Deutsches Institut für Bautechnik

Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products

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European Technical Assessment ETA-23/0685 of 14 June 2024

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Hybrid glulam
Product family to which the construction product belongs	Glulam strengthened by LVL
Manufacturer	Hördener Holzwerk GmbH Landstraße 25 76571 Gaggenau DEUTSCHLAND
Manufacturing plant	Hördener Holzwerk GmbH Landstraße 25 76571 Gaggenau
This European Technical Assessment contains	11 pages including 3 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	EAD 130740-00-0304 – GLULAM STRENGTHENED BY LVL, GLVL AND BLOCK-GLUED GLULAM MADE THEREOF

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Specific Part

1 Technical description of the product

Hybrid glulam is glulam, which inner laminations are made of solid timber and which outer laminations are made of laminated veneer lumber (LVL) (see Annex 1). The outer laminations made of LVL can be arranged on one or on both sides of the cross-section edge.

The inner laminations of the hybrid glulam are made of solid timber from Spruce (*Picea Abies*) in accordance with EN 14081-1 assigned to the strength class T14 in accordance with EN 338. The laminations thickness is 30 mm ≤ t_l ≤ 40 mm. The cross-section part with laminations made of solid timber from Spruce is glulam of the strength class GL 24h in accordance with EN 14080. The inner laminations contain finger joints lengthwise. The finger joints are made in accordance with EN 14080, Annex I.4 with the profil 15 mmx 3.8 mm. The characteristic bending strength of the finger joints $f_{m,l,k}$ is at least 30 N/mm².

The outer laminations of the hybrid glulam are made of LVL "KERTO-S" from Spruce (*Picea Abies*) in accordance with EN 14374. The laminations thickness is 30 mm ≤ t_l ≤ 40 mm. The laminations made of LVL do not contain finger joints.

For the asymmetric lay-up of the hybrid glulam the laminations made of LVL are arranged on only one side of the glulam (tensile zone) and for the symmetric lay-up of the glulam on both sides of the glulam (tensile and compression zone). As outer laminations made of LVL one up to three laminations for each cross-section edge are used. The maximal percentage of the laminations made of LVL is 20 % (asymmetric lay-up) and 40 % (symmetric lay-up). The minimal percentage of the laminations made of LVL is 5 % (asymmetric lay-up) and 10 % (symmetric lay-up).

All laminations – laminations made of solid timber and the laminations made of LVL – have the same thickness.

For the bonding of the hybrid glulam adhesive according to the data deposited at DIBt are used.

The basic structure and geometry of the hybrid glulam is given in Annex 1. The width B of the hybrid glulam is up to 280 mm, the depth H is up to 600 mm and the length L is up to 15 m.

Hybrid glulam with perforations is not part of the ETA.

The ETA does not cover hybrid glulam made of:

- softwood preservative treated against biological attack,
- softwood treated with flame retardants,
- recycled softwood.

The hybrid glulam may be curved as long as the above-mentioned lamination thicknesses are maintained and the radius of curvature meets the limitation given in EN 14080, Annex I, section I.5.1.

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

Hybrid glulam is used in load-bearing timber structures in service classes 1 and 2 in accordance with EN 1995-1-1[1], clause 2.3.1.3.

The performances given in Section 3 are only valid if the hybrid glulam is used in compliance with the specifications and conditions given in Annex 2 and Annex 3 of this European Technical Assessment.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the hybrid glulam of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Strength, stiffness and density properties	See Annex 3
Dimensional stability	The provisions given in EN 14080, section 5.11 are fulfilled.

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	D-s2, d0 in accordance with the Delegated Regulation (EU) 2017/1227 for laminations made of solid softwood timber and (EU) 2017/2293 for the laminations made of LVL.
Resistance to fire	The charring rate for each lamination: β_0 = 0.65 mm/min

3.3 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Formaldehyde emission	NPD

[1] EN 1995-1-1:2004/AC:2006 A1:2008+A2:2014 Eurocode 5: Design of timber structures – Part 1-1: General – Common rules and rules for buildings

3.4 Other essential characteristics

Essential characteristic	Performance
Durability of bonding strength	The provisions of EAD 130740-00-0304 are fulfilled.
Durability against biological attack	The natural durability against biological attack of Spruce heartwood is in accordance with EN 350[2]: – DC 4 against fungi – DC S against beetles – DC S against termites – DC S against marine borer Spruce sapwood is regarded as not durable. The natural durability against biological attack of "Kerto-S" is DC5 against fungi.

