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## European Technical Assessment

**ETA-13/0645**  
of 18.01.2019

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**

STEKO Holz-Bausystem

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

Modular construction system

**Manufacturer**

STEKO Holz-Bausysteme AG  
Splügenstrasse 9  
9008 St. Gallen  
Switzerland

**Manufacturing plants**

STEKO Holz-Bausysteme AG  
Splügenstrasse 9  
9008 St. Gallen  
Switzerland

**This European Technical Assessment contains**

22 pages including 5 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 130087-00-0204 "Modular construction system".

**This European Technical Assessment replaces**

European technical approval ETA-13/0645 with validity from 28.06.2013 to 27.06.2018.

## Remarks

Translations of this 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

### 1.1 General

This European Technical Assessment (ETA)<sup>1</sup> applies to the modular construction system “STEKO Holz-Bausystem”. STEKO Holz-Bausystem is composed of completely ready-made, standardized and industrially manufactured wood modules made of softwood.

STEKO Holz-Bausystem is based on the three basic elements

### **STEKO basic module, footing and header**

which can be stacked together without fasteners. End-plates are used to complete the structure. Interlocking of the special shaped bottom- and top side ensures a displacement-rigid connection between the individual elements. In addition hardwood dowels are mounted to guarantee alignment of the modules as well as compound in longitudinal direction.

The principle structure of the STEKO Holz-Bausystem is shown in Annex 1. The dimensions of the product are specific to the project.

The basic module is composed of five, crosswise glued layers of softwood. The inner core is assembled from battens arranged at a regular distance. Perpendicular to the battens a horizontal layer is arranged followed by the vertical surface layer with butt-joints on the narrow sides. Surfaces are planed.

Footing and header are made from solid wood or wood-based panels, respectively.

The STEKO Holz-Bausystem is reinforced e.g. by coverings or battens or in other appropriate manner.

Beside thermal insulation products the STEKO basic modules may be provided with ballast weight or concrete. These materials do not contribute to the structural characteristics of the STEKO Holz-Bausystem.

The STEKO Holz-Bausystem and the boards for its manufacturing correspond to the specifications given in the Annex 1. The material characteristics, dimensions and tolerances of STEKO Holz-Bausystem, not indicated in these Annex, are given in the technical file<sup>2</sup> of the European Technical Assessment.

Cladding, covering, rain and snow protection, installations (e.g. electrical pipes), filling materials (e.g. insulation, sound absorber), thermal insulation and connection to the structure as well as application of wood preservatives and flame retardants are not subject to the European Technical Assessment.

<sup>1</sup> The ETA-13/0645 was firstly issued in 2013 as European technical approval with validity from 28.06.2013 and converted in 2019 to the European Technical Assessment ETA-13/0645 of 18.01.2019.

<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.

## 1.2 Components

### 1.2.1 Layers of STEKO basic module and end plate

The layers of STEKO basic modules and the end plates are made of European spruce of rectangular cross section, i.e. visually or machine strength graded timber. Only technically dried wood is used. There are no finger joints or butt joints in end grain.

Solid wood shall be classified according to EN 338.

For STEKO basic module, the layers are bonded crosswise by means of an adhesive.

The boards in the surface layer correspond to strength class C24 according to EN 338.

The boards in the horizontal layer and battens correspond to strength class C16 according to EN 338.

### 1.2.2 Battens of footing and header

Battens used to form footing and headers are made of solid wood or wood based panels according to EN 13986 with the dimensions according to Annex 1. There are no finger joints or butt joints.

### 1.2.3 Adhesive

The adhesive for bonding of the basic modules of the STEKO Holz-Bausystem conforms to EN 15425.

### 1.2.4 Hardwood dowels

The hardwood dowels which are mounted to guarantee alignment of the modules as well as compound in longitudinal direction are made of poplar. They shall be free of significant knots, abnormal direction of grain and significant reaction wood, fissures, rot, mould and insect infestation.

### 1.2.5 Reinforcement

STEKO Holz-Bausystem is reinforced e.g. by coverings or vertical battens or in other appropriate manner. The reinforcement is connected to the substructure in an appropriate manner.

Transfer of normal forces from vertical loads is excluded according to plan.

### 1.2.6 Thermal insulation products

Thermal insulation products such as cellulose material etc. conform to a harmonised European standard or a European Technical Assessment and do not contribute to the load bearing characteristics of the STEKO Holz-Bausystem.

