



## Evaluation Report CCMC 13493-R

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### ***JSI 2000, 3000 and 4000 Series I-joist***

#### ***1. Opinion***

It is the opinion of the Canadian Construction Materials Centre (CCMC) that “JSI 2000, 3000 and 4000 Series I-joist” when used as joists in floor applications in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code 2005:

- Clause 1.2.1.1.(1)(a), Division A, using the following acceptable solutions from Division B:
  - Article 4.3.1.1., Design Basis for Wood, (CAN/CSA-O86-01 for I-joist qualification), and
- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
  - Sentence 9.23.4.2.(2), Spans for Joists, Rafters and Beams (i.e. alternative floor joist solution).

This opinion is based on CCMC's evaluation of the technical evidence in Section 4.1 provided by the Report Holder.

#### ***2. Description***

“JSI 2000, 3000 and 4000 Series I-joists” are prefabricated wood I-joists consisting of two continuous flanges and an oriented strandboard (OSB) web as described in Table 2.1.

Finger-jointed flanges are both produced internally and purchased from qualified suppliers.

The “JSI 2000, 3000 and 4000 Series I-joists” are produced by inserting a glued and profiled web into a tapered groove in the top and bottom flanges, thus providing a pressure-glued joint. Consecutive web segments are end-spliced with a tongue-and-groove joint to form a continuous web. Phenol-resorcinol adhesives complying with CSA O112.7-M1977, "Resorcinol and Phenol Resorcinol Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing)," are used to bond the joints: the adhesive used for the flange end joint is CCMC 13057-L and the one used for the web-to-web and web-to-flange joints is CCMC 13051-L.

Third-party quality auditing, which includes monthly in-plant inspections, is conducted by APA EWS (Engineered Wood Association).

**Table 2.1 “JSI 2000, 3000 and 4000 Series I-joists”**

Joist Series	Flange Dimensions (mm)	Flange Type and Grade	Web Thickness	Range of Joist Depths (mm)
JSI 2000	38 x 64	1 650f-1.5E SPF, Proprietary Graded	10 mm <sup>(1)</sup>	241-406
JSI 3000	38 x 64	2 100f-1.8E SPF, Proprietary Graded		241-406
JSI 4000	38 x 89	2 100f-1.8E SPF		241-508

(1) The OSB web conforms to CAN/CSA-O325.0-92, "Construction Sheathing," and/or PS2.

### **3. Conditions and Limitations**

CCMC's compliance opinion in Section 1 is bound by the “JSI 2000, 3000 and 4000 Series I-joist” being used in accordance with the conditions and limitations set out below.

- “JSI 2000, 3000 and 4000 Series I-joists” are intended for structural applications, such as floor, ceiling or roof joists, and are intended for dry service use<sup>(1)</sup> applications only.

*(1) All lumber, wood-based panels and proprietary engineered wood products are intended for “dry service conditions.” “Dry service” is defined as the in-service environment under which the equilibrium moisture content (MC) of lumber is 15% or less over a year and does not exceed 19% at any time. Wood contained within the interior of dry, heated or unheated buildings has generally been found to have a MC between 6% and 14% according to season and location. During construction, all wood-based products should be protected from the weather to ensure that the 19% MC is not exceeded in accordance with the NBC 2005, Division B, Article 9.3.2.5.*

- The following pre-engineering has been provided to CCMC by Jager Engineered Wood Products Ltd. to demonstrate compliance to Part 9 of Division B of the NBC for acceptance by the local authority having jurisdiction (AHJ):

i) Jager’s Pre-engineered Floor Span Charts

When “JSI 2000, 3000 and 4000 Series I-joists” are used as floor joists in simple (single) span applications supporting uniform loads only, the installation must be in accordance with the vibration-controlled floor span tables (including NBC 2005 Code-specified vibration criteria\*) found in Jager documentation, in limit states design for Canada, entitled:

- "JSI User Guide – for Canada," dated February 18, 2010.

JSI joist installation details noted in this document are suitable for those applications falling within the scope of the documents. Applications outside the scope of these installation guidelines shall require engineering on a case-by-case basis.

*\* In cases where concrete topping is applied or bridging/blocking is used and joists are installed at the maximum spans, the current vibration criteria may not address all occupant performance expectations. Jager Engineered Wood Products Ltd. should therefore be consulted for span adjustments, if necessary, in these types of installations.*

- ii) Jager’s Pre-engineered Installation Details

“JSI 2000, 3000 and 4000 Series I-joists” are to be installed in accordance with the APA EWS-specified installation details outlined in 3(i) above and are limited in scope to building designs where the anticipated loads on the following structural details are not exceeded:

- Web Stiffener Requirements (page 5)
- Floor Spans (pages 6-7)

- Web Hole Tables (pages 12-16)
- Floor Layout Details (page 16)
- JSI Joist Blocking Resistance (page 17)
- Squash Block Resistance (page 17)
- JSI Load Bearing Cantilever Resistance (pages 8-11 and 18)
- Filler or Backer Block for Double I-joists (page 20)

- iii) Engineering Required

For structural applications beyond the scope/limitations of the above-referenced Jager Engineered Wood Products Ltd. publication or when required by the authority having jurisdiction, the drawings or related documents shall bear the authorized seal of a professional engineer skilled in wood design and licensed to practice under the appropriate provincial or territorial legislation.

