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European Technical Assessment

ETA-23/0669 of 22.11.2023

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	Egger EcoBox
Product family to which the construction product belongs	Composite wood-based beams and columns
Manufacturer	Egger Holzwerkstoffe Wismar GmbH & Co. KG Am Haffeld 1 23970 Wismar GERMANY
Manufacturing plant	Egger Holzwerkstoffe Wismar GmbH & Co. KG Am Haffeld 1 23970 Wismar GERMANY
This European Technical Assessment contains	23 pages including 4 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) 130367-00-0304 “Composite wood-based beams and columns”.

Specific parts

1 Technical description of the product

1.1 General

This European Technical Assessment (ETA) applies to the composite wood-based beams and columns with box-shaped cross section “Egger EcoBox”. The flanges of Egger EcoBox are made of structural timber and the webs are made of oriented strand boards (OSB) which are bonded together by an adhesive.

Thermal insulation products may be placed inside Egger EcoBox. The thermal insulation products and do not contribute to the structural characteristics of the composite wood-based beams and columns with box-shaped cross section.

Egger EcoBox corresponds to the specifications given in the Annexes 1 to 3. The material characteristics, dimensions and tolerances of Egger EcoBox, not indicated in these Annexes, are given in the technical file[1] of the European Technical Assessment.

The application of wood preservatives and flame retardants is not subject of the European Technical Assessment.

1.2 Flanges

The flanges are made of strength graded structural timber with rectangular cross section according to EN 14081-1[2] of strength class C16 or structural finger jointed solid timber according to EN 15497 of strength class C16. Only technically dried wood shall be used.

Wood species is European spruce or equivalent softwood.

1.3 Web

The web is composed of load-bearing oriented strand boards (OSB) for use in humid conditions, type OSB/3, according to EN 300.

1.4 Adhesive

The adhesive for bonding the web and the flanges should be Type I classified acc. to EN 15425 or EN 301.

1.5 Thermal insulation products

Thermal insulation products inserted into the Egger EcoBox 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 Egger EcoBox. The thermal insulation products are not subject to the European Technical Assessment.

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

2.1 Intended use

Egger EcoBox is intended to be used as a structural element for load-bearing applications in buildings and civil engineering structures, e.g. construction members or frame elements for walls, roofs, floors and trusses.

Egger EcoBox is intended to be used subject to static or quasi static actions. In seismic areas the behaviour factor of composite wood-based beams and columns used for the design is limited to non-dissipative or low-dissipative structures ($q \leq 1{,}5$), see EN 1998-1, Clauses 1.5.2 and 8.1.3 b.

Egger EcoBox is intended to be used in service classes 1 and 2 according to EN 1995-1-1.

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[1] 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.

[2] Reference documents are listed in Annex 4.

2.2 General assumptions

Egger EcoBox 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.

The flanges and the webs shall be bonded together by an adhesive. Adhesive shall be applied on the planed timber or OSB. There shall be no butt joints in the flanges and in the webs.

Design

The European Technical Assessment only applies to the manufacture and use of Egger EcoBox. 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 Egger EcoBox is carried out under the responsibility of an engineer experienced in such products.
- Design of the works shall account for the protection of Egger EcoBox.
- Egger EcoBox is installed correctly.

Design of Egger EcoBox may be according to EN 1995-1-1, taking into account of Annexes 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.

2.3 Working life/Durability

The provisions made in the European Technical Assessment (ETA) are based on an assumed intended working life of Egger EcoBox 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[3].

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.

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 [1)]		
1	Bending moment capacity (edgewise and flatwise)	Annex 2
2	Tension capacity parallel to the product	Annex 2
3	Tension capacity perpendicular to the product	No performance assessed.
4	Compression capacity parallel to the product	Annex 2
5	Bearing capacity	Annex 2
6	Shear capacity (edgewise)	Annex 2
7	Modulus of elasticity parallel to the grain	Annex 2
8	Shear rigidity	Annex 2
9	Torsional shear capacity and rigidity	No performance assessed.
10	Density	Annex 2
11	Creep and duration of the load	Annex 2
12	Dimensional stability	No performance assessed.
13	Corrosion resistance of metal fasteners and other connectors	Not relevant. No performance assessed.
14	Bonding quality and durability of bonding strength	Annex 2

[3] 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.

№	Essential characteristic	Product performance
Basic requirement for construction works 2: Safety in case of fire		
15	Reaction to fire	Annex 2
16	Resistance to fire	No performance assessed.
Basic requirement for construction works 3: Hygiene, health and the environment		
17	Content, emission and/or release of dangerous substances	3.1.1
Basic requirement for construction works 6: Energy economy and heat retention		
18	Thermal conductivity	No performance assessed.
19	Thermal inertia	No performance assessed.
Aspects of durability		
20	Natural durability	Annex 2

3.1.1 Content, emission and/or release of dangerous substances

The release of dangerous substances is determined according to European Assessment Document EAD 130367-00-0304 “Composite wood-based beams and columns”. No dangerous substances is the performance of Egger EcoBox in this respect (Formaldehyde release class E1).

