Element Materials Technology
Rotterdam B.V.
Zekeringstraat 33
1014 BV Amsterdam
Netherlands
Tel: +31 (0) 20-55633555
www.element.com

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

Member of EOTA
www.eota.eu

European Technical Assessment

ETA 20/1175
of 15/12/2020

General Part

Technical Assessment Body Issuing the European Technical Assessment:	Element Materials Technology Rotterdam B.V.
Trade Name of the Construction Product:	JJI-Joist
Product Family to Which the Construction Product Belongs:	EC PAC 13
Manufacturer:	James Jones & Son Ltd Greshop Industrial Estate Forres Morayshire IV36 2GW
Manufacturing Plant(s):	James Jones & Son Ltd Greshop Industrial Estate Forres Morayshire IV36 2GW
This European Technical Assessment Contains:	23 Pages including 8 Annex(es) 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 130367-00-0304 – “Composite Wood-Based Beams and Columns”
This Version Replaces:	ETA 10/0335, Issued on 05/12/2016

1 Technical Description of the Product

JJI-Joists are I-shaped wood-based composites for use as beams, columns or intermediate members, for instance joists, studs or rafters. The flanges are produced from planed-all-round (PAR) softwood timber of strength class C24 which has been finger-jointed in accordance with the principles of EN 15497. The JJI-joists are manufactured with 45mm thick flanges (depth of flange), having widths ranging between 45 and 97mm. This schedule lists properties for a standard range of sizes but also provides the means to determine the properties of intermediate to standard flange sizes.

The JJI-Joists overall depth ranges from 145mm to 450mm.

The web material is formed from 9mm thick OSB and is placed in the beams in 2440mm long sections which are tongue and groove jointed to form a continuous web. The web material is cut parallel to the manufacturing direction of the OSB, therefore the strands will run parallel to the span of the I-joists.

There are three types of adhesive connection in the product: finger joints in the flanges, flange to web joints and web to web joints. A 1 component polyurethane adhesive is used for all three types of connection, although the formulation varies between types. All adhesives used conform to the requirements of EN 15425. A record of the adhesives is kept with Element Materials Technology Rotterdam B.V.

The full range of JJI-joist sizes covered by this ETA is given in Table A1.1 of Annex 1 and intermediate sizes established in accordance with the methods given in Annex 7.

2 Specification of the Intended Use(s) in Accordance with the Applicable European Assessment Document (hereinafter EAD)

JJI-Joists are intended for use as floor or flat roof joists in building constructions. They are also suitable for applications with axial loading, such as studs and rafters.

With regard to moisture behaviour of the I-joists the use is limited to service class 1 and 2 conditions as defined in EN 1995-1-1 (Eurocode 5). Under these conditions, where the moisture content does not exceed 20%, the moisture content of OSB will not exceed 14%. Assuming this moisture content is not exceeded the joists may be taken to have a service life of 50 years[1], provided that there is no mechanical damage or insect attack.

[1] An 'assumed intended working life' means that it is expected that, when an assessment following the ETA provisions is made, and when this working life has elapsed, the real working life may be, in normal use conditions, considerably longer without major degradation affecting the essential requirements.

3 Performance of the Product and References to the Methods Used for its Assessment

BWR	Characteristic	Assessment of Characteristic
1	**Mechanical Resistance and Stability**	**See ETA Section 3.1.1**
	Mechanical Resistance and Stiffness	See ETA Section 3.1.1.1
	Creep and Duration of Load	See ETA Section 3.1.1.2
	Dimensional Stability	See ETA Section 3.1.2
	Seismic Actions	See ETA Section 3.1.3
2	**Safety in Case of Fire**	**See ETA Section 3.2**
	Reaction to Fire	See ETA Section 3.2.1
	Resistance to Fire	See ETA Section 3.2.1
3	**Hygiene, Health & the Environment**	**See ETA Section 3.3**
	Content and Release of Dangerous Substances	See ETA Section 3.3.1
	Wood Preservatives	See ETA Section 3.3.2
7	**Sustainable Use of Natural Resources**	**See ETA Section 3.4**
	Durability	See ETA Section 3.4.1

3.1 Methods of Verification

3.1.1 Mechanical Resistance and Stability

The following aspects of performance are relevant to this essential requirement for the JJI-Joists.

3.1.1.1 Mechanical Resistance and Stiffness

Mechanical properties for James Jones JJI-Joists are given in Annex 2.

3.1.1.2 Creep and Duration of Load

Creep and Duration of load factors for JJI-Joists are given in Annex 3.

3.1.2 Dimensional Stability

Nominal dimensions and permissible deviations are given in Annex 3.

3.1.3 Seismic Evaluations

JJI-Joists are for use in non-dissipative or low dissipative structures.

3.2 Safety in Case of Fire

The following aspects of performance are relevant to this essential requirement for JJI-Joists.

3.2.1 Reaction to Fire

The joists consist of materials classified to have reaction to fire class D-s2, d0 for timber flange and D-s2,d2 for OSB web according to table 8 of EN 13986 using the classes defined in EN 13501-1.

