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Designated according to Article 29 of Regulation (EU) No 305/2011

BBA APPROVAL INSPECTION TESTING CERTIFICATION
TECHNICAL APPROVALS FOR CONSTRUCTION

European Technical Assessment ETA-06/0238

Fifth issue*

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011:

Trade name	STEICOjoist and STEICOwall
Holder of assessment:	STEICO SE Otto-Lilienthal-Ring 30 85622 Feldkirchen Germany Tel: + 49 (0)89 99 1551-0 Fax: + 49 (0)89 99 1551-99 e-mail: info@steico.com website: www.steico.com
Generic type and use of construction product:	Light composite wood-based beams and columns for structural use
Issued on:	24 September 2014
Manufacturing plant:	STEICO Sp. z o.o. ul. Przemyslowa 2 64-700 Czarnkow Poland
Basis of ETA:	This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of the *Guideline for European Technical Approval (ETAG) 011 — Edition Jan 2002 of light composite wood-based beam and columns* used as the European Assessment Document (EAD).
This European Technical Assessment contains:	This European Technical Assessment contains 4 pages plus four Annexes which forms an integral part of the document.

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1 Technical description of the product

STEICO I-joist products are products of composite construction with solid timber or LVL flanges and hard fibreboard or OSB webs.

The web-to-flange connection is made by glueing the web into a groove in the centre of the wide face of the flange. Adhesive in accordance with EN 301, Type 1 or PU adhesive to EN 15425, Type 1 is used in the web-to-web and the web-to-flange joint. The components are machine-assembled in one pass.

The illustration and the description of the product are given in Annex A.

2 Specification of intended use

The STEICO I-joist products are intended to be used as loadbearing building structures eg construction members or frame elements for walls, roofs, floors, facades and trusses.

Further information is given in Annex B.

The provisions made in this European Technical Assessment are based on an assumed intended working life for the joist of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be used as a means for selecting the appropriate product in relation to the expected economically reasonable working life of the construction.

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

3.1 Mechanical resistance and stability (BWR1)

Essential characteristic	Performance
Characteristic design properties – solid timber flanges, ETAG 011	See Annex C, Table C1
Characteristic design properties – LVL flanges, ETAG 011	See Annex C, Table C2
Characteristic bearing resistance – solid timber, ETAG 011	See Annex C, Table C3
Characteristic bearing resistance – LVL flange, ETAG 011	See Annex C, Table C4
Values of k_{mod}, EC5	See Annex C, Table C5
Values of k_{def}, EC5	See Annex C, Table C6
Value of γ_M, EC5	See Annex C, Table C7
Design Recommendations for holes cut in Web, ETAG 011	See Annex C, Tables C8 and C9
Axially loaded members	See Annex C, Tables C10 and C11
Design Recommendations for notches into LVL flanges	See Annex C

3.2 Safety in case of fire (BWR2)

Essential characteristic	Performance
Reaction to fire	D-s2, d0
Resistance to fire	NPD

3.3 Hygiene, health and environment (BWR3)

According to the manufacturer's declaration, the product specification has been compared with the dangerous substances detailed in Council Directive 76/769/EEC (as amended) and listed on the database established on the EC construction website to verify that it does not contain such substances above the acceptable limits.

The hard fibreboard and OSB webs and LVL flange are classified as E1 in accordance with EN 13986 : 2004 and EN 14374 : 2004 respectively, with regard to extractable formaldehyde content. The I-joists do not contain pentachlorophenol and chemical treatment of this product is regulated at national level. If a beam or parts of a beam will be subject to chemical treatment, the effect of the chemical treatment on other properties of the beam (eg structural, durability of fasteners) shall be considered by the regulatory authorities in each Member State.

In addition to the specific clauses relating to dangerous substances contained in this European Technical Assessment, there may be other requirements applicable to the products falling within its scope (eg transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Regulation (EU, No 305/2011), these requirements need also to be complied with, when and where they apply.

3.4 Safety in use (BWR4)

Not relevant to this product.

3.5 Protection against noise (BWR5)

Not relevant to this product.

3.5 Protection against noise (BWR5)

Not relevant to this product.

3.6 Energy economy and heat retention (BWR6)

Essential characteristic	Performance
Hygrothermal properties	See Annex D, Table D1

3.7 Sustainable use of natural resources (BWR7)

For the sustainable use of natural resources no performance was determined for this product.

General aspects relating to fitness for use

Durability and Serviceability are only ensured if the specifications of intended use according to Annex B are kept.

4 Assessment and verification of constancy of performance (AVCP)

In accordance with the decision 97/638/EC of the European Commission[1], as amended, the system(s) of assessment and verification of constancy of the performance (see Annex V to Regulation (EU) No 305/2011) given in the following Table applies.

Product	Intended	Level or Class	System
Light composite wood-based beam and columns	Loadbearing component in building structures		1

5 Technical details necessary for the implementation of the AVCP system

5.1 Tasks for the manufacturer

Tasks for the manufacturer:

- Factory product control
- Further testing of samples taken at the factory by the manufacturer in accordance with the prescribed test plan.

The manufacturer continues to operate a factory production control system. All elements, requirements and provisions adopted by the manufacturer are documented to ensure that the product conforms to this European Technical Assessment.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the prescribed test plan(1). The raw materials shall be subject to controls and tests by the manufacturer before acceptance. Checks on incoming materials, shall include control of the certificates of conformity presented by suppliers (comparison with nominal values) by verifying dimensions and determining material properties.