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

In accordance with EAD No. 130740-00-0304 the applicable European legal act is: Decision 97/176/EC as amended by Decision 2001/596/EC.

The system is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 14 June 2024 by Deutsches Institut für Bautechnik

Anja Dewitt
Head of Section

beglaubigt:
Warns

[2] EN 350:2016 Durability of wood and wood-based products – Testing and classification of the durability to biological agents of wood and wood-based materials

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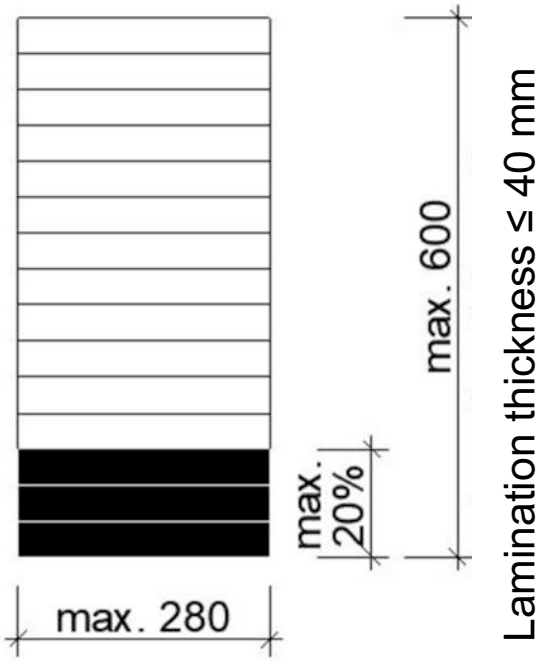
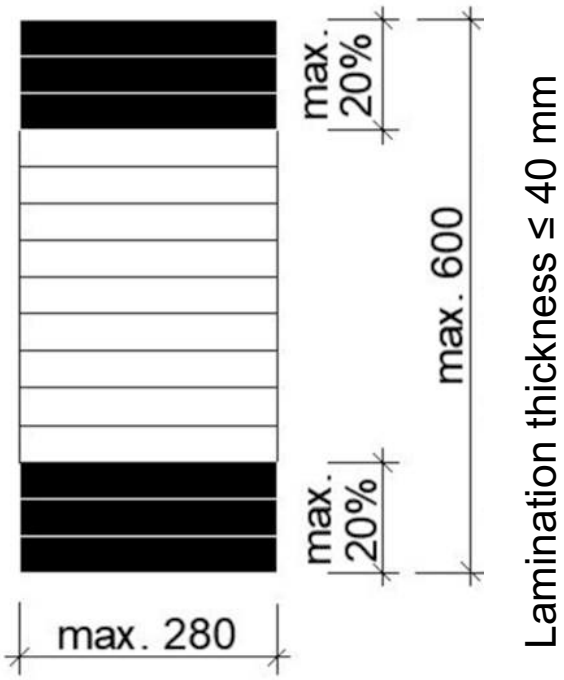
Structure of the hybrid glulam

asymmetric lay-up



symmetric lay-up



Legende

laminations of solid timber made of Spruce

top and bottom: max. 3 laminations made of LVL "Kerto-S"

Hybrid glulam	Annex 1
Basic structure of the product	

Annex 2 Specifications of intended use

A.2.1 Use of hybrid glulam only:

– for static and quasi-static (non-fatigue) loads.

The hybrid glulam is intended to be used in load-bearing timber structures. It may be used as all components, for which the usage of glulam is permitted in accordance with EN 1995-1-1.

A.2.2 Packaging, Transport and storage

The hybrid glulam shall be protected during transport and storage against any damage and detrimental moisture effects. The manufacturer's instructions for packaging, transport and storage shall be observed.

A.2.3 Installation provisions

EN 1995-1-1 applies for the installation.

The hybrid glulam shall be protected against detrimental changes of moisture.