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

### 1.2.7 Concrete

Concrete shall conform to standards and regulations in the place of use and does not contribute to the load bearing characteristics of the STEKO Holz-Bausystem.

The concrete is not subject to the European Technical Assessment.

### 1.2.8 Ballast weight

Ballast weight such as sand etc. conforms to a harmonised European standard or a European Technical Assessment and does not contribute to the load bearing characteristics of the STEKO Holz-Bausystem.

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 STEKO Holz-Bausystem is intended to be used in load-bearing and non load-bearing interior and exterior walls of buildings with a maximum of 3 storeys and a maximum distance between floors of 3.04 m.

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<sup>3</sup>. 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 STEKO Holz-Bausystem is 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 STEKO Holz-Bausystem. Verification of stability of the works including application of loads on the product is not subject to the European Technical Assessment.

The following conditions shall be observed:

- Design of the STEKO Holz-Bausystem is carried out under the responsibility of an engineer experienced in such products.
- Design of the works shall account for the protection of the STEKO Holz-Bausystem.
- In service, the STEKO Holz-Bausystem is not exposed to detrimental moisture. The definitions of service classes 1 and 2 according to EN 1995-1-1 apply.
- The single elements of the STEKO Holz-Bausystem are installed correctly.
- The STEKO Holz-Bausystem must be fixed in position horizontally, perpendicular to the surface of the wall at the top and the bottom.
- The STEKO Holz-Bausystem shall be reinforced by coverings or vertical battens. A reinforcement of STEKO – modular construction system with vertical battens  $b/h = 100/80$  mm of strength class C24 according to EN 338 at a regular distance of 960 mm leads to adequate bending capacity. Design of the reinforcement shall be done in individual cases.
- The transfer of horizontal loads in plane of the wall shall not lead to tension forces (open joint). Anchoring and transfer of tension forces shall be ensured through adequate constructions (e.g. threaded rods).

Design of the STEKO Holz-Bausystem members elements may be according to EN 1995-1-1 and EN 1995-1-2, taking into account of Annex 2 and Annex 4 of the European Technical Assessment.

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

<sup>3</sup> Reference documents are listed in Annex 5.

### 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, services and holes

Ducts and services shall as far as possible be arranged not to affect the performances of the elements of STEKO Holz-Bausystem. 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 battens and cutting of slots in the outer layers 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 STEKO Holz-Bausystem of 50 years, when installed in the works, provided that the product is 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 experience<sup>4</sup>.

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.

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<sup>4</sup> 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 <sup>1)</sup>		
1	Mechanical resistance of boards	1.2.1
2	Dimensions	Annex 1
3	Mechanical properties of wall element	Annex 2
4	Racking strength and stiffness of wall element	Annex 2
5	Interaction: moment – normal force	Annex 2
6	Creep and duration of load	Annex 2
7	Dimensional stability	Annex 2
8	Durability of timber without preservative treatment	Annex 2
9	Resistance to delamination	Annex 2
10	Resistance to corrosion of metal parts	No performance assessed.
Basic requirement for construction works 2: Safety in case of fire		
11	Reaction to fire	Annex 2
12	Resistance to fire	Annex 2
Basic requirement for construction works 3: Hygiene, health and the environment		
13	Content, emission and/or release of dangerous substances	3.1.1
14	Air permeability	Annex 2
Basic requirement for construction works 4: Safety and accessibility in use		
15	Impact resistance	Annex 2
Basic requirement for construction works 5: Protection against noise		
16	Airborne sound insulation	Annex 2
17	Impact sound insulation	No performance assessed.
18	Sound absorption	No performance assessed.
Basic requirement for construction works 6: Energy economy and heat retention		
19	Thermal resistance	Annex 2
20	Thermal inertia	Annex 2
<sup>1)</sup> 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 EAD 130087-00-0204, "Modular construction system". No dangerous substances is the performance of the STEKO Holz-Bausystem 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 STEKO Holz-Bausystem 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 the European Assessment Document EAD 130087-00-0204, Modular construction system.

### 3.2.2 Identification

The European Technical Assessment for the STEKO Holz-Bausystem 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 97/176/EC the system of assessment and verification of constancy of performance to be applied to the STEKO Holz-Bausystem 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 plan<sup>5</sup>;
- (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;

<sup>5</sup> 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.