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 Egger EcoBox 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 and 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 to 4 and 6 of Regulation (EU) № 305/2011 has been made in accordance with European Assessment Document EAD 130367-00-0304 “Composite wood-based beams and columns”.

3.2.2 Identification

The European Technical Assessment for Egger EcoBox 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 99/92/EC the system of assessment and verification of constancy of performance to be applied to Egger EcoBox 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[4];

(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 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 Egger EcoBox 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.

[4] 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.

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 Egger EcoBox 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

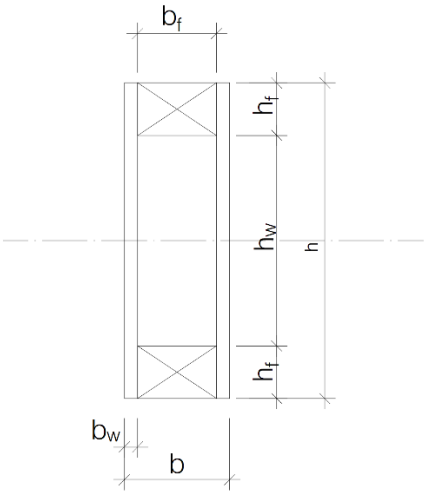
The results of continuous surveillance are made available on demand by the notified product certification body to Österreichisches Institut für Bautechnik. When the provisions of the European Technical Assessment and the control plan are no longer fulfilled, the certificate of constancy of performance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

Issued in Vienna on 22.11.2023
by Österreichisches Institut für Bautechnik

The original document is signed by:

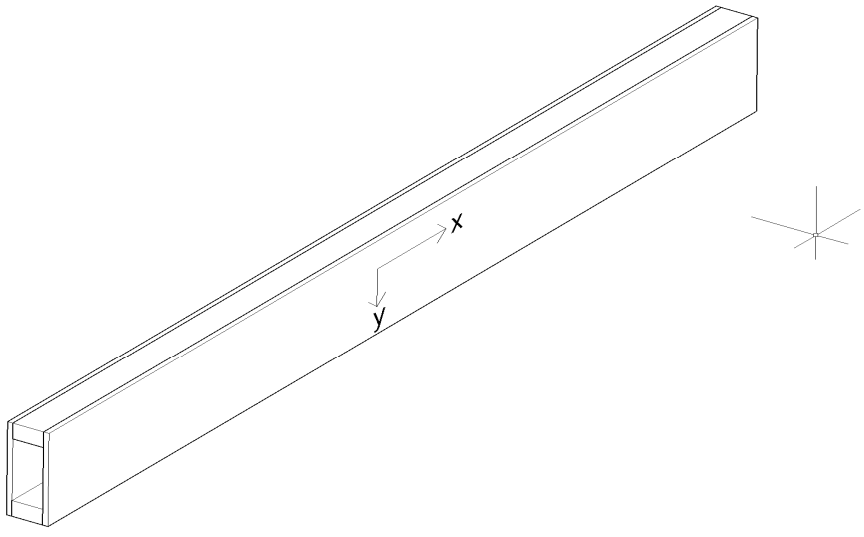
Georg Kohlmaier
Deputy Managing Director

Figure 1: Principle structure of Egger EcoBox



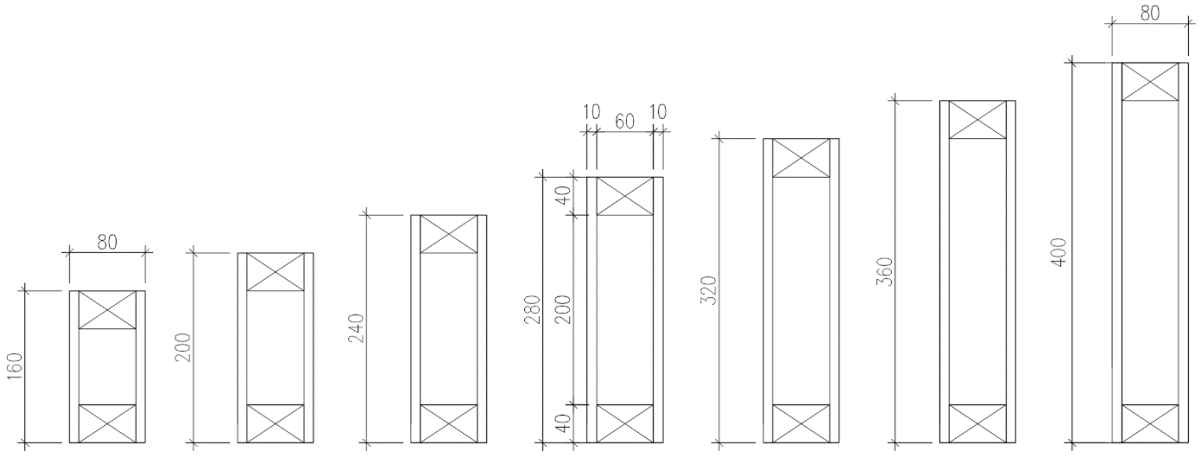
b	… Width of Egger EcoBox
h	… Height of Egger EcoBox
b_w	… Thickness of the web
b_f	… Width of the flanges
h_f	… Height of the flanges
h_w	… Clear height of the web