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Annex 3: Strength, stiffness and density properties of the hybrid glulam

The hybrid glulam has – based on the gross section – the strength and stiffness properties given in Table A.3.1. For the inner part of the cross-section made of solid timber laminations the strength and stiffness properties for GL 24h given in EN 14080, Table 5 may be used.

Table A.3.1: Strength and stiffness properties for hybrid glulam

Property	Orientation of the laminations	Symbol	Value [N/mm²]
Bending strength	flatwise	$f_{m,flat,k}$	symmetric lay-up: see Table A.3.2 asymmetric lay-up: see Table A.3.3
	edgewise	$f_{m,edge,k}$	$24 \cdot E_{0,ges,mean} / 11500$ a)
Tensile strength parallel to the grain		$f_{t,0,k}$	$19.2 \cdot E_{0,ges,mean} / 11500$ a) b)
Compression strength parallel to the grain		$f_{c,0,k}$	$24 \cdot E_{0,ges,mean} / 11500$ a) b)
Tensile strength perpendicular to the grain	flatwise	$f_{t,90,flat,k}$	solid timber: $f_{t,90,flat,BSH,k} = 0.5$ LVL: $f_{t,90,flat,FSH,k} = 0.15$
	edgewise	$f_{t,90,edge,k}$	solid timber: $f_{t,90,edge,BSH,k} = 0.5$ LVL: $f_{t,90,edge,FSH,k} = 0.8$
Compression strength perpendicular to the grain	flatwise	$f_{c,90,flat,k}$	solid timber: $f_{c,90,flat,BSH,k} = 2.5$ LVL: $f_{c,90,flat,FSH,k} = 2.2$
	edgewise	$f_{c,90,edge,k}$	solid timber: $f_{c,90,edge,BSH,k} = 2.5$ LVL: $f_{c,90,edge,FSH,k} = 6.0$
Shear strength parallel to the grain		$f_{v,k}$	2.3
Bending Modulus of elasticity parallel to the grain	flatwise	$E_{m,flat,mean}$	symmetric lay-up: see Table A.3.2 asymmetric lay-up: see Table A.3.3
		$E_{m,flat,k}$	$5/6 \cdot E_{m,flat,mean}$
	edgewise	$E_{m,edge,mean}$	$E_{0,ges,mean}$ a)
		$E_{m,edge,k}$	$5/6 \cdot E_{m,edge,mean}$
Shear modulus parallel to the grain		$G_{0,mean}$	$(1 - a) \cdot 650 + a \cdot 380$
		$G_{0,k}$	$5/6 \cdot G_{0,mean}$
Modulus of elasticity perpendicular to the grain		$E_{90,mean}$	130
		$E_{90,k}$	100

a) $E_{0,ges,mean} = (1 - a) \cdot 11500 + a \cdot 13800$ in N/mm^2
a = percentage of the lamination made of LVL in the cross-section

b) If the load introduction takes place only in the part of the cross-section made of the solid timber made from Spruce, the strength properties for glulam GL 24h given in EN 14080, Table 5 have to be used.

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Annex 3: Strength, stiffness and density properties of the hybrid glulam

Table A.3.2: Characteristic value of the bending strength and mean value of the bending modulus of elasticity in N/mm² for flatwise arranged laminations and a percentage of the laminations made of LVL from 10 % up to 40 % (glulam strengthened on both sides of the cross-section, symmetric lay-up of the hybrid glulam)