3.2.2 Resistance to Fire

No performance determined. Performance in relation to Resistance to Fire would be determined for the complete structural element including any associated finishes.

3.3 Hygiene, Health and the Environment

3.3.1 Content and/or Release of Dangerous Substances

Based on the declaration by the Manufacturer, the product does not contain harmful or dangerous substances as defined in the EU database.

Note:

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 (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.

3.3.2 Wood Preservatives

On request, for use Class 2, the timber flanges may be treated with an organic based preservation system for wood at a low pressure. The treated wood is suitable without an additional coating for internal applications without release of dangerous substances.

3.4 Sustainable Use of Natural Resources

3.4.1 Durability

James Jones JJI-Joists can be used in service classes 1 and 2 according to Eurocode 5, and use classes 1 and 2 as specified in EN 335. The product may be exposed to the weather for a short time during installation. Product with treated flanges is available on request for use class 2.

3.5 General Aspects Related to the Performance of the Product

3.5.1 Manufacturing

The JJI-Joists are manufactured in the factory in accordance with the provisions of this European Technical Assessment.

Changes to the product or production process, which could result in this deposited data/information being incorrect, should be communicated to Element Materials Technology Rotterdam B.V. before the changes are introduced. Element Materials Technology Rotterdam B.V. will decide whether or not such changes affect the ETA and consequently the validity of the CE marking on the basis of the ETA and if so whether further assessment or alterations to the ETA will be necessary.

3.5.2 Installation

Refer to Annex 4 for installation instructions.

3.5.2.1 Timber Flanges

The flanges are of European redwood (*Pinus sylvestris*) and whitewood (*Picea abies*), which have natural durabilities in the region of 3 – 4 in accordance with EN 350-2:1994.

In service classes 1 and 2, where the moisture content of timbers will not exceed 20%, the risk of fungal decay is low. Durability may also be reduced by attack from insects

such as Longhorn beetle, dry wood termites and common furniture beetle (*Anobium punctatum*) in regions where these may be found.

The timber flanges are available treated with a preservative when the product is to be used under use class 2 conditions. This is a low pressure treatment conducted on the flanges before they are integrated into the product. The treatment has been demonstrated not to affect the strength of the JJI-joists. The treatment renders the flange material less susceptible to fungal decay than equivalent un-treated material.

3.5.2.2 OSB Webs

The webs are made of OSB/3 material which must comply with EN 300 requirement regarding:

- Internal bond
- Thickness swelling
- Moisture resistance

OSB/3 is a specification for load-bearing boards for use in humid conditions. OSB/3 boards have the appropriate resistance to biodegradation for use classes UC1 and UC2 as defined in EN 335 in installations where there is a possibility of occasional wetting, for instance by condensation. Prolonged wetting of OSB/3 should be avoided.

OSB/3 may be susceptible to termite attack in temperate regions where this occurs.

3.5.3 Packaging, Transport and Storage

JJI-Joists shall be protected against harmful wetting during transport and storage. The joists will arrive on site with a typical flange moisture content of 16%.

The beams must not be lifted or stored in such a way that bending around the weak axis may cause damage to the beams. On site the joists should be stacked on edge and stored out of ground contact.

JJI-Joists shall be stored to minimize changes in moisture content, caused by the weather, by storing under cover but permit free passage of air.

They should be protected from excessive sun, rain or moisture. Site storage is intended to be temporary, prior to erection. The fabrication and delivery of joists should therefore be arranged to minimize the storage time, both at the fabricator's premises and on site.

James Jones & Sons recommends that the joists should be wrapped in protective plastic covering, to protect the beams from short-term exposure to inclement weather.

The manufacturer must ensure that the information of these provisions is given to those concerned.

I-Joists damaged during storage or transport must be discarded. Only sound joists should be installed

3.5.4 Use, Maintenance & 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 damage to any joist occur during the service life, the joist should be replaced or assessed by a qualified engineer.

4 Assessment and Verification of Constancy of Performance (hereinafter AVCP) System Applied, with reference to its Legal Base

4.1 System of Attestation and Verification of Performance

According to the Decision 1999/92/EC of the European Commission, as amended, the System(s) of Assessment and Verification of Constancy of Performance (see Annex V to Regulation (EU) No 305/2011) is 1.

5 Technical Details necessary for the Implementation of the AVCP System, as provided for in the applicable EAD

5.1 Tasks for the Manufacturer

5.1.1 Factory Production Control (FPC)

The Manufacturer has a Factory Production Control (FPC) system and exercises permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of policies, procedures and work instructions. This FPC system ensures that the product is in conformity with this European Technical Assessment.

The Manufacturer shall only use raw materials or components that are supplied with the relevant inspection documents. All incoming raw materials shall be subject to inspection, verification, controls and tests (as applicable) by the manufacturer.

The results of FPC are recorded and evaluated. These records include but are not limited to:

- Product specification and designation, basic materials and components
- Type(s) of Control 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 the person responsible for FPC

These records shall be presented to Element Materials Technology Rotterdam B.V. upon request.

5.1.2 Factory Testing/Assessment

In this context, testing is taken to mean physical testing and/or visual examination of the product/process. Normally only properties related to the mechanical resistance and stability of the I-joists shall be assessed.

