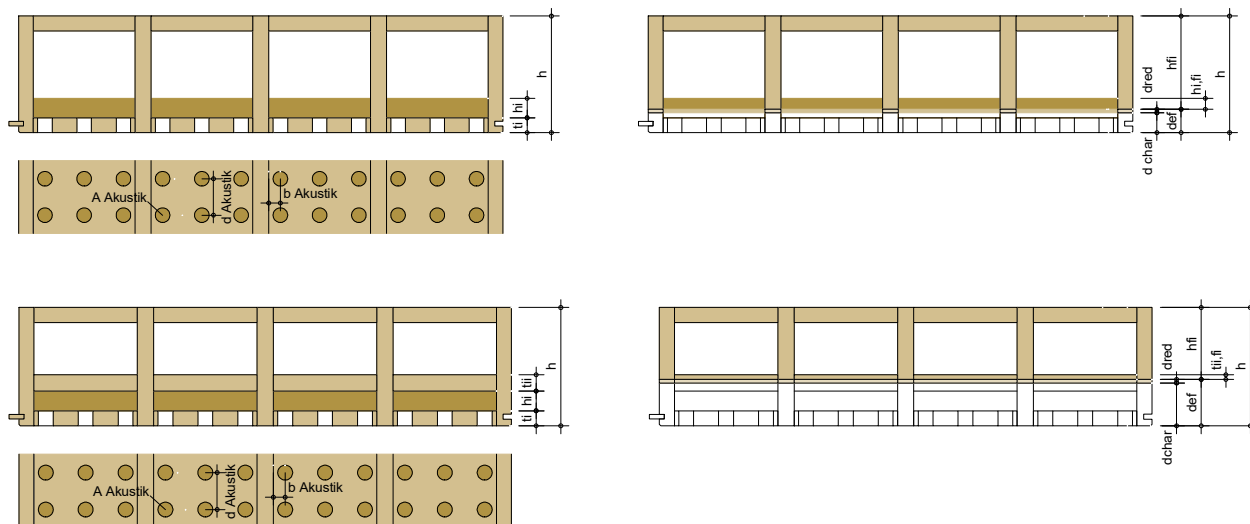
$d_{red} = 7 \text{ mm}$... depth of layer for consideration of strength loss in areas adjacent to the charred layer

Dimensions in mm
 Time in minutes
 Density in kg/m³

LIGNATUR-elements	Annex 3 of European Technical Assessment ETA-11/0137 of 04.11.2019
Resistance to fire – Charring rates	

Charring rate of LIGNATUR acoustics elements

To improve the acoustic performance, the lower skin can be perforated with holes or slots. Annex 5 shows the usual types of perforation. The charring rate of perforated skins can be determined by:



$$d_{ef} = d_{char} + d_{red} = t_1 \cdot \beta_1 + t_2 \cdot \beta_2 + t_3 \cdot \beta_3 + 7 \text{ mm}$$

d_{ef} effective charring depth for determination of residual cross section

d_{char} depth of charred layer after required fire resistance time

$t = t_1 + t_2 + t_3$... required fire resistance time

t_1 charring time in the area of the skin

t_2 charring time in the area of wood fibre

t_3 charring time in the area of wood

$\beta_1 = 0.22 \cdot k + 0.72$ mm/min charring rate

$$k = \frac{A_{Akustik}}{b_{Akustik} \cdot d_{Akustik}} \cdot 10^3$$

For $A_{Akustik}$, $b_{Akustik}$, $d_{Akustik}$ and t_i see Annex 5.

$$\beta_2 = 0.9 \cdot \sqrt{\frac{450}{\rho_{iso}}} \text{ mm/min charring rate for thermal insulation product of wood fibre}$$

ρ_{iso} density of thermal insulation product of wood fibre

$d_{red} = 7 \text{ mm}$... depth of layer for consideration of strength loss in areas adjacent to the charred layer

Dimensions in mm
Time in minutes
Density in kg/m³

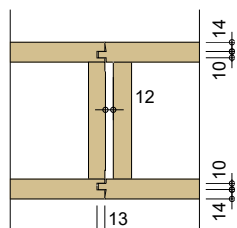
LIGNATUR-elements	Annex 3
Resistance to fire – Charring rates	of European Technical Assessment ETA-11/0137 of 04.11.2019

Joints between the LIGNATUR-elements

LIGNATUR floors and roofs of fire resistance classes REI30, REI60 and REI90 shall be provided with appropriate joints between the LIGNATUR-elements.