The manufactured joists are checked for:

- flange and web material
- dimensional accuracy
- visual quality
- glue spread
- fit of component parts
- strength of completed joist.

The frequency of controls and tests conducted during production and on the assembled joist is laid down in the prescribed test plan, taking account of the manufacturing process of the joist. The results of factory production control are recorded and evaluated. The records include at least:

- designation of the product, basic material and components
- type of control or testing
- date of manufacture of the product and date of testing of the product or basic material and components
- result of control and testing and, if appropriate, comparison with requirements
- signature of person responsible for factory production control.

The records shall be presented to the inspection body involved in the continuous surveillance.

Details of the extent, nature and frequency of testing and controls to be performed within the factory production control shall correspond to the prescribed test plan included in the technical documentation of this European Technical Assessment.

(1) The prescribed test plan is deposited with the British Board of Agrément and is made available to the notified bodies involved in the conformity attestation process.

The manufacturer shall make a declaration in accordance with the requirements of this European Technical Assessment.

(1) Official Journal of the European Communities No L254 of 08.10.1996

5.2 Tasks for the notified bodies

Tasks for the notified product certification body:

- determination of the product type on the basis of type testing, type calculation, tabulated values or descriptive documentation of the product
- initial inspection of the manufacturing plant and of factory product control
- continuous surveillance, assessment and evaluation of factory production control

In cases where the provisions of the European Technical Assessment and its control plan are no longer fulfilled, the notified body shall withdraw the Certificate of constancy of performance and inform the British Board of Agrément without any delay.

BBA APPROVAL INSPECTION TESTING CERTIFICATION
TECHNICAL APPROVALS FOR CONSTRUCTION

On behalf of the British Board of Agrément

Date of Fifth issue: 24 September 2014

Brian Chamberlain
Head of Approvals — Engineering

Claire Curtis-Thomas
Chief Executive

ANNEX A ILLUSTRATION AND DESCRIPTION OF PRODUCT

A1 Description of Product

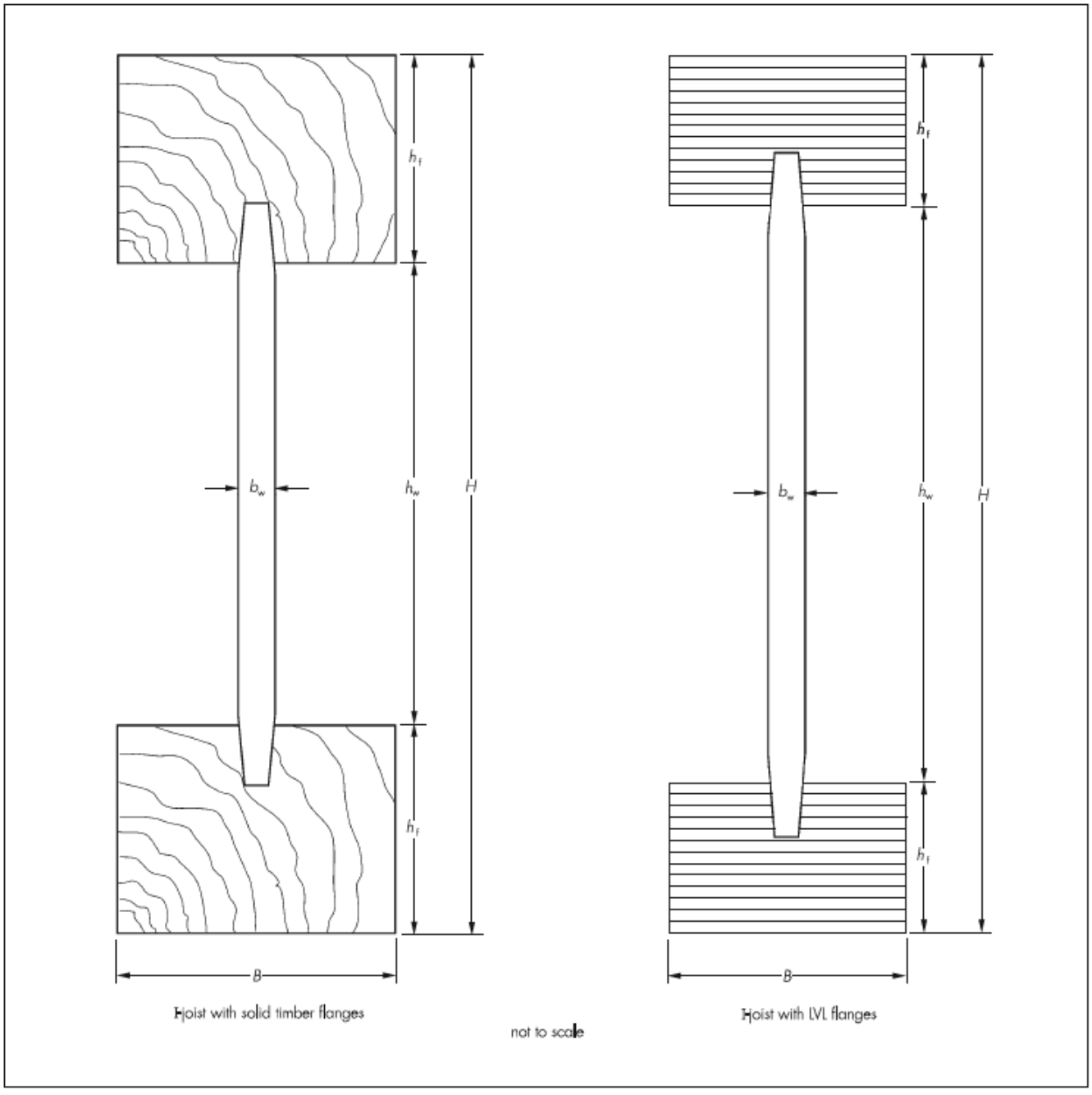
The STEICO I-Joist products (Figure A1) are available in a range of sizes as shown in Table A1 and Table A2.