Figure 2: Definition of orientation of OSB-webs; x = major axis y = minor axis



Egger EcoBox	Annex 1
Structure of Egger EcoBox	of European Technical Assessment ETA-23/0669 of 22.11.2023

Figure 3: Cross sections of Egger EcoBox



Dimensions in mm

Egger EcoBox	Annex 1
Structure of Egger EcoBox	of European Technical Assessment ETA-23/0669 of 22.11.2023

Table 2: Dimensions and specifications

Item		Dimension / Specification
Egger EcoBox		
Product-type		**EB.80/10**
Width b	mm	80
Height h	mm	160 to 400
Length	m	≤ 13,0
Flanges		
Surface	—	planed
Width b_f	mm	60
Height $h_{f,t}$, $h_{f,c}$	mm	40
Strength graded structural timber with rectangular cross section according to EN 14081-1 or structural finger jointed solid timber according to EN 15497	—	C16 according to EN 338
Strength and stiffness characteristics and density:	—	$f_{m,k}$ = 16 MPa $f_{t,0,k}$ = 8,5 MPa $f_{c,0,k}$ = 17 MPa $f_{v,k}$ = 3,2 MPa $E_{m,0,mean}$ = 8000 MPa $E_{m,0,k}$ = 5400 MPa G_{mean} = 500 MPa ρ_k = 310 kg/m³ ρ_{mean} = 370 kg/m³
k_{def}	—	0,6 in service class 1 0,8 in service class 2

Egger EcoBox	Annex 2
Characteristic data of Egger EcoBox	of European Technical Assessment ETA-23/0669 of 22.11.2023

Item		Dimension / Specification
Webs		
Thickness b_w	mm	10
Height h	mm	160 to 400
Load-bearing panels for use in humid conditions according to EN 300	—	OSB/3
Strength and stiffness characteristics and density:	—	$f_{t,x,k}$ = 9,9 MPa $f_{t,y,k}$ = 7,2 MPa $f_{c,x,k}$ = 15,9 MPa $f_{c,y,k}$ = 12,9 MPa $f_{v,k}$ = 6,8 MPa $f_{v,r,k}$ = 1,0 MPa $E_{t,x}$ =$E_{c,x}$ = 3800 MPa $E_{t,y}$ = $E_{c,y}$ = 3000 MPa $E_{m,x,panel}$ = 4930 MPa $E_{m,y,panel}$ = 1980 MPa $G_{v,mean}$ = 1080 MPa ρ_{mean} = 600 kg/m³
k_{def}	—	1,5 in service class 1 2,25 in service class 2

Egger EcoBox	Annex 2
Characteristic data of Egger EcoBox	of European Technical Assessment ETA-23/0669 of 22.11.2023

Table 3: Product characteristics of Egger EcoBox

BWR	Essential characteristic	Assessment method	Level / Class / Description
1	**Mechanical resistance and stability**		
	Bending moment capacity (edgewise and flatwise)	EN 1995-1-1 and Annex 3	see Table 5 and Table 6
	Tension capacity parallel to the product	EAD 130367-00-0304, Clause 2.2.3	see Table 8
	Compression capacity parallel to the product	EN 1995-1-1 and Annex 3	see Table 7
	Bearing capacity $F_{bear,cal}$	EN 1995-1-1 and Annex 3	see Table 9
	Shear capacity (edgewise)	EN 1995-1-1 and Annex 3	see Table 9
	Modulus of elasticity parallel to the grain – flexural rigidity	EN 1995-1-1 and Annex 3	see Table 4
	Shear rigidity	EAD 130367-00-0304, Clause 2.2.9	see Table 9
	Density	ρ_{mean} and ρ_k according to Table 2	
	Creep and duration of load	k_{def} according to Table 2 k_{mod} according to EN 1995-1-1, Table 3.1	
	Bonding quality and durability of bonding strength - Shear test according to EN 14080, Annex D - Cleaving test according to EN 14374, Annex B	EAD 130367-00-0304, Clause 2.2.15	Glue bond between components is equally strong as the components. Percentage of wood failure > 80% Percentage of wood failure > 70%