- (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 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 STEKO Holz-Bausystem 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 STEKO Holz-Bausystem 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.

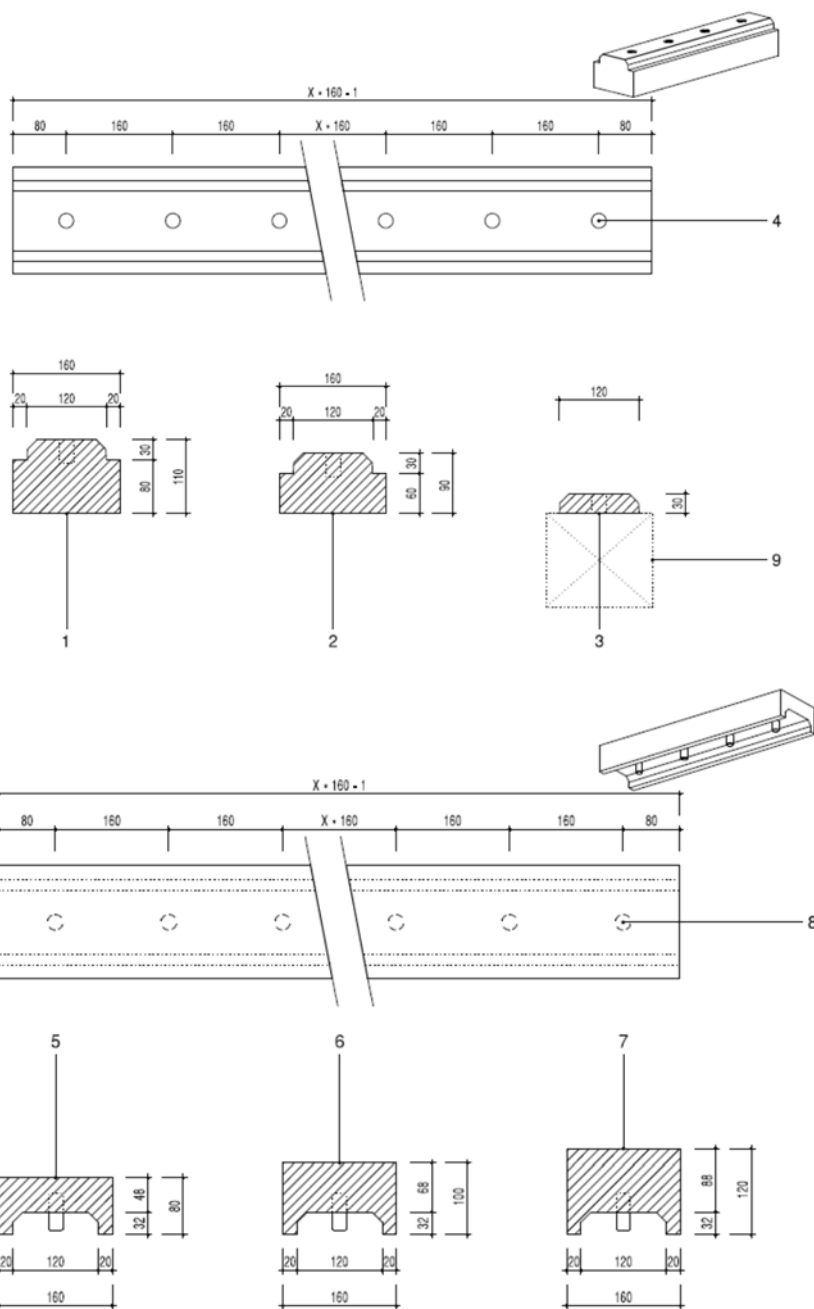
Issued in Vienna on 18.01.2019  
by Österreichisches Institut für Bautechnik

The original document is signed by:

Rainer Mikulits  
Managing Director



### Footing and header of STEKO Holz-Bausystem



- |   |                               |   |                              |
|---|-------------------------------|---|------------------------------|
| 1 | footing standard height 80 mm | 5 | header standard height 80 mm |
| 2 | footing reduced height 60 mm  | 6 | header height 100 mm         |
| 3 | footing batten                | 7 | header height 120 mm         |
| 4 | bore hole d = 22 mm           | 8 | hardwood dowel d = 20 mm     |