For I-joists a visual assessment shall include checks which are detailed in a prescribed test plan, which is part of the factory production control.

All measuring and testing equipment shall be regularly calibrated and inspected according to the documented FPC system. Production records shall be kept for each batch of I-joists for at least 10 years

5.2 Tasks for the Notified Body

5.2.1 Initial Type Testing

Initial type testing, including Sampling has been undertaken under the responsibility of Element Materials Technology Rotterdam B.V. to verify that the production line in question is able to manufacture products in conformity with this ETA.

The initial type testing has been limited to testing the beams in bending.

Whenever a change occurs in materials or production process which would significantly change the above characteristics, the tests or assessments shall be repeated for the appropriate characteristics.

5.2.2 Initial Inspection of Factory and of Factory Production Control

An assessment of each production unit shall be carried out to demonstrate that the factory production control is in conformity with the ETA and any subsidiary information. This assessment shall be based on an initial inspection of the factory..

5.2.3 Continuing Surveillance

It is recommended that the Notified Body visit each Production Unit/Factory twice a year for regular inspection. It shall be verified that the system of factory production control and the specified manufacturing process is maintained in accordance with this European Technical Assessment.

The results of product certification and continuous surveillance shall be made available on demand by the certification body or inspection body, respectively, or to Element Materials Technology Rotterdam B.V. In cases where the provisions of this European Technical Assessment and the prescribed test plan are no longer fulfilled, the conformity certificate shall be withdrawn.

Issued in Amsterdam, Netherlands on 15/12/2020

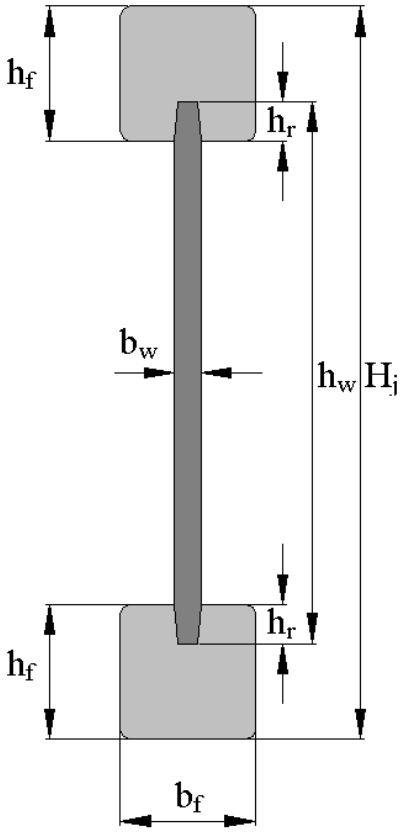
By

Niresh D Somlie

Technical Assessment Body Manager

Annex 1: Description of the Product

Figure A1.1: Cross Section of JJI-Joist



H_j = Joist height/depth

b_f = Flange width

h_f = Flange height/depth

h_w = Web height/depth

b_w = Web thickness

h_r = Web rout height

The flanges for JJI-Joists are produced from planed-all-round (PAR) softwood timber, which is of strength class C24 and has been finger-jointed in accordance with the principles of EN 15497. The flange depth (height) is 45mm, but the allowable width ranges from 45 to 97mm.

The webs are formed from 9mm OSB/3. The OSB is placed in the beams in 2440mm long sections, which are tongued and grooved jointed to form a continuous web. The web material is cut parallel to the manufacturing direction of the OSB and as such the strands will run parallel to the span of the I-joists.

The range of joist depths covered in this assessment is 145 to 450 mm.

There are three types of adhesive connection in the product: finger joints in the flanges, flange to web joints and web to web joints. A 1 component polyurethane adhesive is used for all three types of connection, although the formulation varies between types. All adhesives used conform to the requirements of EN 15425. A record of the adhesives is kept with Element Materials Technology Rotterdam B.V.

Table A1.1: Product Range and Dimensions for JJI-Joists with 9mm thick Webs

Joist Designation	Depth H_j (mm)	Flange Size $h_f \times b_f$ (mm)	Weight per metre (kg/m)
JJI-145A+	145	45 × 47	2.26
JJI-195A+	195	45 × 47	2.56
JJI-195B+		45 × 63	3.21
JJI-195C		45 × 72	3.57
JJI-195D		45 × 97	4.58
JJI-220A+	220	45 × 47	2.70
JJI-220B+		45 × 63	3.35
JJI-220C		45 × 72	3.72
JJI-220D		45 × 97	4.73
JJI-235A+	235	45 × 47	2.79
JJI-235B+		45 × 63	3.44
JJI-235C		45 × 72	3.80
JJI-235D		45 × 97	4.82
JJI-240A+	240	45 × 47	2.82
JJI-240B+		45 × 63	3.47
JJI-240C		45 × 72	3.83
JJI-240D		45 × 97	4.85
JJI-245A+	245	45 × 47	2.85
JJI-245B+		45 × 63	3.50
JJI-245C		45 × 72	3.86
JJI-245D		45 × 97	4.87
JJI-300A+	300	45 × 47	3.17
JJI-300B+		45 × 63	3.82
JJI-300C		45 × 72	4.18
JJI-300D		45 × 97	5.20
JJI-350A+	350	45 × 47	3.46
JJI-350B+		45 × 63	4.11
JJI-350C		45 × 72	4.48
JJI-350D		45 × 97	5.49
JJI-360A+	360	45 × 47	3.52
JJI-360B+		45 × 63	4.17
JJI-360C		45 × 72	4.54
JJI-360D		45 × 97	5.55
JJI-400A+	400	45 × 47	3.76
JJI-400B+		45 × 63	4.40
JJI-400C		45 × 72	4.77
JJI-400D		45 × 97	5.78
JJI-450A+	450	45 × 47	4.05
JJI-450B+		45 × 63	4.70
JJI-450C		45 × 72	5.06
JJI-450D		45 × 97	6.07