Total number of laminations	1 LVL-lamination in the bending tensile and compressive zone each			2 LVL-lamination in the bending tensile and compressive zone each			2 LVL-lamination in the bending tensile and compressive zone each		
	Percentage of LVL	Bending strength $f_{m,flat,k}$	Bending Modulus of elasticity $E_{m,flat,mean}$	Percentage of LVL	Bending strength $f_{m,flat,k}$	Bending modulus of elasticity $E_{m,flat,mean}$	Percentage of LVL	Bending strength $f_{m,flat,k}$	Bending Modulus of elasticity $E_{m,flat,mean}$
5	0.400	42.2	13300	-	-	-	-	-	-
6	0.333	39.9	13100	-	-	-	-	-	-
7	0.286	37.9	13000	-	-	-	-	-	-
8	0.250	35.7	12800	-	-	-	-	-	-
9	0.222	34.1	12700	-	-	-	-	-	-
10	0.200	32.9	12600	0.400	37.5	13300	-	-	-
11	0.182	32.0	12500	0.364	36.8	13200	-	-	-
12	0.167	31.2	12500	0.333	36.3	13100	-	-	-
13	0.154	30.6	12400	0.308	35.8	13000	-	-	-
14	0.143	30.1	12400	0.286	35.4	13000	-	-	-
15	0.133	29.6	12300	0.267	35.0	12900	0.400	36.1	13300
16	0.125	29.2	12300	0.250	34.7	12800	0.375	35.8	13200
17	0.118	28.9	12200	0.235	34.4	12800	0.353	35.5	13200
18	0.111	28.6	12200	0.222	34.1	12700	0.333	35.2	13100
19	0.105	28.3	12200	0.211	33.5	12700	0.316	35.0	13100
20	0.100	28.1	12100	0.200	32.8	12600	0.300	34.7	13000

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Annex 3: Strength, stiffness and density properties of the hybrid glulam

Table A.3.3: Characteristic value of the bending strength and mean value of the bending modulus of elasticity in N/mm² for flatwise arranged laminations and a percentage of the laminations made of LVL from 5 % up to 20 % (glulam strengthened on one side of the cross-section, asymmetric lay-up of the hybrid glulam)

Total number of laminations	1 LVL-lamination in the bending tensile zone				2 LVL-laminations in the bending tensile zone				3 LVL-laminations in the bending tensile zone			
	Per-centage of LVL	Bending strength $f_{m,flat,k}$		Bending modulus of elasticity $E_{m,flat,mean}$	Per-centage of LVL	Bending strength $f_{m,flat,k}$		Bending modulus of elasticity $E_{m,flat,mean}$	Per-centage of LVL	Bending strength $f_{m,flat,k}$		Bending modulus of elasticity $E_{m,flat,mean}$
		NK1[a)]	NK2[a)]			NK1[a)]	NK2[a)]			NK1[a)]	NK2[a)]	
5	0.200	30.3	29.3	12400	-	-	-	-	-	-	-	-
6	0.167	29.8	28.7	12300	-	-	-	-	-	-	-	-
7	0.143	29.5	28.3	12200	-	-	-	-	-	-	-	-
8	0.125	29.3	28.0	12100	-	-	-	-	-	-	-	-
9	0.111	29.1	27.7	12100	-	-	-	-	-	-	-	-
10	0.100	29.0	27.5	12000	0.200	30.3	29.3	12400	-	-	-	-
11	0.091	28.8	27.2	12000	0.182	30.0	29.0	12300	-	-	-	-
12	0.083	28.6	27.0	12000	0.167	29.8	28.7	12300	-	-	-	-
13	0.077	28.4	26.8	11900	0.154	29.7	28.5	12200	-	-	-	-
14	0.071	28.3	26.6	11900	0.143	29.5	28.3	12200	-	-	-	-
15	0.067	28.2	26.5	11900	0.133	29.4	28.1	12200	0.200	30.3	29.3	12400
16	0.063	28.1	26.4	11900	0.125	29.3	28.0	12100	0.188	30.1	29.1	12300
17	0.059	28.0	26.3	11900	0.118	29.2	27.8	12100	0.176	30.0	28.9	12300
18	0.056	27.9	26.2	11800	0.111	29.1	27.7	12100	0.167	29.8	28.7	12300
19	0.053	27.9	26.1	11800	0.105	29.1	27.6	12100	0.158	29.7	28.5	12300
20	0.050	27.8	26.0	11800	0.100	29.0	27.5	12000	0.150	29.6	28.4	12200

a) NK1 / NK2: Service classes 1 and 2 in accordance with EN 1995-1-1.

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Annex 3: Strength, stiffness and density properties of the hybrid glulam

Table A.3.4: Density for hybrid glulam

Property	Symbol	Value [kg/m³]
Density	ρ_{mean}	420
	ρ_k	385[a)]

a) For the assessment of mechanical fasteners, which are embedded in the LVL laminations only, a characteristic density of 480 kg/m³ may be used.