The solid timber flanges are one of strength class L17 or L36 to EN 14081-4 : 2009 and finger jointed to length in accordance with EN 385 : 2001. The LVL flanges are of class 1.6E or class 2.0E comprising laminated veneers bonded with phenol-formaldehyde adhesive, laid with the grain running parallel. The veneers are oriented perpendicular to the web.

The hard fibreboard web is in accordance with EN 622-2 : 2004, type HB.HLA1, and is placed in the beams in sections 1200 mm to 2500 mm long. The OSB/3 and OSB/4 are in accordance with EN 300 : 2006 and the strands of the OSB run perpendicular to the long axis of the I-beam. Web-to-web connections consist of a tongue-and-groove joint.

A2 Illustration of Product

Figure A1 Sections (dimensions in mm)



ANNEX A ILLUSTRATION AND DESCRIPTION OF PRODUCT (continued)

Table A1 Dimensions and information for STEICO I-joist products with solid timber flanges

Series	Flange width B (mm)	Joist depth H (mm)	Flange depth h_f (mm)	Flange grade	Web thickness b_w (mm)		
					HB.HLA1	OSB/3	OSB/4
SJ 45	45	160 to 400	45	L36	8.0	10.0	8.5
SJ 60	60	160 to 500	45	L36	8.0	10.0	8.5
SJ 90	90	160 to 500	45	L36	8.0	10.0	8.5
SW 45	45	160 to 400	45	L17	6.7 or 8.0	6.7 or 10.0	6.7 or 8.5
SW 60	60	160 to 500	45	L17	6.7 or 8.0	6.7 or 10.0	6.7 or 8.5
SW 90	90	160 to 500	45	L17	6.7 or 8.0	6.7 or 10.0	6.7 or 8.5

Table A2 Dimensions and information for STEICO I-joist products with LVL flanges

Series	Flange width B (mm)	Joist depth H (mm)	Flange depth h_f (mm)	Flange grade	Web thickness b_w (mm)		
					HB.HLA1	OSB/3	OSB/4
SJ_L 45	45	160 to 400	39	2.0E LVL	8.0	10.0	8.5
SJ_L 60	60	160 to 500	39	2.0E LVL	8.0	10.0	8.5
SJ_L 90	90	160 to 500	39	2.0E LVL	8.0	10.0	8.5
SW_L 45	45	160 to 400	39	1.6E LVL	6.7 or 8.0	6.7 or 10.0	6.7 or 8.5
SW_L 60	60	160 to 500	39	1.6E LVL	6.7 or 8.0	6.7 or 10.0	6.7 or 8.5
SWL 90	90	160 to 500	39	1.6E LVL	6.7 or 8.0	6.7 or 10.0	6.7 or 8.5

Table A3 Manufacturing tolerances (mm)

Description(1)	Tolerances (mm)
Joist depth – H	–2 to + 1
Joist width – B	–2 to + 2
Flange depth – h_f	–2 to + 2
Web thickness – b_w	–0.8 to + 0.8
Joist length – l	–0

(1) See Figure A1.

ANNEX B SPECIFICATION OF INTENDED USE

B1 Intended Use

The product is intended for use as a loadbearing component in building structures, eg construction members or frame elements for walls, roofs, floors, facades and trusses where Basic Work Requirements 1, 2, 3 and 6 *Mechanical resistance and stability, Safety in case of fire, Hygiene, health and environment and Energy economy and heat retention* respectively apply.

The untreated I-joists are for use in timber structures subject to conditions defined by service classes 1 and 2 of EN 1995-1-1 : 2004 (Eurocode 5) and in Hazard Classes 1 and 2 as specified in EN 335-1 : 2006 for members subject to static or quasi-static loading. It may be exposed directly to the weather for a short time during installation.

The ability of the product to resist loads without undue deflection (serviceability) is dealt with in the section headed *BWR1 Mechanical resistance and stability.*

The assessment of fitness for the intended use has been made in accordance with ETAG 011.

B2 Manufacturing

The product is manufactured in accordance with the provisions of the European Technical Assessment using the manufacturing processes as identified in the inspection of the plant by the British Board of Agrément and the notified body and laid down in the technical documentation.

B3 Installation

A joist is deemed fit for its intended use provided:

- it is designed in accordance with Eurocode 5 or an appropriate national code using the design data given in Annex C. Design and detailing of structures should be carried out by a suitably qualified and experienced person in accordance with the manufacturer's instructions and the requirements of this ETA
- verifiable calculation, notes and drawings are prepared taking account of the loads to be resisted

ANNEX B SPECIFICATION OF INTENDED USE (continued)

- the minimum end bearing length for I-joists with LVL flange material shall be 35 mm and the minimum intermediate bearing length shall be 45 mm
- the minimum end bearing length for I-joists with solid timber flange material shall be 45 mm and the minimum intermediate bearing length shall be 75 mm.