Table A1.2: Characteristic Properties for Joist Flanges to be used in Calculations taken from EN 338 for Strength Class C24

Flange Properties - All Joist Series		
Bending strength – parallel to grain (N/mm^2)	$f_{m,k}$	24
Tensile strength – parallel to grain (N/mm^2)	$f_{t,0,k}$	14
Compression strength – parallel to grain (N/mm^2)	$f_{c,0,k}$	21
Compression strength – perpendicular to grain (N/mm^2)	$f_{c,90,k}$	2.5
Shear strength – parallel to grain (N/mm^2)	$f_{v,k}$	4.0
Bending stiffness parallel to grain – mean (N/mm^2)	E_{mean}	11000
Bending stiffness parallel to grain – min (N/mm^2)	$E_{0.05}$	7400
Characteristic density (kg/m^3)	ρ_k	350
Density – mean (kg/m^3)	ρ_{mean}	420

Table A1.3: Web Properties for all JJI-Joist Series- from EN 12369-1 for OSB/3

Web Properties for Web Thickness of:		9mm
Axial tensile strength parallel to the manufacturing direction (N/mm^2)	$f_{t,0,k}$	9.9
Axial compression strength parallel to the manufacturing direction (N/mm^2)	$f_{c,0,k}$	15.9
Axial tensile strength perpendicular to the manufacturing direction (N/mm^2)	$f_{t,90,k}$	7.2
Axial compression strength perpendicular to the manufacturing direction (N/mm^2)	$f_{c,90,k}$	12.9
Panel shear strength (N/mm^2)	$f_{v,k}$	6.8
Panel shear stiffness (N/mm^2)	G_v	1080
Axial stiffness (in tension or compression) parallel to the manufacturing direction (N/mm^2)	$E_{axial,0}$	3800
Axial stiffness (in tension or compression) perpendicular to the manufacturing direction (N/mm^2)	$E_{axial,90}$	3000
The 5% characteristic values for OSB/3 stiffness properties shall be taken as 0.85 times the mean values given above		

JJI-Joists are manufactured following documented quality control systems.

Quality control procedures include checks on web, flange and adhesive materials for specification and moisture content, dimensional checks before and after preparation, verification of adhesive spread, fit of component parts and curing temperature. Manufacturing tolerances are given in Table A1.4. Regular tests are undertaken to monitor adhesive bond on the web-flange connections, shear strength and the strength of completed joists.

Table A1.4: Manufacturing Tolerances

Member Dimension	Tolerance (mm)
Overall Joist Length	- 0, + 30
Overall Joist Depth	± 2.0
Flange Thickness/Depth	± 2.0
Web Thickness	± 0.8

Annex 2: Mechanical Properties

Table A2.1 Characteristic Strength and Stiffness Properties for JJI-Joists with 9mm Web Thickness