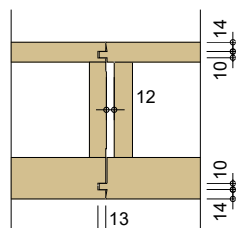
LIGNATUR box element

REI 30



Joint width 12 mm
Joint with groove and tongue

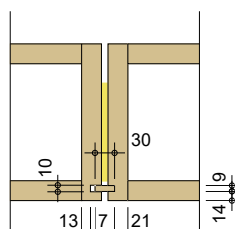
REI 60



Joint width 12 mm
Joint with groove and tongue

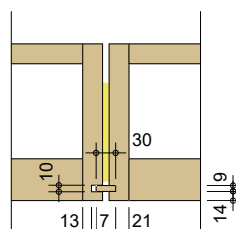
LIGNATUR surface element

REI 30



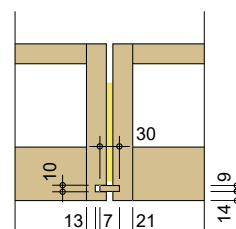
Joint width 10 mm
Joint with groove and separate tongue
Joint insulation¹⁾

REI 60



Joint width 10 mm
Joint with groove and separate tongue
Joint insulation¹⁾

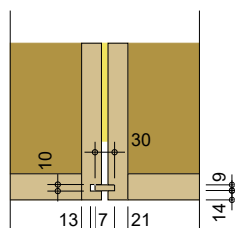
REI 90



Joint width 10 mm
Joint with groove and separate tongue
Joint insulation¹⁾

LIGNATUR shell element

REI 30



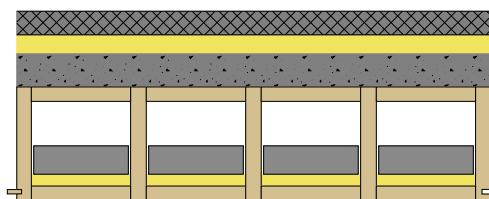
Joint width 10 mm
Joint with groove and separate tongue
Joint insulation¹⁾

Dimensions in mm

¹⁾ Joint insulation with reaction to fire class at least A2-s1, d0

LIGNATUR-elements	Annex 3
Resistance to fire - Joints	of European Technical Assessment ETA-11/0137 of 04.11.2019

Examples with improved airborne and impact sound performance

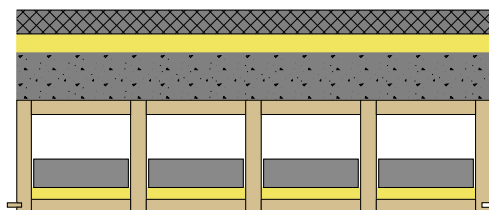


50 mm Cement screed $m' = 120 \text{ kg/m}^2$
 40 mm Impact sound insulation board
 $\rho = 59,4 \text{ kg/m}^3$, $s' = 6 \text{ MN/m}^3$
 70 mm Ballast weight $m' = 105 \text{ kg/m}^2$
 240 mm LIGNATUR surface element silence12
 $m' = 71 \text{ kg/m}^2$ including ballast
 weight: concrete blocks¹⁾

Mass per unit area of assembly: $m' \cong 301 \text{ kg/m}^2$

$R_w(\text{C}; \text{C}_{tr}) = 72 \text{ (-1; -5) dB}$

$L_{n,w}(\text{C}_l) = 45 \text{ (-2) dB}$

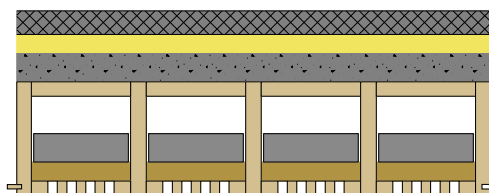


50 mm Cement screed $m' = 120 \text{ kg/m}^2$
 40 mm Impact sound insulation board
 $\rho = 59,4 \text{ kg/m}^3$, $s' = 6 \text{ MN/m}^3$
 100 mm Ballast weight $m' = 150 \text{ kg/m}^2$
 240 mm LIGNATUR surface element silence12
 $m' = 71 \text{ kg/m}^2$ including ballast
 weight: concrete blocks¹⁾

Mass per unit area of assembly: $m' \cong 345 \text{ kg/m}^2$

$R_w(\text{C}; \text{C}_{tr}) = 72 \text{ (-1; -5) dB}$

$L_{n,w}(\text{C}_l) = 44 \text{ (-2) dB}$



50 mm Cement screed $m' = 120 \text{ kg/m}^2$
 40 mm Impact sound insulation board
 $\rho = 59,4 \text{ kg/m}^3$, $s' = 6 \text{ MN/m}^3$
 60 mm Ballast weight $m' = 90 \text{ kg/m}^2$
 240 mm LIGNATUR surface element silence12
 with acoustics perforation
 $m' = 74 \text{ kg/m}^2$ including ballast
 weight: concrete blocks¹⁾