Table 4 continued: Product characteristics of Egger EcoBox

BWR	Essential characteristic	Assessment method	Level / Class / Description
2	**Safety in case of fire**		
	Reaction to fire		
	Structural timber	Commission Decision 2003/43/EC as amended by 2003/593/EC, 2006/673/EC and 2007/348/EC	Min. mean density ≥ 350 kg/m³ Overall thickness ≥ 22 mm Euroclass D-s2, d0
	OSB/3		Density ≥ 600 kg/m³ Overall thickness ≥ 9 mm Euroclass D-s2,d0
-	**Aspects of durability**		
	Natural durability of wood – Use classes	EN 335	1 and 2

Calculation of design values

The design values can be calculated according EN 1995-1-1, Clause 2.4.3 (1) as follows.

For strength capacities:

$$X_{Rd} = \min\left(\frac{X_{Rk,wood} * k_{mod,wood}}{\gamma_{m,wood}}; \frac{X_{Rk,OSB} * k_{mod,OSB}}{\gamma_{m,OSB}}\right)$$

For bending moment capacities:

$$M_{y/z,Rd} = \min\left(\frac{M_{y/z,Rk,wood} * k_{mod,wood}}{\gamma_{m,wood}}; \frac{M_{y/z,Rk,OSB} * k_{mod,OSB}}{\gamma_{m,OSB}}\right)$$

For calculation at ultimate limit state in service classes 1 and 2 (long-term loads) the deformation factor k_{def} for wood and OSB shall be consider according to Table 2 and EN 1995-1-1, Clause 2.3.2.2.

Cross section values, mechanical resistance and stability

Table 4: Dimensions, cross-section values and rigidities at t = 0 and t = ∞ in service classes 1 and 2

cross section				stiffness cross section											
				cross section values						t = 0					
h	h_f	b	h_w	A_{wood}	$I_{y,wood}$	$I_{z,wood}$	A_{OSB}	$I_{y,OSB}$	$I_{z,OSB}$	$A_{ef,t=0}$	$I_{y,ef,t=0}$	$I_{z,ef,t=0}$	$EA_{t=0}$	**$EI_{y,t=0}$**	**$EI_{z,t=0}$**
mm	mm	mm	mm	cm²	cm⁴	cm⁴	cm²	cm⁴	cm⁴	cm²	cm⁴	cm⁴	kN	**kN*m²**	**kN*m²**
160	40	80	80	48,0	1.792	144	32,0	683	395	63,2	2.116	331	50560	**169,30**	**26,52**
200	40	80	120	48,0	3.136	144	40,0	1.333	493	67,0	3.769	378	53600	**301,55**	**30,27**
240	40	80	160	48,0	4.864	144	48,0	2.304	592	70,8	5.958	425	56640	**476,67**	**34,02**
280	40	80	200	48,0	6.976	144	56,0	3.659	691	74,6	8.714	472	59680	**697,11**	**37,77**
320	40	80	240	48,0	9.472	144	64,0	5.461	789	78,4	12.066	519	62720	**965,29**	**41,51**
360	40	80	280	48,0	12.352	144	72,0	7.776	888	82,2	16.046	566	65760	**1.283,65**	**45,26**
400	40	80	320	48,0	15.616	144	80,0	10.667	987	86,0	20.683	613	68800	**1.654,61**	**49,01**

				t = ∞ service class 1						t = ∞ service class 2					
h	h_f	b	h_w	$A_{ef,t=\infty}$	$I_{y,ef,t=\infty}$	$I_{z,ef,t=\infty}$	$EA_{t=\infty}$	**$EI_{y,t=\infty}$**	**$EI_{z,t=\infty}$**	$A_{ef,t=\infty}$	$I_{y,ef,t=\infty}$	$I_{z,ef,t=\infty}$	$EA_{t=\infty}$	**$EI_{y,t=\infty}$**	**$EI_{z,t=\infty}$**
mm	mm	mm	mm	cm²	cm⁴	cm⁴	kN	**kN*m²**	**kN*m²**	cm²	cm⁴	cm⁴	kN	**kN*m²**	**kN*m²**
160	40	80	80	57,7	2.000	264	28.864	**99,98**	**13,20**	56,4	1.972	248	25.075	**87,63**	**11,01**
200	40	80	120	60,2	3.541	294	30.080	**177,07**	**14,70**	58,5	3.487	274	26.010	**154,97**	**12,17**
240	40	80	160	62,6	5.564	324	31.296	**278,22**	**16,20**	60,6	5.470	300	26.946	**243,12**	**13,32**
280	40	80	200	65,0	8.088	354	32.512	**404,41**	**17,70**	62,7	7.939	326	27.881	**352,82**	**14,48**
320	40	80	240	67,5	11.132	384	33.728	**556,61**	**19,20**	64,8	10.909	352	28.816	**484,83**	**15,63**
360	40	80	280	69,9	14.716	414	34.944	**735,80**	**20,70**	66,9	14.398	378	29.752	**639,90**	**16,78**
400	40	80	320	72,3	18.859	444	36.160	**942,93**	**22,20**	69,0	18.422	404	30.687	**818,76**	**17,94**