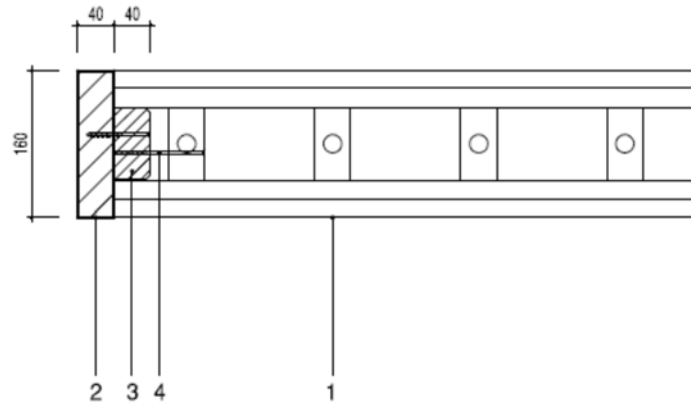
**STEKO Holz-Bausystem**

Product specification

Annex 1

of European Technical Assessment  
 ETA-13/0645 of 18.01.2019

### End plate of STEKO Holz-Bausystem



- 1 STEKO basic module
- 2 end plate 40 x 160 mm or 20 x 160 mm
- 3 connecting batten
- 4 screw connection

**STEKO Holz-Bausystem**

Product specification

Annex 1

of European Technical Assessment  
ETA-13/0645 of 18.01.2019

**Table 2:** Product characteristics of the STEKO Holz-Bausystem

BWR	Essential characteristic	Assessment method	Level / Class / Description
1	<b>Mechanical resistance and stability</b>		
	Mechanical properties of wall element	EN 1995-1-1 and/or Annex 4 <sup>1)</sup>	–
	Racking strength and stiffness of wall element		–
	Interaction: moment – normal force		Input parameters for spring characteristics for nonlinear determination of load bearing capacity:  <u>STEKO modules:</u> $E_1 = -0.1861 \cdot n_1^2 + 45.7 \cdot n_1 + 487 \text{ N/mm}^2$ $E_2 = 80 \text{ N/mm}^2$ $m_1 = 0.05 \cdot n_1 \text{ kNm/m}$ $m_2 = 0.07 \cdot (120 - n) \text{ kNm/m}$  <u>Support area</u> Torsional stiffness: factor $\alpha = 0.15$
Moisture content	EN 13183-1	12 ± 2 %	

<sup>1)</sup> The load bearing capacity is determined by calculation according to EN 1995-1-1 and Annex 4, applying the characteristic values of softwood of the respective strength class according to EN 338.

<b>STEKO Holz-Bausystem</b>	Annex 2  of European Technical Assessment ETA-13/0645 of 18.01.2019
Characteristic data	

electronic copy





**Examples with improved airborne performance**

	160 mm	Spruce $m' = 40 \text{ kg/m}^2$
<p><math>R_w(C; C_{tr}) \geq 31 \text{ (-1; -3) dB}</math></p>		
	160 mm 80 mm	Spruce $m' = 40 \text{ kg/m}^2$ Thermal insulation $m' = 6 \text{ kg/m}^2$
<p><math>R_w(C; C_{tr}) \geq 33 \text{ (-1; -2) dB}</math></p>		
	160 mm 80 mm 12.5 mm	Spruce $m' = 40 \text{ kg/m}^2$ Thermal insulation $m' = 6 \text{ kg/m}^2$ Gypsum plasterboard $m' = 12 \text{ kg/m}^2$
<p><math>R_w(C; C_{tr}) \geq 38 \text{ (-1; -3) dB}</math></p>		
	12.5 mm 160 mm 80 mm 12.5 mm	Gypsum plasterboard $m' = 12 \text{ kg/m}^2$ Spruce $m' = 40 \text{ kg/m}^2$ Thermal insulation $m' = 6 \text{ kg/m}^2$ Gypsum plasterboard $m' = 12 \text{ kg/m}^2$
<p><math>R_w(C; C_{tr}) \geq 40 \text{ (-1; -3) dB}</math></p>		
	160 mm 80 mm 5 mm 12 mm	Spruce $m' = 40 \text{ kg/m}^2$ Thermal insulation $m' = 6 \text{ kg/m}^2$ Insulating foil $m' = 10 \text{ kg/m}^2$ Particle board $m' = 9 \text{ kg/m}^2$
<p><math>R_w(C; C_{tr}) \geq 39 \text{ (0; -2) dB}</math></p>		