Mass per unit area of assembly: $m' \cong 288 \text{ kg/m}^2$

$R_w(\text{C}; \text{C}_{tr}) = 71 \text{ (-1; -6) dB}$

$L_{n,w}(\text{C}_l) = 43 \text{ (0) dB}$

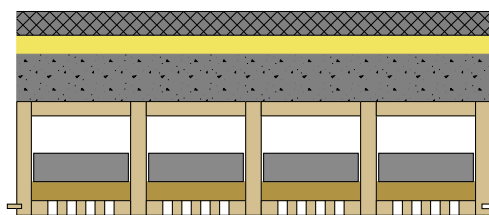
¹⁾ Concrete blocks, density $\rho = 2\,250 \text{ kg/m}^3$

LIGNATUR-elements

Annex 4

Airborne and impact sound insulation

of European Technical Assessment
ETA-11/0137 of 04.11.2019

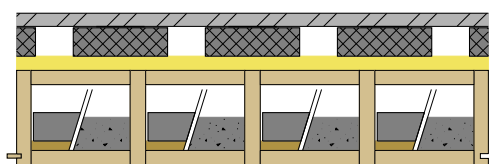


50 mm Cement screed $m' = 120 \text{ kg/m}^2$
 40 mm Impact sound insulation board
 $\rho = 59,4 \text{ kg/m}^3$, $s' = 6 \text{ MN/m}^3$
 100 mm Ballast weight $m' = 150 \text{ kg/m}^2$
 240 mm LIGNATUR surface element silence12
 with acoustics perforation
 $m' = 74 \text{ kg/m}^2$ including ballast
 weight: concrete blocks¹⁾

Mass per unit area of assembly : $m' \cong 348 \text{ kg/m}^2$

$R_w(\text{C}; \text{C}_{tr}) = 71 \text{ (-2; -5) dB}$

$L_{n,w}(\text{C}_l) = 41 \text{ (0) dB}$



28 mm Gypsum fiberboard $m' = 45,4 \text{ kg/m}^2$
 2.8 mm Impact sound insulation fleece
 $m' = 2.4 \text{ kg/m}^2$
 60 mm Concrete blocks in stripes
 $m' = 89.4 \text{ kg/m}^2$
 30 mm Impact sound insulation board
 $m' = 4 \text{ kg/m}^2$, $s' \leq 15 \text{ MN/m}^3$
 200 mm LIGNATUR surface element silence12
 $m' = 117 \text{ kg/m}^2$ including ballast
 weight: aggregates $m' = 50 \text{ kg/m}^2$
 and concrete blocks¹⁾

Mass per unit area of assembly : $m' \cong 231 \text{ kg/m}^2$

$R_w(\text{C}; \text{C}_{tr}) = 72 \text{ (-2; -7) dB}$

$L_{n,w}(\text{C}_l) = 47 \text{ (-2) dB}$

¹⁾ Concrete blocks, density $\rho = 2\,250 \text{ kg/m}^3$

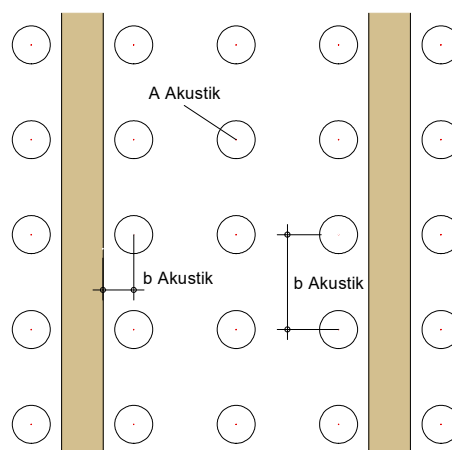
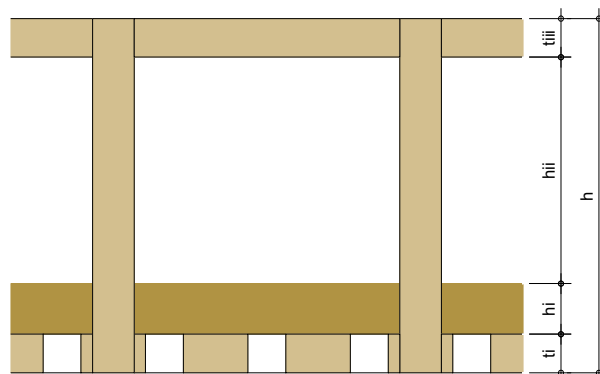
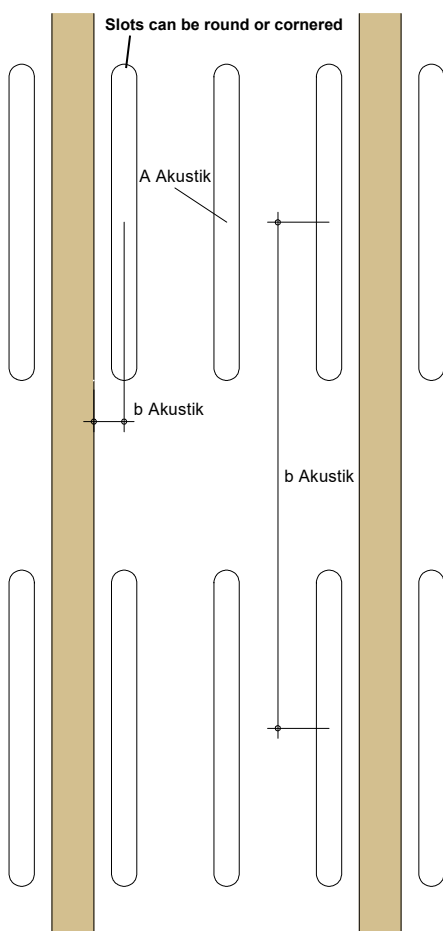
LIGNATUR-elements