Table 5: Homogenization factors and characteristic bending moment – main direction – $M_{y,Rk}$ - at t = 0 and t = ∞ in service classes 1 and 2

wood		OSB		$M_{y,Rk}$ t = 0		$M_{y,Rk}$ t = ∞ service class 1		$M_{y,Rk}$ t = ∞ service class 2	
$k_{h,m,wood}$	$k_{h,t,wood}$	$k_{h,m,OSB}$	h	wood	OSB	wood	OSB	wood	OSB
-	-	-	mm	kN*m	kN*m	kN*m	kN*m	kN*m	kN*m
1,60	2,10	1,21	160	6,00	6,69	5,67	9,88	5,59	11,26
1,45	1,98	1,10	200	7,94	8,63	7,46	12,67	7,34	14,41
1,34	1,89	1,01	240	9,59	10,47	8,96	15,28	8,81	17,36
1,25	1,82	0,94	280	11,25	12,24	10,44	17,76	10,25	20,14
1,17	1,76	0,89	320	12,91	13,97	11,91	20,14	11,67	22,81
1,11	1,71	0,84	360	14,59	15,66	13,38	22,44	13,09	25,37
1,06	1,67	0,80	400	16,28	17,33	14,84	24,69	14,50	27,87

Table 6: Homogenization factor and characteristic bending moment – weak direction – $M_{z,Rk}$ - at t = 0 and t = ∞ in service classes 1 and 2

wood		$M_{z,Rk}$ t = 0		$M_{z,Rk}$ t = ∞ service class 1		$M_{z,Rk}$ t = ∞ service class 2	
$k_{h,m,wood}$	h	wood	OSB	wood	OSB	wood	OSB
-	mm	kN*m	kN*m	kN*m	kN*m	kN*m	kN*m
1,60	160	2,12	1,73	1,69	2,15	1,59	2,33
1,45	200	2,42	1,97	1,88	2,39	1,75	2,58
1,34	240	2,72	2,22	2,08	2,64	1,92	2,82
1,25	280	3,02	2,46	2,27	2,88	2,09	3,06
1,17	320	3,32	2,70	2,46	3,13	2,25	3,31
1,11	360	3,62	2,95	2,65	3,37	2,42	3,55
1,06	400	3,92	3,19	2,84	3,61	2,59	3,80

Table 7: Calculated characteristic compression capacities parallel to the product at t = 0 and t = ∞ in service classes 1 and 2

	$N_{c,Rk}$ t = 0		$N_{c,Rk}$ t = ∞ service class 1		$N_{c,Rk}$ t = ∞ service class 2	
h	wood	OSB	wood	OSB	wood	OSB
mm	kN	kN	kN	kN	kN	kN
160	107	212	98	302	96	341
200	114	224	102	315	99	354
240	120	237	106	327	103	366
280	127	250	111	340	107	379
320	133	262	115	353	110	392
360	140	275	119	366	114	405
400	146	288	123	378	117	417

Table 8: Calculated characteristic tension capacities parallel to the product at t = 0 and t = ∞ in service classes 1 and 2

wood		$N_{t,Rk}$ t = 0		$N_{t,Rk}$ t = ∞ service class 1		$N_{t,Rk}$ t = ∞ service class 2	
$k_{h,t,wood}$	h	wood	OSB	wood	OSB	wood	OSB
-	mm	kN	kN	kN	kN	kN	kN
1,20	160	65	132	59	188	58	212
1,20	200	68	140	61	196	60	220
1,20	240	72	148	64	204	62	228
1,20	280	76	155	66	212	64	236
1,20	320	80	163	69	220	66	244
1,20	360	84	171	71	228	68	252
1,20	400	88	179	74	236	70	260

Table 9: Calculated characteristic shear capacities at t = 0 and t = ∞ in service classes 1 and 2

	$V_{z,Rk}$				support length*		$V_{y,Rk}$
	web	glue area			edge bearing	center bearing	
h		t = 0	t = ∞ sc=1	t = ∞ sc=2			
mm	kN	kN	kN	kN	cm	cm	kN
160	16,3	11,8	11,1	11,0	5,0	10,0	10,2
200	21,8	15,7	14,8	14,5	6,5	13,0	10,2
240	27,2	19,9	18,5	18,2	8,0	16,0	10,2
280	32,6	24,2	22,5	22,1	9,5	19,0	10,2
320	38,1	28,7	26,5	26,0	11,5	23,0	10,2
360	43,5	33,4	30,7	30,0	13,0	26,0	10,2
400	49,0	38,3	34,9	34,1	15,0	30,0	10,2