Joist Designation	Depth (mm)	Bending moment capacity M (kNm)	Bending stiffness EI (10^9Nmm^2)	Shear strength capacity V (kN)	Shear stiffness GA (10^6N)	Intermediate bearing capacity -minimum 89mm bearing length		End bearing capacity -minimum 45mm bearing length		End bearing capacity -minimum 89mm bearing length	
						N/S (kN)	W/S (kN)	N/S (kN)	W/S (kN)	N/S (kN)	W/S (kN)
JJI-145A+	145	3.89	139.6	9.54	0.748	16.37	16.37	8.50	8.50	10.33	10.76
JJI-195A+	195	5.67	305.1	10.64	1.234	16.37	16.37	8.50	8.50	10.33	10.76
JJI-195B+		7.20	424.7	11.82	1.234	21.94	21.94	11.39	11.39	13.18	14.42
JJI-195C		8.03	505.6	12.44	1.234	25.07	25.07	12.90	13.02	13.18	16.48
JJI-195D		10.22	740.5	14.06	1.234	26.66	30.00	12.90	17.54	13.18	22.20
JJI-220A+	220	6.60	407.4	11.33	1.477	16.37	16.37	8.50	8.50	10.33	10.76
JJI-220B+		8.37	588.5	12.48	1.477	21.94	21.94	11.39	11.39	13.18	14.42
JJI-220C		9.32	667.3	13.09	1.477	25.07	25.07	12.90	13.02	13.18	16.48
JJI-220D		11.86	941.3	14.71	1.477	26.66	30.00	12.90	17.54	13.18	22.20
JJI-235A+	235	7.17	472.4	11.77	1.623	16.37	16.37	8.50	8.50	10.33	10.76
JJI-235B+		9.08	678.1	12.90	1.623	21.94	21.94	11.39	11.39	13.18	14.42
JJI-235C		10.11	771.3	13.51	1.623	25.07	25.07	12.90	13.02	13.18	16.48
JJI-235D		12.85	1088.0	15.12	1.623	26.66	30.00	12.90	17.54	13.18	22.20
JJI-240A+	240	7.35	495.0	11.92	1.671	16.37	16.37	8.50	8.50	10.33	10.76
JJI-240B+		9.32	707.6	13.05	1.671	21.94	21.94	11.39	11.39	13.18	14.42
JJI-240C		10.37	807.4	13.65	1.671	25.07	25.07	12.90	13.02	13.18	16.48
JJI-240D		13.18	1140.8	15.26	1.671	26.66	30.00	12.90	17.54	13.18	22.20
JJI-245A+	245	7.54	518.0	12.08	1.720	16.37	16.37	8.50	8.50	10.33	10.76
JJI-245B+		9.55	737.2	13.19	1.720	21.94	21.94	11.39	11.39	13.18	14.42
JJI-245C		10.64	844.4	13.80	1.720	25.07	25.07	12.90	13.02	13.18	16.48
JJI-245D		13.52	1195.4	15.40	1.720	26.66	30.00	12.90	17.54	13.18	22.20
						N/S: no web stiffeners		W/S: web stiffeners required			

Table A2.1 (Continued) Characteristic Strength and Stiffness Properties for JJI-Joists with 9mm Web Thickness

Joist Designation	Depth (mm)	Bending moment capacity M (kNm)	Bending stiffness EI (10^9Nmm^2)	Shear strength capacity V (kN)	Shear stiffness GA (10^6N)	Intermediate bearing capacity -minimum 89mm bearing length		End bearing capacity -minimum 45mm bearing length		End bearing capacity -minimum 89mm bearing length	
						N/S (kN)	W/S (kN)	N/S (kN)	W/S (kN)	N/S (kN)	W/S (kN)
JJI-300A+	300	9.67	816.3	13.86	2.255	16.37	16.37	8.50	8.50	10.33	10.76
JJI-300B+		12.21	1121.9	14.91	2.255	21.94	21.94	11.39	11.39	12.66	14.42
JJI-300C		13.58	1319.5	15.49	2.255	25.07	25.07	12.08	13.02	12.66	16.48
JJI-300D		17.22	1899.0	17.07	2.255	26.66	30.00	12.08	17.54	12.66	22.20
JJI-350A+	350	11.66	1113.5	15.61	2.741	16.37	16.37	8.50	8.50	9.72	10.76
JJI-350B+		14.68	1484.6	16.60	2.741	21.94	21.94	10.22	11.39	9.72	14.42
JJI-350C		16.31	1899.6	17.16	2.741	25.07	25.07	10.22	13.02	10.93	16.48
JJI-350D		20.65	2647.6	18.70	2.741	26.66	30.00	10.22	17.54	10.93	22.20
JJI-360A+	360	12.06	1189.7	15.97	2.838	16.37	16.37	8.50	8.50	9.24	10.76
JJI-360B+		15.18	1585.3	16.95	2.838	21.94	21.94	9.76	11.39	9.24	14.42
JJI-360C		16.86	2037.2	17.50	2.838	25.07	25.07	9.76	13.02	10.75	16.48
JJI-360D		21.34	2803.4	19.03	2.838	26.66	30.00	9.76	17.54	10.75	22.20
JJI-400A+	400	13.70	1521.6	17.43	3.227	16.37	16.37	8.20	8.50	9.23	10.76
JJI-400B+		17.20	2023.3	18.37	3.227	21.94	21.94	8.20	11.39	9.23	14.42
JJI-400C		19.09	2673.0	18.91	3.227	25.07	25.07	8.20	13.02	10.17	16.48
JJI-400D		24.12	3428.0	20.41	3.227	25.79	30.00	8.20	17.54	10.17	22.20
JJI-450A+	450	15.79	1999.3	19.31	3.713	16.37	16.37	6.79	8.50	9.23	10.76
JJI-450B+		19.77	2651.5	20.20	3.713	21.50	21.50	6.79	11.39	9.23	14.42
JJI-450C		21.92	3018.4	20.72	3.713	21.50	22.27	6.79	13.02	9.23	16.48
JJI-450D		27.64	4170.4	22.18	3.713	21.50	30.00	6.79	17.54	9.23	22.20
						N/S: no web stiffeners		W/S: web stiffeners required			