B4 Criteria

The fitness for use of the joist can be assumed if it is installed correctly in accordance with the following requirements:

- installation is carried out by personnel under the direction of supervisors, all of whom are appropriately qualified for this work
- installation is in accordance with the manufacturer's specifications and drawings prepared for that purpose, and the appropriate tools are used
- the flanges must not be drilled, notched or otherwise altered on site unless it has been otherwise written in the manufacture's literature or specification (Annex C)
- the joists should be handled and installed in a similar manner to solid timber beams. However, the strength and stiffness of joists about their minor axis is less than that of corresponding solid timber sections. Therefore, care must be exercised to ensure that joists are not damaged during handling due to bending about their minor axis. In accordance with normal good practice for timber they should be protected from wetting during installation
- the characteristic bending moments given in Annex C, Table C1 and Table C2, is based on the assumption that lateral bracing to the compression flange (at a spacing not exceeding ten times the flange width) is in place. Alternative bracing will require separate analysis
- the joists should have a moisture content at the time of installation close to that attained in service
- temporary bracing should be provided to keep the joists in a straight and plumb position during installation
- rigid service pipes can be incorporated within the floor, roof or wall void by passing through site-cut holes in accordance with the manufacturer's literature or specification as detailed in Annex C
- Attack from insects such as house longhorn beetle, dry wood termites and woodworm may reduce the durability of the product.

B5 Recommendations on packaging, transport and storage

Delivery and site storage must be carried out in accordance with the manufacturer's instructions. During transportation the joists must be protected from adverse weather. The joists should be stored clear of the ground and stacked vertically (within the plane of the spans). Precautions should be taken to minimise changes in moisture content due to the weather. Full cover should be provided but permit free passage of air.

B6 Recommendations on use, maintenance and repair

The assessment of the fitness for use is based on the assumption that maintenance is not required during the assumed intended working life.

Should repair prove necessary, an assessment must be made in each case. It is the responsibility of the manufacturer to ensure that the information on the specific conditions given in Sections 3, A1, B3, B4 and Annex C is given to those concerned. This information may be made by replicating the respective parts of the European Technical Assessment.

ANNEX C MECHANICAL RESISTANCE AND STABILITY

The mechanical properties, characteristic load-carrying capacities and modification factors for the product are given in this Annex which has been derived in accordance with ETAG 011. Details for incorporation of holes in the web and axial loading should be used for designs in accordance with EN 1995-1-1 : 2004 (Eurocode 5). The load-carrying capacities have been derived by calculation and calculation assisted by test.

Where cyclic design of the structure is required, the product may have the capacity to behave as shear walls. This must be verified by testing or by design for a full wall system:

- The ductile behaviour of the final construction must be designed to confirm that the joints and connections are designed and installed in accordance with Eurocode 8 and National Annex of Member States
- The dissipated energy in the structure is solely dependent upon the composition of the wall members, connections and the sheeting material such as OSB, gypsum fibre board, plywood and chipboard and the assembly of the wall system in the structure
- The connection between the sheeting material and the I-joist flanges may be considered as a connection between the sheeting material and a solid wood respectively a solid LVL section.

ANNEX C MECHANICAL RESISTANCE AND STABILITY (continued)

Table C1 Characteristic design properties — solid timber flanges

Type	Depth (mm)	Moment capacity (kN·m)	Shear capacity (kN)	Bending stiffness EIjoist (N·mm² x 10⁹)	Shear stiffness GAjoist (MN)
SJ 45	160	4.96	9.79	183	1.42
	200	7.09	11.98	327	2.09
	220	8.00	13.04	416	2.42
	240	8.92	14.07	516	2.76
	250	9.38	14.43	571	2.93
	300	11.74	16.14	888	3.77
	350	13.64	17.72	1281	4.61
	360	14.01	18.02	1369	4.78
	400	15.51	19.20	1753	5.45
SJ 60	160	6.75	10.36	249	1.42
	200	9.45	12.64	436	2.09
	220	10.66	13.74	554	2.42
	240	11.87	14.81	687	2.76
	250	12.48	15.18	759	2.93
	300	15.57	16.93	1177	3.77
	350	18.03	18.52	1693	4.61
	360	18.52	18.83	1808	4.78
	400	20.45	20.01	2310	5.45
	450	22.83	21.41	3030	6.29
	500	25.20	21.62	3855	7.13
SJ 90	160	10.04	11.18	370	1.42
	200	14.13	13.65	651	2.09
	220	15.96	14.82	827	2.42
	240	17.75	15.96	1025	2.76
	250	18.65	16.35	1132	2.93
	300	23.21	18.17	1752	3.77
	350	26.80	19.82	2513	4.61
	360	27.51	20.13	2683	4.78
	400	30.30	21.34	3419	5.45
	450	33.74	22.77	4472	6.29
	500	37.12	23.46	5675	7.13
SW 45	160	2.49	6.86	127	1.12
	200	3.56	8.40	227	1.63
	220	4.01	9.15	289	1.88
	240	4.48	9.88	359	2.13
	250	4.63	10.13	390	2.26
	300	5.90	11.35	618	2.89
	350	6.86	12.47	893	3.52
	360	7.05	12.50	954	3.64
	400	7.81	11.55	1223	4.15
SW 60	160	3.32	7.25	169	1.12
	200	4.74	8.86	302	1.63
	220	5.34	9.64	384	1.88
	240	5.95	10.39	477	2.13
	250	6.18	10.65	520	2.26
	300	7.82	11.89	818	2.89
	350	9.06	13.02	1178	3.52
	360	9.30	13.24	1258	3.64
	400	10.28	13.40	1608	4.15
	450	11.48	11.97	2108	4.78
	500	12.67	10.92	2685	5.41
SW 90	160	4.91	7.85	251	1.12
	200	7.05	9.56	450	1.63
	220	7.99	10.39	574	1.88
	240	8.89	11.19	711	2.13
	250	9.27	11.46	779	2.26
	300	11.64	12.75	1216	2.89
	350	13.44	13.91	1746	3.52
	360	13.80	14.14	1863	3.64
	400	15.21	14.99	2376	4.15
	450	16.93	13.70	3107	4.78
	500	18.64	12.72	3945	5.41