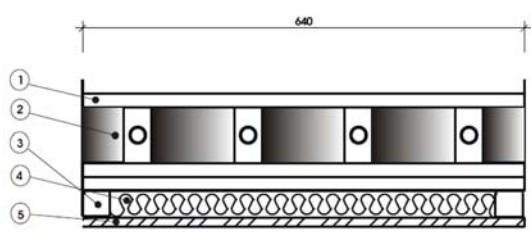
**STEKO Holz-Bausystem**

Airborne sound insulation

Annex 3

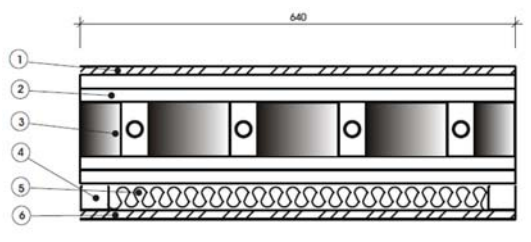
of European Technical Assessment  
 ETA-13/0645 of 18.01.2019





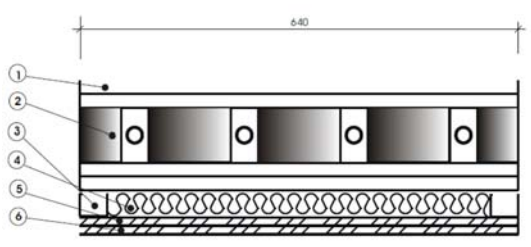
- 160 mm Spruce  $m' = 40 \text{ kg/m}^2$
- 80 mm Thermal insulation  $m' = 6 \text{ kg/m}^2$
- 40 mm Metal supports
- 40 mm Thermal insulation  $m' = 2 \text{ kg/m}^2$
- 12.5 mm Gypsum plasterboard  $m' = 12 \text{ kg/m}^2$

$R_w(C; C_{tr}) \geq 56 \text{ (-2; -8) dB}$



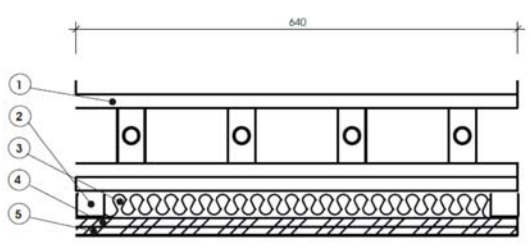
- 12.5 mm Gypsum plasterboard  $m' = 12 \text{ kg/m}^2$
- 160 mm Spruce  $m' = 40 \text{ kg/m}^2$
- 80 mm Thermal insulation  $m' = 6 \text{ kg/m}^2$
- 40 mm Metal supports
- 40 mm Thermal insulation  $m' = 2 \text{ kg/m}^2$
- 12.5 mm Gypsum plasterboard  $m' = 12 \text{ kg/m}^2$

$R_w(C; C_{tr}) \geq 56 \text{ (-1; -7) dB}$



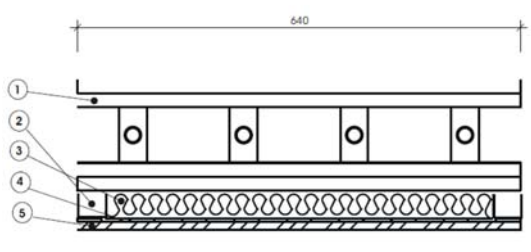
- 160 mm Spruce  $m' = 40 \text{ kg/m}^2$
- 80 mm Thermal insulation  $m' = 6 \text{ kg/m}^2$
- 40 mm Metal supports
- 40 mm Thermal insulation  $m' = 2 \text{ kg/m}^2$
- 12.5 mm Gypsum plasterboard  $m' = 12 \text{ kg/m}^2$
- 12.5 mm Gypsum plasterboard  $m' = 12 \text{ kg/m}^2$

$R_w(C; C_{tr}) \geq 58 \text{ (-2; -7) dB}$



- 160 mm Spruce  $m' = 40 \text{ kg/m}^2$
- 40 mm Metal supports
- 40 mm Thermal insulation  $m' = 2 \text{ kg/m}^2$
- 12.5 mm Gypsum plasterboard  $m' = 12 \text{ kg/m}^2$
- 12.5 mm Gypsum plasterboard  $m' = 12 \text{ kg/m}^2$