Annex 3: Creep and Duration of Load Factors

Table A3.1 Values of k_{mod} for JJI-Joists in Service Class 1 Conditions

Duration of load	Bending and axial resistance	Shear resistance	Bearing resistance	
			N/S	W/S
Permanent	0.60	0.40	0.40	0.60
Long Term	0.70	0.50	0.50	0.70
Medium Term	0.80	0.70	0.70	0.80
Short Term	0.90	0.90	0.90	0.90
Instantaneous	1.10	1.10	1.10	1.10
N/S = No Web Stiffeners used. W/S = Web Stiffeners required				

Table A3.2 Values of k_{mod} for JJI-Joists in Service Class 2 Conditions

Duration of Load	Bending and Axial Resistance	Shear Resistance	Bearing Resistance	
			N/S	W/S
Permanent	0.60	0.30	0.30	0.60
Long Term	0.70	0.40	0.40	0.70
Medium Term	0.80	0.55	0.55	0.80
Short Term	0.90	0.70	0.70	0.90
Instantaneous	1.10	0.90	0.90	1.10
N/S = No Web Stiffeners used. W/S = Web Stiffeners required				

Table A3.3 Values of k_{def} for JJI-Joists

Bending and Axial Deformation		Shear Deformation	
Service Class 1	***Service Class 2***	***Service Class 1***	***Service Class 2***
0.60	0.80	1.50	2.25

Annex 4: Installation Instructions

The technical manual of the manufacturer shall be followed; current examples of details are given below. The following points are especially critical.

1 JJI-Joists shall be installed on the basis of a specific structural design for each installation, using the load-bearing capacities given in Annex 2 of this ETA.

2 Actions at joist supports shall not exceed the bearing resistance given in Annex 2.

3 The joists shall be installed by appropriately qualified personnel, following an installation plan and relevant construction details worked out for each individual building project. The installation plan shall be based on the manufacturer's general guide and provisions for installing JJI-Joists.

4 Temporary bracing should be used to keep the JJI-Joists in a straight and plumb position during installation and to avoid instability. I-joists should be handled similar to solid timber beams, except that their strength and stiffness is less around their minor axis. Hence care must be taken to ensure that joists are not damaged during handling due to bending around this axis.

5 The flanges must not be drilled, notched or material otherwise removed on site.

6 Significantly damaged I-joists should not be used.

7 In common with similar timber based products, it is recommended that eye protection and dust masks be used when cutting.

The manufacturer shall ensure that the information of these provisions is given to those concerned.

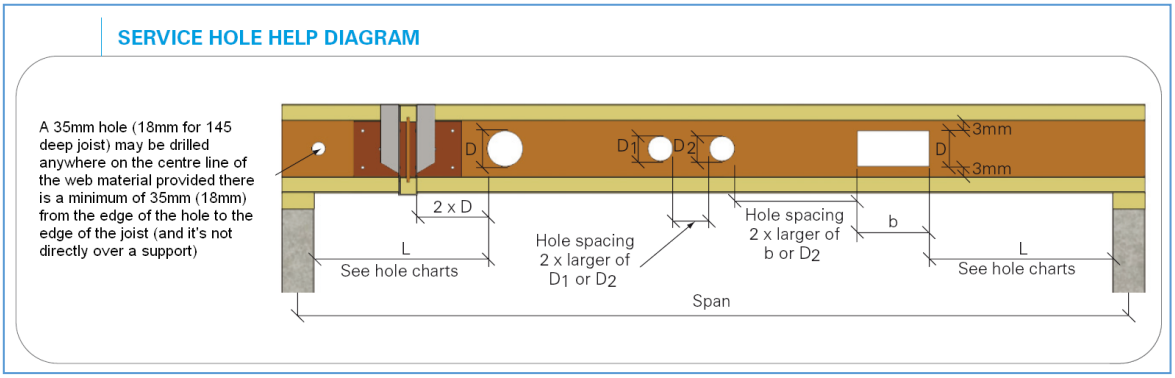
Annex 5: Shear Strength of Joists with Service Holes

Service holes must not be cut in the JJI-Joist flange.

The maximum size of a service hole that can be cut in the web at a particular location depends on the specific load configuration on the joist, because of this it is not possible to provide general rules that apply to all cases. The following should be considered when cutting service holes:

- Where more than one hole is to be cut, the minimum spacing between holes should be 2***L***, where ***L*** is the length of a square or rectangular hole or diameter of a circular hole.
- Holes should be cut on the centreline of the web where possible.
- The rectangular hole width ***b*** should not exceed 1.5 times the height ***D***. Refer to Figure A5.1.
- All holes should be cut carefully taking care not to over-cut. Radiused corners to square cut holes are desirable. Flanges should never be cut.
- Where holes are required in the rim and header joists of timber frame construction the manufacturer should be contacted for advice.
- Holes should not be placed above supports or below load bearing partitions.
- With the exception of JJI 145A+ joists 35mm holes can be placed along the centreline without causing a detrimental reduction in shear capacity.
- 18mm holes can be placed in JJI 145A+ joists along the centreline without causing a detrimental reduction in shear capacity.
- If in doubt contact the manufacturer.

Figure A5.1 Service Holes Diagram



(Note that the hole charts have been replaced with the calculation method below.)

In addition to the clauses stated above, the shear capacity $V_{k,hole}$ of JJI-Joists with circular and rectangular should be determined by calculation.