NOTE 1: The characteristics for beams within the depth range not listed in the Table can be calculated by linear interpolation.

NOTE 2: The shear stiffness shall be reduced with the factor 0.85 by using OSB as a web material.

ANNEX C MECHANICAL RESISTANCE AND STABILITY (continued)

Table C2 Characteristic design properties —LVL flanges

Type	Depth (mm)	Characteristic bending moment (kN·m)	Characteristic vertical shear (kN)	Bending stiffness EIjoist (N·mm² x 10⁹)	Shear stiffness GAjoist (MN)
SJ_L 45	160	5.90	9.79	195	1.83
	200	7.81	11.98	343	2.50
	220	8.79	13.04	433	2.84
	240	9.78	14.07	536	3.18
	250	10.27	14.43	591	3.34
	300	12.82	16.14	912	4.18
	350	15.43	17.72	1308	5.02
	360	15.96	18.02	1397	5.19
	400	17.75	19.20	1783	5.86
SJ_L 60	160	7.85	10.36	259	1.83
	200	10.36	12.64	455	2.50
	220	11.65	13.74	575	2.84
	240	12.94	14.81	709	3.18
	250	13.60	15.18	782	3.34
	300	16.91	16.93	1203	4.18
	350	20.30	18.52	1721	5.02
	360	20.98	18.83	1836	5.19
	400	23.61	20.01	2337	5.86
	450	26.48	21.41	3056	6.70
	500	29.34	21.62	3880	7.54
SJ_L 90	160	11.82	11.18	389	1.83
	200	15.47	13.65	679	2.50
	220	17.37	14.82	857	2.84
	240	19.28	15.96	1056	3.18
	250	20.24	16.35	1164	3.34
	300	25.09	18.17	1785	4.18
	350	30.03	19.82	2545	5.02
	360	31.02	20.13	2714	5.19
	400	35.04	21.34	3447	5.86
	450	39.73	22.77	4493	6.70
	500	44.13	23.46	5687	7.54
SW_L 45	160	3.38	6.86	148	1.56
	200	4.47	8.40	260	2.12
	220	5.03	9.15	330	2.41
	240	5.60	9.88	407	2.69
	250	5.89	10.13	450	2.83
	300	7.36	11.35	695	3.53
	350	8.87	12.47	998	4.24
	360	9.18	12.50	1066	4.38
	400	10.21	11.55	1362	4.94
SW_L 60	160	4.49	7.25	197	1.56
	200	5.93	8.86	346	2.12
	220	6.67	9.64	437	2.41
	240	7.41	10.39	539	2.69
	250	7.79	10.65	595	2.83
	300	9.70	11.89	916	3.53
	350	11.65	13.02	1311	4.24
	360	12.04	13.24	1399	4.38
	400	13.56	13.40	1783	4.94
	450	15.23	11.97	2333	5.64
	500	16.89	10.92	2964	6.35
SW_L 90	160	6.72	7.85	294	1.56
	200	8.85	9.56	516	2.12
	220	9.94	10.39	651	2.41
	240	11.03	11.19	802	2.69
	250	11.58	11.46	884	2.83
	300	14.37	12.75	1357	3.53
	350	17.21	13.91	1937	4.24
	360	17.78	14.14	2065	4.38
	400	20.09	14.99	2624	4.94
	450	22.80	13.70	3423	5.64
	500	25.34	12.72	4335	6.35

NOTE 1: The characteristics for beams within the depth range not listed in the Table can be calculated by linear interpolation.

NOTE 2: The shear stiffness shall be reduced with the factor 0.85 by using OSB as a web material.

ANNEX C MECHANICAL RESISTANCE AND STABILITY (continued)