$R_w(C; C_{tr}) \geq 55 \text{ (-2; -8) dB}$



- 160 mm Spruce  $m' = 40 \text{ kg/m}^2$
- 40 mm Metal supports
- 40 mm Thermal insulation  $m' = 2 \text{ kg/m}^2$
- 5 mm Insulating foil  $m' = 10 \text{ kg/m}^2$
- 12.5 mm Gypsum plasterboard  $m' = 12 \text{ kg/m}^2$
- 12.5 mm Gypsum plasterboard  $m' = 12 \text{ kg/m}^2$

$R_w(C; C_{tr}) \geq 54 \text{ (-2; -8) dB}$

<b>STEKO Holz-Bausystem</b>	Annex 3 of European Technical Assessment ETA-13/0645 of 18.01.2019
Airborne sound insulation	



## Verification of modular construction system under combined moment – normal force loading

### Verification of compression stresses in wall and footing

Hereby, only the compressed area beneath the two cover layers shall be taken into account.

### Verification of normal force load-bearing capacity

$$N_d \leq \min \left\{ \begin{array}{l} N_{crit,wall} \left( 1 - \frac{e}{e_k} \right) + N_{crit,V} \\ \frac{N_{crit,wall} + N_{crit,V}}{\frac{N_{crit,V} \cdot e}{f_{m,V,d} \cdot W_V} + 1} \end{array} \right. \quad (1)$$

where

$$N_{crit,wall} = \frac{\pi^2 \cdot E_W \cdot I_W}{l^2}$$

$$N_{crit,V} = \frac{\pi^2 \cdot E_V \cdot I_V}{l^2}$$

$E_W$  ... modulus of elasticity of the wall;  $E_W = 250 + 350 \cdot \sigma_{c,d} \leq 1500 \text{ N/mm}^2$

$E_V$  ... modulus of elasticity of reinforcement;  $E_V = \frac{E_{0,05}}{\gamma_M}$

$E_{0,05}$  ... characteristic value of modulus of elasticity of reinforcement

$\sigma_{c,d}$  ... design value for compression stresses in cover layers

$I_W$  ... second moment of inertia of the wall;  $I_W = 200 \cdot 10^6 \text{ mm}^4$  per meter width of the wall

$I_V$  ... second moment of inertia of reinforcement around the horizontal wall-axis in the considered area

$e$  ... eccentricity of normal force;  $e = \frac{l}{200} + \frac{M_d}{N_d}$

$l$  ... height of the wall

$M_d$  ... design value of bending moment in the half height of the wall obtained for external forces with 1<sup>st</sup> order theory

$N_d$  ... design value of centric normal force acting on the wall

$e_k$  ... core width;  $e_k = 0,062 \text{ m}$

<b>STEKO Holz-Bausystem</b>	Annex 4
Design considerations	of European Technical Assessment ETA-13/0645 of 18.01.2019

$f_{m,v,d}$  ... design value of bending strength of reinforcement

$W_V$  ... section modulus of reinforcement

**Verification of bending load-bearing capacity**

$$M_d \leq N_d \left[ \left( 1 + \frac{N_{crit,v} - N_d}{N_{crit,wall}} \right) \cdot e_k - \frac{l}{200} \right] \quad (2)$$

where

$N_d$  ... design value of centric normal force acting on the wall (acting beneficially)

For the case that the terms under (1) and (2) fail, the verification of normal force and bending load-bearing capacity can be fulfilled under the following conditions:

$$N_d \leq \frac{N_{crit,v}}{\frac{N_{crit,v} \cdot e}{f_{m,v,d} \cdot W_V} + 1} \quad (3)$$

and

$$M_d \leq \frac{(N_{crit,v} - N_d) \cdot f_{m,v,d} \cdot W_V}{N_{crit,v}} - N_d \cdot \frac{l}{200} \quad (4)$$

**Verification of horizontal force in plane of the wall**

**Verification of stability against overturning**

$$H_d \leq \frac{N_d \cdot a_{res}}{h} \quad (5)$$

where

$a_{res}$  ... distance of resulting normal force from the end of the wall

$H_d$  ... design value of horizontal force

$N_d$  ... design value of normal force acting on the wall

$h$  ... height of wall element

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Design considerations	

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<b>STEKO Holz-Bausystem</b>	Annex 5 of European Technical Assessment ETA-13/0645 of 18.01.2019
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