* support length to activate the whole shearing capacity $V_{z,Rk}$

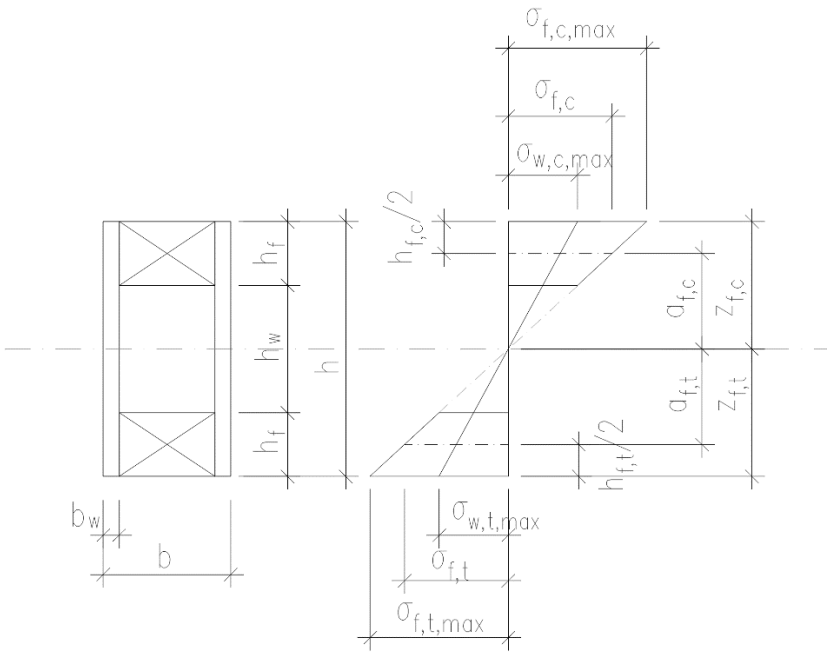
Table 10: Calculated characteristic compression capacities for EcoBox studs on bottom plate (softwood C24)

	compression capacity - column on bottom plate (C24 softwood)				
	edge	center		edge	center
h	$A_{ef,1}$	$A_{ef,2}$	k_{c90}	$N_{c,Rk,1}$	$N_{c,Rk,2}$
mm	cm²	cm²	-	kN	kN
160	128,0	160,0	1,25	40	50
200	148,0	184,0	1,25	46	58
240	168,0	208,0	1,25	53	65
280	188,0	232,0	1,25	59	73
320	208,0	256,0	1,25	65	80
360	228,0	280,0	1,25	71	88
400	248,0	304,0	1,25	62	95

Bending moment capacity and flexural rigidity

Bending moment capacity can be calculated based on EN 1995-1-1, Clause 9.1.1. The principle of stress distribution is shown in the following:

Figure 4: Definition of dimensions and stresses



Calculations are performed using the effective cross section (the whole cross section made of the flange material in this case) with

$A_{ef} = A_{wood} + \frac{E_{OSB}}{E_{wood}} A_{OSB}$ and $I_{ef} = I_{wood} + \frac{E_{OSB}}{E_{wood}} I_{OSB}$

and

$E_{mean,fin} = \frac{E_{mean}}{(1+k_{def} \cdot \varphi_2)}$ for calculation at ultimate limit state in service classes 1 and 2 (long-term loads)

The obtained stresses in the OSB section are transformed to the original cross section.
The calculated stress values shall not exceed the strength of the components in any point of the cross section at the time t=0 and t=∞. The stresses according to EN 1995-1-1, Clause 9.1.1, shall be verified. The characteristic bending moment capacities can be calculated thereof e.g. in case of edgewise bending:

- edge stresses in the compression flange

$$\sigma_{f,c,max,k} \leq f_{m,k} \cdot k_{h,m,wood}$$

$$M_{y,max,k} = \frac{f_{m,k} \cdot k_{h,m,wood} \cdot I_{ef,fin}}{z_{f,c}}$$

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- edge stresses in the tension flange

$$\sigma_{f,t,max,k} \leq f_{m,k} \cdot k_{h,m,wood}$$

$$M_{y,max,k} = \frac{f_{m,k} \cdot k_{h,m,wood} \cdot I_{ef,fin}}{z_{f,t}}$$

- center of gravity stresses in the compression flange

$$\sigma_{f,c,k} \leq f_{c,0,k} \cdot k_c$$

$$M_{y,max,k} = \frac{f_{c,0,k} \cdot I_{ef,fin}}{a_{f,c}}$$

- center of gravity stresses in the tension flange

$$\sigma_{f,t,k} \leq f_{t,0,k} \cdot k_{h,t,wood}$$

$$M_{y,max,k} = \frac{f_{t,0,k} \cdot k_{h,t,wood} \cdot I_{ef,fin}}{a_{f,t}}$$

- characteristic compressive stress in the web

$$\sigma_{w,c,k} \leq f_{c,\mathrm{OSB},k}$$

$$M_{y,max,k} = \frac{f_{c,OSB,k} \cdot I_{ef,inst}}{z_{f,c}} \cdot \frac{E_{wood}}{E_{OSB}}$$