For joist depths between 195 and 450mm the effect of holes should be calculated from equations 5.1, 5.2, 5.3 or 5.4 according to the type (circular/square or rectangular) and value of the web opening (Z).

Three calculation cases are described below.

Case 5a: Circular/square holes with $Z \leq 0.2$ and rectangular holes with $Z \leq 0.1$

Case 5b: Circular/square holes with $0.2 < Z \leq 1.0$ and rectangular holes with $0.1 < Z \leq 0.8$

Case 5c: Rectangular holes with $Z > 0.8$

Where $Z = \left(\frac{D}{H_j - (2 \times h_f)}\right)$

D = Hole diameter, square or rectangle height (mm)
H_j = Joist depth (mm)
h_f = Flange depth (mm)

Case 5a: Circular / square holes with $Z \leq 0.2$; rectangular holes with $Z \leq 0.1$

$$V_{k,hole} = V_{k,a} = \min \begin{Bmatrix} b_w \times h_w \times \left(1 + 0.5 \times \frac{h_{f,t} + h_{f,c}}{h_w}\right) \times f_{v,k} \\ V_k \end{Bmatrix} \quad \text{for} \quad h_w \leq 35 b_w \qquad \text{Equation 5.1}$$

$$V_{k,hole} = V_{k,b} = \min \begin{Bmatrix} 35 \times b_w^2 \times \left(1 + 0.5 \times \frac{h_{f,t} + h_{f,c}}{h_w}\right) \times f_{v,k} \\ V_k \end{Bmatrix} \text{ for } 35 b_w \leq h_w \leq 70 b_w \qquad \text{Equation 5.2}$$

Where:

$h_w = H_j - 2 \times (h_f - h_r)$ $\qquad$ $h_{f,t} = h_{f,c} = h_f$

$V_{k,hole}$ = Characteristic shear capacity of a JJI-Joist with a hole (N)
$V_{k,a}$ = Characteristic shear capacity of the JJI-Joist with a hole to Equation 5.1 (N)
$V_{k,b}$ = Characteristic shear capacity of the JJI-Joist with a hole to Equation 5.2 (N)
V_k = Characteristic shear capacity of the JJI-Joist
$f_{v,k}$ = Characteristic web panel shear capacity (N/mm²)
H_j = Joist depth (mm)
b_w = Web thickness (mm)
h_w = Web height (mm)
h_f = Flange depth (mm)
$h_{f,t}$ = Flange depth on the tension edge (mm)
$h_{f,c}$ = Flange depth on the compression edge (mm)
h_r = Rout depth (mm)

Case 5b: Circular / square holes with $0.2 < Z \leq 1.0$; rectangular holes with $0.1 < Z \leq 0.8$

$$V_{k,hole} = \min \begin{Bmatrix} K_b + b_w \times h_w \times \left(1 - \frac{N \times D}{H_j - (2 \times h_f)}\right)^{2.3} \times f_{v,k} \\ V_{k,a} \text{ or } V_{k,b} \end{Bmatrix} \qquad \text{Equation 5.3}$$

Where:

$$K_b = 3615.55 \times \left(\frac{h_f \times b_f - h_r \times b_r}{b_w \times H_j - (2 \times h_f) + 2 \times b_r \times h_r}\right)^{0.5}$$

K_b = Flange contribution to hole shear capacity (N)
$V_{k,hole}$ = Characteristic shear capacity of a JJI-Joist with a hole (N)
$V_{k,a}$ = Characteristic shear capacity of the JJI-Joist with a hole to Equation 5.1 (N)
$V_{k,b}$ = Characteristic shear capacity of the JJI-Joist with a hole to Equation 5.2 (N)
$f_{v,k}$ = Characteristic web panel shear from Table A1.3 (N/mm²))
N = Hole type. N = 1 for square or circular holes; N = 1.25 for rectangular holes
D = Hole diameter, square or rectangle height (mm)
b_w = Web thickness (mm)
h_w = Web height (mm)
H_j = Joist depth (mm)
h_f = Flange depth (mm)

b_f = Flange width (mm)
h_r = Rout depth (mm)
b_r = Average rout width (mm)

Case 5c: Rectangular holes with Z>0.8

$$V_{k,hole} = 0.8 \times K_b \quad \text{Equation 5.4}$$

Where:
K_b = as defined in Case 5b (N)
$V_{k,hole}$ = Characteristic shear capacity of a JJI-Joist with a hole (N)

For joist depth 145A+ the characteristic shear capacity of circular holes should be calculated according to equation 5.5 and the characteristic shear capacity for rectangular holes to equation 5.6

$$V_{k,hole} = 0.05 \times Z + 8.46 \quad \text{Equation 5.5}$$

$$V_{k,hole} = 0.05 \times Z + 8.43 \quad \text{Equation 5.6}$$

Where:
$V_{k,hole}$ = Characteristic shear capacity of a JJI-Joist with a hole (kN)
Z = web opening as defined above

Annex 6: Web Stiffeners

Web stiffeners shall be used when dictated by design. The following diagram illustrates how they should be installed. Characteristic Values when web stiffeners are used can be found in Table A2.1.