Table C3 Characteristic bearing resistance — solid timber

Type (mm)	Joist depth (mm)	End bearing capacity (kN)				Intermediate bearing capacity (kN)			
		45 mm stiffeners		89 mm stiffeners		75 mm stiffeners		89 mm stiffeners	
		without	with	without	with	without	with	without	with
SJ 45	160	8.1	9.1	8.7	10.1	17.8	20.9	20.1	21.2
	200	8.1	9.7	8.7	10.7	17.8	21.5	20.1	21.8
	220	8.1	10.0	8.7	11.0	17.8	21.8	20.1	22.1
	240	8.1	10.3	8.7	11.3	17.8	22.1	20.1	22.4
	250	8.1	10.5	8.7	11.5	17.8	22.2	20.1	22.5
	300	8.1	11.2	8.7	12.2	17.8	23.0	20.1	23.3
	350	8.1	12.0	8.7	13.0	17.8	23.7	20.1	24.0
	360	8.1	12.1	8.7	13.1	17.8	23.9	20.1	24.2
	400	8.1	12.7	8.7	13.7	17.8	24.5	20.1	24.8
SJ 60	160	12.0	12.1	12.6	13.6	19.9	20.7	21.6	22.4
	200	12.0	12.7	12.6	14.2	19.9	21.3	21.6	23.0
	220	12.0	13.0	12.6	14.5	19.9	21.6	21.6	23.3
	240	12.0	13.3	12.6	14.8	19.9	21.9	21.6	23.6
	250	12.0	13.5	12.6	15.0	19.9	22.1	21.6	23.8
	300	12.0	14.2	12.6	15.7	19.9	22.8	21.6	24.5
	350	12.0	15.0	12.6	16.5	19.9	23.6	21.6	25.3
	360	12.0	15.1	12.6	16.6	19.9	23.7	21.6	25.4
	400	12.0	15.7	12.6	17.2	19.9	24.3	21.6	26.0
	450	10.8	16.5	11.4	18.0	18.7	25.1	20.4	26.8
	500	9.5	17.2	10.1	18.7	17.4	25.8	19.1	27.5
SJ 90	160	12.9	13.2	15.3	14.8	27.1	31.0	29.3	35.3
	200	12.9	13.8	15.3	15.4	27.1	31.6	29.3	35.9
	220	12.9	14.1	15.3	15.7	27.1	31.9	29.3	36.2
	240	12.9	14.4	15.3	16.0	27.1	32.2	29.3	36.5
	250	12.9	14.6	15.3	16.2	27.1	32.3	29.3	36.7
	300	12.9	15.3	15.3	16.9	27.1	33.1	29.3	37.4
	350	12.9	16.1	15.3	17.7	27.1	33.8	29.3	38.2
	360	12.9	16.2	15.3	17.8	27.1	34.0	29.3	38.3
	400	12.9	16.8	15.3	18.4	27.1	34.6	29.3	38.9
	450	11.7	17.6	14.1	19.2	25.8	35.3	28.1	39.7
	500	10.4	18.3	12.8	19.9	24.6	36.1	26.8	40.4

NOTE: The characteristics for beams within the depth range not listed in the Table can be calculated by linear interpolation.

Table C4 Characteristic bearing resistance — LVL flange

Type (mm)	Joist depth H (mm)	End bearing capacity (kN)						Intermediate bearing capacity (kN)					
		35 mm stiffener		45 mm stiffener		89 mm stiffener		45 mm stiffener		75 mm stiffener		89 mm stiffener	
		without	with	without	with	without	with	without	with	without	with	without	with
SJ_L 45	160	8.1	14.0	9.1	16.0	11.3	17.9	15.9	20.8	17.9	21.3	21.2	25.2
	200	8.1	14.6	9.1	16.6	11.3	18.5	15.9	21.4	17.9	21.9	21.2	25.8
	220	8.1	14.9	9.1	16.9	11.3	18.8	15.9	21.7	17.9	22.2	21.2	26.1
	240	8.1	15.2	9.1	17.2	11.3	19.1	15.9	22.0	17.9	22.5	21.2	26.4
	250	8.1	15.3	9.1	17.4	11.3	19.2	15.9	22.2	17.9	22.7	21.2	26.6
	300	8.1	16.1	9.1	18.1	11.3	20.0	15.9	22.9	17.9	23.4	21.2	27.3
	350	8.1	16.8	9.1	18.9	11.3	20.7	15.9	23.7	17.9	24.2	21.2	28.1
	360	8.1	17.0	9.1	19.0	11.3	20.9	15.9	23.8	17.9	24.3	21.2	28.2
	400	8.1	17.6	9.1	19.6	11.3	21.5	15.9	24.4	17.9	24.9	21.2	28.8
SJ_L 60	160	9.5	16.3	12.2	17.1	14.3	17.6	18.9	28.8	22.5	31.0	25.3	34.5
	200	9.5	16.9	12.2	17.7	14.3	18.2	18.9	29.4	22.5	31.6	25.3	35.1
	220	9.5	17.2	12.2	18.0	14.3	18.5	18.9	29.7	22.5	31.9	25.3	35.4
	240	9.5	17.5	12.2	18.3	14.3	18.8	18.9	30.0	22.5	32.2	25.3	35.7
	250	9.5	17.7	12.2	18.4	14.3	18.9	18.9	30.2	22.5	32.3	25.3	35.8
	300	9.5	18.4	12.2	19.2	14.3	19.7	18.9	30.9	22.5	33.1	25.3	36.6
	350	9.5	19.2	12.2	19.9	14.3	20.4	18.9	31.7	22.5	33.8	25.3	37.3
	360	9.5	19.3	12.2	20.1	14.3	20.6	18.9	31.8	22.5	34.0	25.3	37.5
	400	9.5	19.9	12.2	20.7	14.3	21.2	18.9	32.4	22.5	34.6	25.3	38.1
	450	–	–	10.9	21.4	13.0	21.9	–	–	21.3	35.3	24.0	38.8
	500	–	–	9.7	22.2	11.8	22.7	–	–	20.0	36.1	22.8	39.6
SJ_L 90	160	11.1	20.9	15.6	23.5	16.5	23.4	23.1	36.8	27.1	38.2	31.3	42.5
	200	11.1	21.5	15.6	24.1	16.5	24.0	23.1	37.4	27.1	38.8	31.3	43.1
	220	11.1	21.8	15.6	24.4	16.5	24.3	23.1	37.7	27.1	39.1	31.3	43.4
	240	11.1	22.1	15.6	24.7	16.5	24.6	23.1	38.0	27.1	39.4	31.3	43.7
	250	11.1	22.3	15.6	24.9	16.5	24.7	23.1	38.2	27.1	39.6	31.3	43.8
	300	11.1	23.0	15.6	25.6	16.5	25.5	23.1	38.9	27.1	40.3	31.3	44.6
	350	11.1	23.8	15.6	26.4	16.5	26.2	23.1	39.7	27.1	41.1	31.3	45.3
	360	11.1	23.9	15.6	26.5	16.5	26.4	23.1	39.8	27.1	41.2	31.3	45.5
	400	11.1	24.5	15.6	27.1	16.5	27.0	23.1	40.4	27.1	41.8	31.3	46.1
	450	–	–	14.4	27.9	15.3	27.7	–	–	25.8	42.6	30.1	46.8
	500	–	–	13.1	28.6	14.0	28.5	–	–	24.6	43.3	28.8	47.6