- characteristic tensile stress in the web

$$\sigma_{w,t,k} \leq f_{t,\mathrm{OSB},k} \cdot k_{h,m,OSB}$$

$$M_{y,max,k} = \frac{f_{t,OSB,k} \cdot k_{h,m,OSB} \cdot I_{ef,inst}}{z_{f,t}} \cdot \frac{E_{wood}}{E_{OSB}}$$

The factors $k_{h,m}$ and $k_{h,t}$ are determined similar to k_h for solid timber acc. EN 1995-1-1, Clause 3.2 (3) as:

$$k_{h,m,wood} = k_{hom,m,wood} \cdot \left(\frac{150}{h}\right)^{0,45} \text{ with } k_{hom,m,wood} = 1{,}64$$

$$k_{h,m,OSB} = k_{hom,m,OSB} \cdot \left(\frac{150}{h}\right)^{0,45} \text{ with } k_{hom,m,OSB} = 1{,}26$$

$$k_{h,t,wood} =\cdot k_{hom,t,wood} \cdot \left(\frac{150}{h}\right)^{0,25} \text{ with } k_{hom,t,wood} = 2{,}13$$

Factor $k_c = 1$ according to EN 1995-1-1, Clause 9.1.1 (3).

The flexural rigidity can be calculated as:

$$EI_{ef} = E_{wood} \cdot I_{ef}$$

Tension capacity parallel to the product

Tension capacity parallel to the product can be calculated as:

$$N_{t,k} = f_{t,0,k} \cdot k_{h,t} \cdot A_{ef}$$

The factor $k_{h,t}$ can be calculated similar to k_h for solid timber acc. EN 1995-1-1, Clause 3.2 (3) as:

$$k_{h,t} = \left(\frac{150}{b_{wood}}\right)^{0,2}$$

Compression capacity parallel to the product

Compression capacity parallel to the product can be calculated according to EN 1995-1-1, Clause 9.1.4 and Annex C. Hereby, the load is assumed to be applied in the centre of gravity (instability by buckling is not considered).

Calculations are performed using the effective cross section (the whole cross section made of the flange material in this case) with

$$A_{ef} = A_{wood} + \frac{E_{OSB}}{E_{wood}} A_{OSB}$$

The compression strength parallel to the product is the same as the one for the flanges.

The calculated stress values shall not exceed the strength of the components in any point of the cross section. The following stress shall be verified according to EN 1995-1-1, Annex C:

$$\sigma_{c,0,k} = f_{c,0,k} \cdot k_c$$

Factor $k_c = 1$ according to EN 1995-1-1, Clause 9.1.1 (3).

The characteristic compression capacities parallel to the product are calculated thereof:

$$F_{c,k} = f_{c,0,k} \cdot A_{ef,fin}$$

In case of consideration of instability by buckling, slenderness ratio about the z/y-axis can be determined as:

$$\lambda_{z/y} = l \cdot \sqrt{\frac{A}{I_{z/y,ef}}}$$

Bearing capacity

For the design of supports and load application points the area of the two OSB webs only with the compressive strength in the direction of the panel $f_{c,y,k}$ can be assumed for compressive forces in a simplified and safe way by neglecting a contribution of the flanges.

The bearing capacity is limited by shear capacity with the support lengths given in Table 9.

Shear capacity

Shear capacity can be calculated based on EN 1995-1-1, Clause 9.1.1.

The calculated stress values shall not exceed the strength of the components in any point of the cross section. The stresses according to EN 1995-1-1, Clause 9.1.1, shall be verified. The characteristic shear capacities can be calculated thereof:

- Shear stress in the web

$$F_{v,w,Ek} \leq \begin{cases} b_w h_w \left(1 + \dfrac{0{,}5\left(h_{f,t} + h_{f,c}\right)}{h_w}\right) f_{v,0,k} \text{ for } h_w \leq 35 b_w \\ 35 b_w^2 \left(1 + \dfrac{0{,}5\left(h_{f,t} + h_{f,c}\right)}{h_w}\right) f_{v,0,k} \text{ for } 35 b_w \leq h_w \leq 70 b_w \end{cases}$$

as $h_w \leq 35 b_w$ in all cases

$$F_{v,max,k} = 2 \cdot b_w \cdot h_w \left(1 + \frac{0{,}5\left(h_{f,t} + h_{f,c}\right)}{h_w}\right) \cdot f_{v,0,k}$$