Airborne and impact sound insulation

Annex 4

of European Technical Assessment
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Perforated skins for acoustic elements



Example type 1

Example type 3

Type 1:	$A_{Akustik} = 5000 \text{ mm}^2$
Type 2:	$A_{Akustik} = 707 \text{ mm}^2$
Type 3:	$A_{Akustik} = 314 \text{ mm}^2$
Type 3.1:	$A_{Akustik} = 314 \text{ mm}^2$
Type 5:	$A_{Akustik} = 177 \text{ mm}^2$
Type 5.1:	$A_{Akustik} = 177 \text{ mm}^2$
Type 6:	$A_{Akustik} = 64 \text{ mm}^2$
Type 6.1:	$A_{Akustik} = 64 \text{ mm}^2$
Type 8:	$A_{Akustik} = 3420 \text{ mm}^2$
Type 8.1:	$A_{Akustik} = 3420 \text{ mm}^2$
Diverse:	$A_{Slot} \leq 5000 \text{ mm}^2$
	$A_{Hole} \leq 707 \text{ mm}^2$

$d_{Akustik} = 400 \text{ mm}$	$b_{Akustik} = 24 \text{ mm}$
$d_{Akustik} = 75 \text{ mm}$	$b_{Akustik} = 24 \text{ mm}$
$d_{Akustik} = 40 \text{ mm}$	$b_{Akustik} = 5 \text{ mm}$
$d_{Akustik} = 40 \text{ mm}$	$b_{Akustik} = 45 \text{ mm}$
$d_{Akustik} = 40 \text{ mm}$	$b_{Akustik} = 5 \text{ mm}$
$d_{Akustik} = 40 \text{ mm}$	$b_{Akustik} = 45 \text{ mm}$
$d_{Akustik} = 20 \text{ mm}$	$b_{Akustik} = 15 \text{ mm}$
$d_{Akustik} = 20 \text{ mm}$	$b_{Akustik} = 35 \text{ mm}$
$d_{Akustik} = 600 \text{ mm}$	$b_{Akustik} = 9 \text{ mm}$
$d_{Akustik} = 600 \text{ mm}$	$b_{Akustik} = 33 \text{ mm}$
$d_{Slot} \leq 600 \text{ mm}$	$b_{Slot} \geq 1 \text{ mm}$
$d_{Hole} \leq 75 \text{ mm}$	$b_{Hole} \geq 1 \text{ mm}$

LIGNATUR-elements

Annex 5

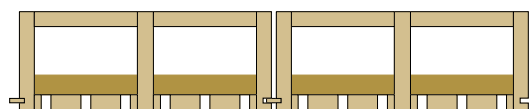
Sound absorption – Perforated skins

of European Technical Assessment
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Examples with improved sound absorption

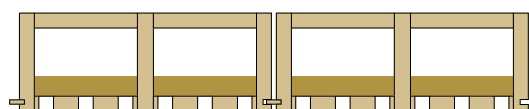
Absorber material: thermal insulation product of wood fibre, density $\rho < 110 \text{ kg/m}^3$