NOTE: The characteristics for beams within the depth range not listed in the Table can be calculated by linear interpolation.

ANNEX C MECHANICAL RESISTANCE AND STABILITY (continued)

Table C5 Values of k_{mod} to be used with Eurocode 5 when designing STEICO I-joist products

Duration of load	Bending and axial resistance		Shear resistance				Bearing ressistance	
	Service Class 1	Service Class 2	Service Class 1		Service Class 2		Service Class 1	Service Class 2
			HB*	OSB	HB*	OSB		
Permanent	0.60	0.60	0.42	0.48	0.34	0.42	0.60	0.60
Long term	0.70	0.70	0.56	0.59	0.45	0.53	0.70	0.70
Medium term	0.80	0.80	0.72	0.74	0.60	0.66	0.80	0.80
Short term	0.90	0.90	0.87	0.90	0.73	0.79	0.90	0.90
Instantaneous	1.10	1.10	1.10	1.10	0.93	0.99	1.10	1.10

* HB – Hard fibreboard web

Table C6 Values of k_{def} to be used with Eurocode 5 when designing STEICO I-joist products

Duration of load	Bending and axial deformation		Shear deformation			
	Service Class 1	Service Class 2	Service Class 1		Service Class 2	
			HB	OSB	HB	OSB
Permanent	0.60	0.80	2.25	1.50	3.00	2.25

Table C7 Recommended values of γ_M to be used with Eurocode 5 when designing STEICO I-joist products in absence of nationally determined parameters

Combination	Bending and axial resistance	Shear resistance	Bearing resistance
Fundamental	1.2	1.3	1.2
Accidental	1.0	1.0	1.0

Design recommendations for holes cut in web

The characteristic shear capacity for STEICO I-joist products with holes in the web can be calculated as follows:

$$V_{hole,k} = V_k \bullet k_{hole}$$

where:

V_k Characteristic shear capacity for STEICO I-joist products without holes in the web.

k_{hole} Hole strength reduction factor.

Round holes reduction factor:

$$k_{hole} = \frac{H_{Beam} - h_f - 0.9 \bullet D}{H - h_f}$$

where:

H_{Beam} depth of the beam

h_f depth of the flange

D diameter of the hole $D \le H - 2.1 \bullet h_f \le 200$ mm

This reduction in shear shall not be considered for round holes with diameter ≤ 38 mm.

Rectangular holes reduction factor:

$$k_{hole} = \min \left\{ 0.30 \cdot \left(\frac{H_{Beam}}{h_{hole}} \right)^{0.1} \cdot \left(\frac{H_{Beam}}{l_{hole}} \right)^{0.18} \cdot \left(\frac{h_{hole}}{l_{hole}} \right)^{0.2} \cdot k_{depth}; 0.9 \right\}$$

where:

H_{Beam} depth of the beam

h_{hole} height of the hole $h_{hole} \le H - 2.1 \bullet h_f \le 200$ mm

l_{hole} length of the hole $l_{hole} \le 300$ mm

k_{depth} depth factor

ANNEX C MECHANICAL RESISTANCE AND STABILITY (continued)

For beams with 200 mm ≤ H_{Beam} ≤ 400 mm:

$$k_{depth} = \left(\frac{280}{H_{Beam}}\right)^{0.8}$$

For beams with 400 mm < H_{Beam} ≤ 500 mm

$$k_{depth} = \left(\frac{H_{Beam}}{500}\right)^{1.3}$$

Notes:

1. The length to height ratio for rectangular holes must be between 0.5 and 2.0.
2. The rectangular hole equations to be used with length and height > 20 mm.
3. Reduction in shear shall not be considered for rectangular holes with maximum size of 15 mm x 40 mm.
4. All permitted position of hole to be located in the center of the web.