- Shear stress in the glue area between the flanges and the web

$$\tau_{mean,k} \leq \begin{cases} f_{v,90,k} \text{ for } h_f \leq 4 b_w \\ f_{v,90,k} \left(\dfrac{4 b_w}{h_f}\right)^{0{,}8} \text{ for } h_f > 4 b_w \end{cases}$$

as $h_f \leq 4 b_w$ in all cases

$$F_{v,max,k} = \frac{2 \cdot I_{ef} \cdot l_{glue} \cdot f_{v,90,k}}{S_{ef}}$$

Shear rigidity

Shear rigidity for glued thin webbed beams is defined based on the cross section area and material values of the web.

The shear rigidity can be calculated as:

$(GA)_{calc} = G_{OSB,mean} \cdot 2 \cdot b_w \cdot h_w$

Compression capacity – stud on bottom plate

Compression capacity of butt joint with Egger EcoBox studs on bottom plate (C24) is calculated according to EN 1995, Clause 6.1.5 with effective contact length for the area of the flanges and also for both sides of the webs as given in Figure 6 and 7:

$N_{c,Rk} = A_{ef} \cdot f_{c,90,k} \cdot k_{c,90}$

$k_{c,90}$ = 1,25 for solid softwood timber according EN 1995-1-1.

Figure 6: Definition of center and edge studs (shaded area shows A_{ef})

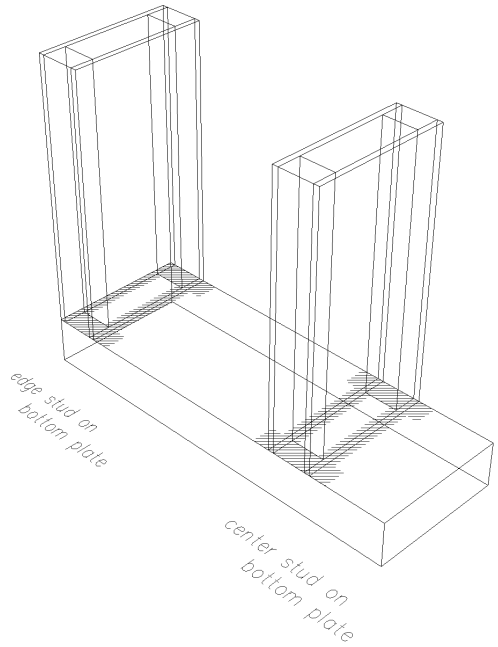
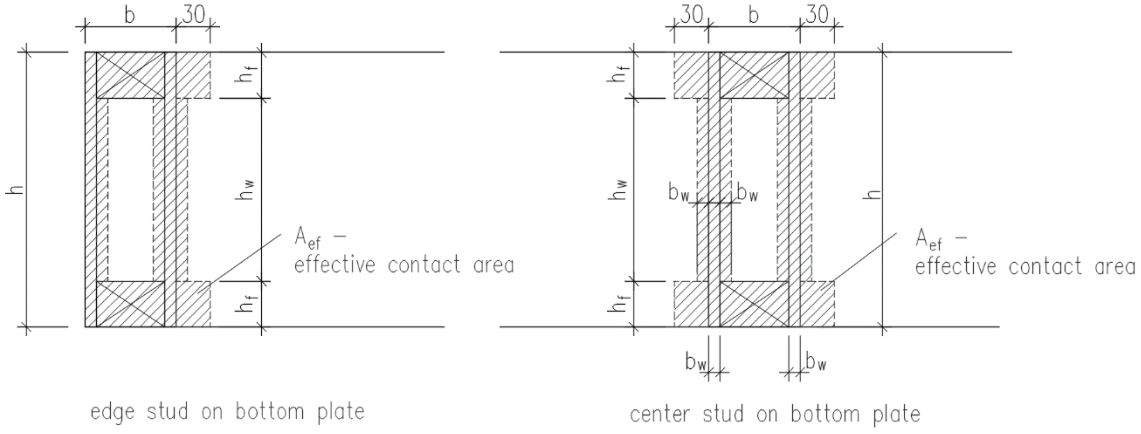


Figure 7: Definition of A_{ef} for Egger EcoBox studs on bottom plate (C24)



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European Assessment Document (EAD) 130367-00-0304 “Composite wood-based beams and columns”

EN 300 (06.2006), Oriented Strand Boards (OSB) – Definitions. classification and specifications

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

EN 15497 (04.2014), Structural finger jointed solid timber – Performance requirements and minimum production requirements