Figure A6.1 Web Stiffener Use

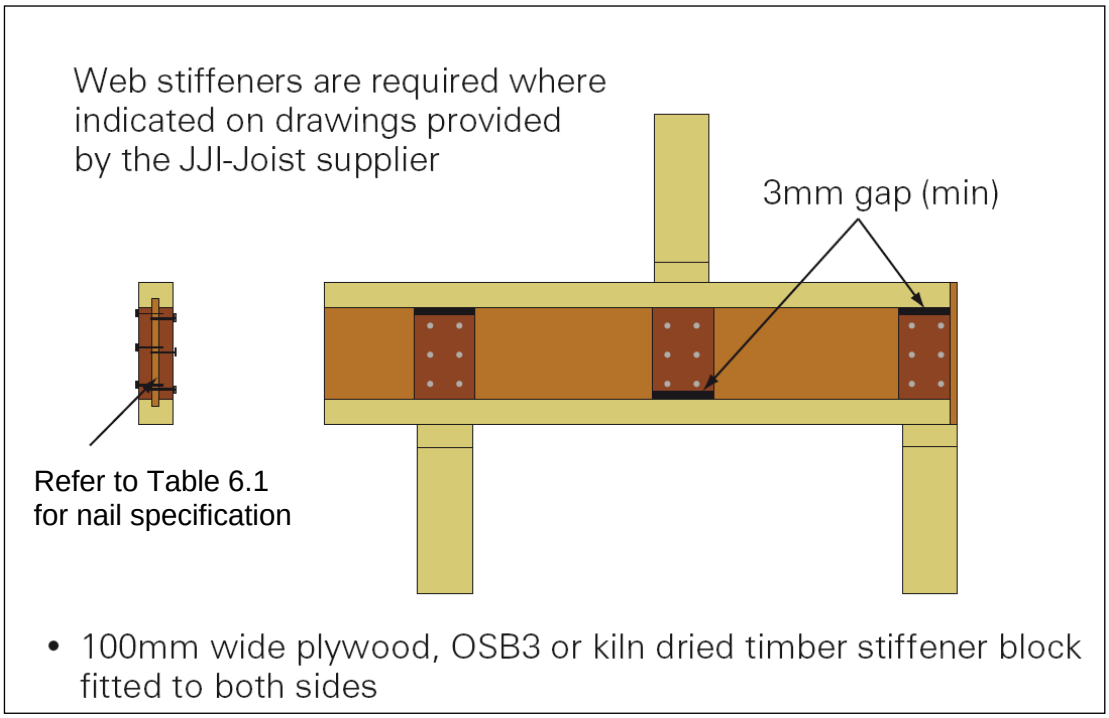


Table A6.1 Web Stiffener Material Dimensions

Flange Size	Thickness of Web Stiffener (mm)	Nail Diameter (mm)	Length of Nails (mm)
A+	19	3.35	65
B+	27	3.35	65
C	31	3.35	65
D	44	3.35	90

Annex 7: Characteristic Values for Intermediate Joist Sizes

Strength values for intermediate joists sizes were derived using the method agreed with Element Materials Technology Rotterdam B.V. Shear stiffness capacities can be derived from OSB properties and joist dimensions.

To derive bending stiffness capacities (EI) for intermediate joist depth the equations in Table A7.1 can be used if the depth is within the given range in the table.

To derive EI for intermediate flange widths linear interpolation is permitted between existing joist widths – extrapolation is not permitted.

Table A7.1 Equations for derivation of EI Values for Intermediate Joist Depths

Flange Size	EI Equation	Range of Depths Covered
A+	$EI_{A+} = 1.03 \times 10^{-5} {H_j}^3 + 0.00331 {H_j}^2 + 1.3016 H_j - 150.157$	145 – 300mm
B+	$EI_{B+} = 2.4044 \times 10^{-4} {H_j}^3 - 0.170845 {H_j}^2 + 46.36 H_j - 3902$	195 – 300mm
C	$EI_{C} = 6.75 \times 10^{-5} {H_j}^3 - 0.0322 {H_j}^2 + 11.1 H_j - 935$	195 – 400mm
D	$EI_{D} = -9.30 \times 10^{-5} {H_j}^3 + 0.104 {H_j}^2 - 23.1 H_j + 1980$	195 – 450mm

EI values outside the range of depths covered by Table A7.1 should be determined taking E_{mean} for the flange from Table A1.2 and $E_{axial,0}$ for the web from Table A1.3. The moment of inertia should be determined from first principles, taking the stiffness of the web into account.

Annex 8: Axially Loaded Members

The axial load-bearing capacity of JJI-joist products should be calculated in accordance with EN1995-1-1 (Eurocode 5). For combined actions (e.g. compression and bending), the appropriate interaction equations should be used.

The capacity should be derived from the cross-section of the JJI-joists as given in Table A1.1 and the characteristic values for the flange material given in Table A1.2.

The contribution of the web to the axial load bearing capacity should be neglected. However, the web may be considered to restrain the flanges from in-plane bending.