Guidance for holes without design

Hard fibreboard web:

Table C8 Holes without the need of individual design in hard fibreboard web

Hole Type	Number of holes in one row[1]	Minimal distance between hole edges (mm)	Location in web	Minimal beam height (mm)	Shear capacity[2] (%)
Round: *D* up to 25 mm	5	25	Anywhere	200	100
Round: *D* from 26 mm to 38 mm	3	2 x *D*	Beam axis	200	100
Rectangular: *H* x *l* ≤ 14 mm x 40 mm	1	–	Anywhere	200	100

(1) In one row means a group of holes, which are placed within minimal distance. The distance between the rows of holes should be greater than or equal to the depth of the joist.

(2) 100% means, no reduction of the shear capacity required $V_{hole,k} = V_k$.

OSB web:

Table C9 Holes without the need of individual design in OSB web

Hole Type	Number of holes in one row[1]	Minimal distance between hole edges (mm)	Location in web	Minimal beam height (mm)	Shear capacity[2] (%)
Round: *D* up to 25 mm	5	25	Anywhere	200	90
	3	50	Anywhere	220	100
Round: *D* from 26 mm to 38 mm	3	2 x *D*	Beam axis	200	80
	2	2 x *D*	Beam axis	220	100
Rectangular: *H* x *l* ≤ 14 mm x 40 mm	1	–	Anywhere	200	100

(1) In one row means a group of holes, which are placed within minimal distance. The distance between the rows of holes should be greater than or equal to the depth of the joist.

(2) 100% means no reduction of the shear capacity required: $V_{hole,k} = V_k$.
90% means a reduction of the shear capacity of 10%: $V_{hole,k} = 0.9 \times V_k$.
80% means a reduction of the shear capacity of 20%: $V_{hole,k} = 0.8 \times V_k$.

Axially loaded members

The axial load-carrying capacity of STEICO *I-joist products* should be calculated in accordance with the procedures given in Eurocode 5. The capacity should be derived from the cross-section of the I-beams as given in Annex A and the characteristic values for LVL flange material as given in Table C10. STEICO*wall* with L 17 solid timber flanges shall be calculated by using the strength values as given in EN 338 : 2003 for the strength class C 18, STEICO*joist* with L 36 solid timber flanges shall be calculated by using the strength values as given in EN 338 : 2003 for the strength class C 35. In the case of combined actions (eg compression and bending), the relevant interaction equations given in Eurocode 5 should be used.

ANNEX C MECHANICAL RESISTANCE AND STABILITY (continued)

Table C10 Characteristic values LVL flange material in N·mm^{-2} and kg·m^{-3}

Property		LVL 2.0E	LVL 1.6
Bending strength	$f_{m,k}$	48.0	26.0
Tension strength parallel to grain	$f_{t,0,k}$	36.0	16.0
Compression strength parallel to grain	$f_{c,0,k}$	36.0	22.0
Mean modulus of elasticity parallel to grain	E_{mean}	13800	11000
Characteristic modulus of elasticity parallel to grain	$E_{0,05}$	11600	10000
Characteristic density	ρ_k	480	430

The characteristic values for the HB.HLA1 hard fibreboard and OSB for designs in accordance with Eurocode 5 are given in Table C11.

Table C11 Characteristic values for HB.HLA1 and OSB web material N·mm^{-2} and kg·m^{-3}

Property		HB.HLA1	OSB/3	OSB/4
Bending strength of web edgewise parallel to beam	$f_{m,90,k}$	31.0	7.2	8.5
Tension strength of the web parallel to beam	$f_{t,90,k}$	20.0	7.2	8.5
Compression strength of the web parallel to beam	$f_{c,90,k}$	21.0	12.9	14.3
Shear strength of the web edgewise	$f_{v,k}$	14.0	6.8	6.9
Mean modulus of elasticity parallel to beam	E_{mean}	5300	3000	3200
Mean modulus of rigidity	G_{mean}	2100	1080	1090
Characteristic density	ρ_k	900	550	555

The characteristic shear strength of the web - flange joint is $f_{v,joint,k} = 2.40$ N·mm^{-2}.

Design recommendations for notches into LVL flanges

The characteristic moment capacity of the I-joist with notches on the side of the flanges can be calculated as follows:

$$M_{notch,k} = M_k \bullet k_{notch}$$

where:

$M_{notch,k}$ Characteristic moment capacity for STEICO I-joist product with notches on the side of the flanges.

M_k Characteristic moment capacity for STEICO I-joist product without notches

$$k_{notch} = \frac{b_{flange} - t_{notch}}{b_{flange}}$$

where:

b_{flange} flange width

t_{notch} depth of the notch $\leq 0.25 \bullet b_{flange}$

The maximal width of the notch parallel to the beam length is up to $2 \bullet b_{flange}$.

ANNEX D HYGROTHERMAL PROPERTIES

Hygrothermal properties in accordance with EN 12524 : 2000, are given in Table D1. The natural variation of the materials has been accounted for in these values.

Table D1 Hygrothermal properties

Material	Density[1] (mean) ρ_m (kg·m^{-3})	Design thermal conductivity λ (W·m^{-1}·K^{-1})	Specific heat capacity c_p (J·kg^{-1}·K^{-1})	Water vapour resistance factor[2] μ	
				dry	wet
LVL flanges	500	0.13	1600	50	20
Solid timber flanges	450	0.13	1600	50	20
Hard fibreboard webs	900	0.14	1700	10	20
OSB webs	600	0.13	1700	200	200

(1) The density for timber- and wood-based products is the density in equilibrium with 20°C and 65% relative humidity.
(2) Water vapour resistance factors are given as dry cup and wet cup values (see EN ISO 12572 : 2001).

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