Dimensions: $h = 200 \text{ mm}$, $t_i = 31 \text{ mm}$, $h_i = 40 \text{ mm}$



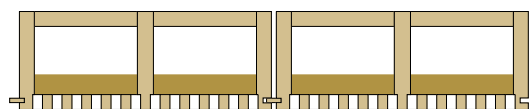
$\alpha_w = 0,55$

Acoustics type 1 Class of absorber: D
Slot dimension: 20 / 250 mm
Grid: 81 / 400 mm



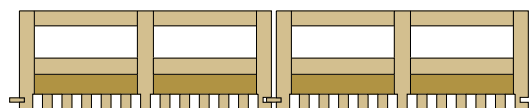
$\alpha_w = 0,50$

Acoustics type 2 Class of absorber: D
Hole diameter: 30 mm
Grid: 81/75 mm



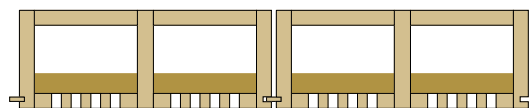
$\alpha_w = 0,90$

Acoustics type 3 Class of absorber: A
Hole diameter: 20 mm
Grid: 40 / 40 mm



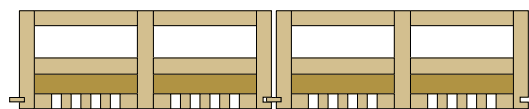
$\alpha_w = 0,85$

Acoustics type 3 ZL Class of absorber: B
Hole diameter: 20 mm
Grid: 40 / 40 mm



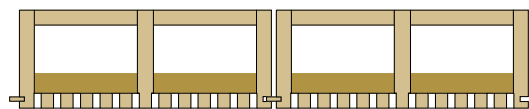
$\alpha_w = 0,75$

Acoustics type 3.1 Class of absorber: C
Hole diameter: 20 mm
Grid: 40 / 40 mm



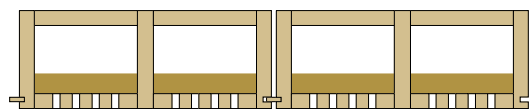
$\alpha_w = 0,60$

Acoustics type 3.1 ZL Class of absorber: C
Hole diameter: 20 mm
Grid: 40 / 40 mm



$\alpha_w = 0,65 \text{ (L)}$

Acoustics type 5 Class of absorber: C
Hole diameter: 15 mm
Grid: 40 / 40 mm



$\alpha_w = 0,50 \text{ (L)}$

Acoustics type 5.1 Class of absorber: D
Hole diameter: 15 mm
Grid: 40 / 40 mm

LIGNATUR-elements

Sound absorption

Annex 5

of European Technical Assessment
ETA-11/0137 of 04.11.2019

Guideline for European Technical Approval ETAG 019 “Prefabricated wood-based loadbearing stressed skin panels”, Edition November 2004, used as European Assessment Document

EN 301 (10.2017), Adhesives, phenolic and aminoplastic, for load-bearing timber structures – Classification and performance requirements

EN 338 (04.2016), Structural timber – Strength classes

EN 717-1 (10.2004), Wood-based panels - Determination of formaldehyde release – Part 1: Formaldehyde emission by the chamber method

EN 1995-1-1 (11.2004), +AC (06.2006), +A1 (06.2008), +A2 (05.2014), Eurocode 5 – Design of timber structures - Part 1-1: General – Common rules and rules for buildings

EN 1995-1-2 (11.2004) +AC (06.2006), +AC (03.2009), Eurocode 5 – Design of timber structures – Part 1-2: General – Structural fire design

EN 13183-1 (04.2002), Moisture content of a piece of sawn timber – Part 1: Determination by oven dry method

EN 13501-1 (12.2018), Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests

EN 15425 (01.2017), Adhesives – One component polyurethane for load bearing timber structures – Classification and performance requirements

EN ISO 10140-2 (09.2010), Acoustics – Laboratory measurement of sound insulation of building elements – Part 2: Measurement of airborne sound insulation

EN ISO 10140-3 (09.2010), Acoustics – Laboratory measurement of sound insulation of building elements – Part 3: Measurement of impact sound insulation

EN ISO 354 (05.2003), Acoustics – Measurement of sound absorption in a reverberation room

EN ISO 717-1 (03.2013), Acoustics – Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation

EN ISO 717-2 (03.2013), Acoustics – Rating of sound insulation in buildings and of building elements - Part 2: Impact sound insulation

EN ISO 6946 (07.2017), Building components and building elements – Thermal resistance and thermal transmittance - Calculation method

EN ISO 10211 (07.2017), Thermal bridges in building construction – Heat flows and surface temperatures - Detailed calculations

LIGNATUR-elements	Annex 6
Reference documents	of European Technical Assessment ETA-11/0137 of 04.11.2019