Installations beyond the scope/limitations of 3(i) and 3(ii) imply, but are not limited to, the following:

- rim board resistance
- higher loads/longer spans than the manufacturer's pre-engineered details
- concentrated loads
- offset bearing walls
- areas of high wind or high seismicity
- stair openings
- roof spans
- design of supporting wall studs/beams when total load exceeds the NBC 2005 pre-engineered floor/roof joist tables
- design of supporting foundation footings when total load exceeds the NBC 2005 pre-engineered floor/roof joist tables (sentence 9.15.3.4.(2)).

The engineer shall design in accordance with CAN/CSA-O86-01, "Engineering Design in Wood," and may use, as a guide, the *Engineering Guide for Wood Frame Construction* published by the Canadian Wood Council.

- iv) Engineering Support Provided by Manufacturer

APA EWS provides engineering and product support in conjunction with Jager Engineered Wood Products Ltd.

APA EWS: 1-253-620-7400

APA EWS e-mail: help@apawood.org

This product must be identified with the phrase "CCMC 13493-R" along the side of the product. This CCMC number is only valid when it appears in conjunction with the APA-EWS Certification Mark.

#### **4. Technical Evidence**

CCMC's Technical Guide for "JSI 2000, 3000 and 4000 Series I-joist" sets out the nature of the technical evidence required by CCMC to enable it to evaluate a product as an acceptable or alternative solution in compliance with the NBC 2005. The Report Holder has submitted (i) the CCMC specified testing, summarized in the Appendix, and (ii) derived design values, as outlined below, for CCMC's evaluation. Testing was conducted at independent laboratories recognized by CCMC. The corresponding test results for "JSI 2000, 3000 and 4000 Series I-joist" are summarized below.

**4.1 NBC 2005 Compliance Data for “JSI 2000, 3000 and 4000 Series I-joist” on which CCMC Based its Opinion in Section 1**

**4.1.1 General**

**4.1.1.1 Design Values**

**Table 4.1.1.1 Engineering Properties of “JSI 2000, 3000 and 4000 Series I-joists”<sup>(1)</sup>**

Joist Series	Joist Depth (mm)	Factored Moment Resistance <sup>(2)</sup> (kN·mm)	Factored Shear Resistance (kN)	Factored End Reaction <sup>(3)</sup> (kN)		Factored Intermediate Reaction <sup>(4)</sup> (kN)	EI <sup>(5)</sup> x10 <sup>6</sup> (kN·mm <sup>2</sup> )	K <sup>(6)</sup> (kN)
				Bearing Length				
				38 mm	44 mm			
JSI 2000	241	6 167	7.86	7.51	7.58	15.16	554	21 973
	302	7 994	9.97	8.14	8.42	17.55	947	27 489
	356	9 629	12.01	8.14	8.42	17.55	1 383	32 381
	406	11 162	13.83	8.14	8.42	17.55	1 885	37 007
JSI 3000	241	8 524	7.86	7.51	7.58	15.16	663	21 973
	302	11 049	9.97	8.14	8.42	17.55	1 136	27 489
	356	13 293	12.01	8.14	8.42	17.55	1 676	32 381
	406	15 413	13.83	8.14	8.42	17.55	2 293	37 007
JSI 4000	241	12 075	7.86	7.51	7.58	17.34	918	21 973
	302	15 649	9.97	8.42	8.99	19.38	1 570	27 489
	356	18 852	12.01	8.42	8.99	21.20	2 301	32 381
	406	21 851	13.83	8.42	8.99	21.20	3 134	37 007
	457	24 710	15.66	8.42	8.99	21.20	4 012	41 633
	508	27 353	17.48	8.42	8.99	21.20	5 082	46 259

**Notes to Table 4.1.1.1:**

(1) The tabulated values are for the standard term of load duration ( $K_D = 1.0$ ). All values, except EI and K, are permitted to be adjusted for other load durations as permitted by the Code.

- (2) The factored bending moment resistance of I-joists shall not be increased by any Code-allowed system effect factor.
- (3) Factored end reaction of the I-joist with a bearing length of 38 mm or 44 mm without bearing stiffeners. Higher end reactions are permitted. For a bearing length of 102 mm, the end reaction may be set equal to the tabulated shear value. Interpolation of the end reaction between 38 mm and 102 mm bearing is permitted. For end reaction values over 10.88 kN, bearing stiffeners are required. For the 457 mm and 508 mm joist depths with a bearing length of 38 mm or 44 mm with bearing stiffeners, the end reaction may be set equal to 11.93 kN and 13.97 kN, respectively
- (4) Factored intermediate reaction of the I-joist with a minimum bearing length of 89 mm without bearing stiffeners. Higher intermediate reactions are permitted. For the 457 mm and 508 mm joist depths with bearing stiffeners, the intermediate reaction may be set equal to 27.94 kN.
- (5) EI = bending stiffness of the I-joist.
- (6) K = coefficient of shear deflection.

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## APPENDIX A

The design values obtained from testing to ASTM D 5055-04, “Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists,” as specified in CAN/CSA-O86-01, are summarized below. The manufacturer’s published pre-engineered joist spans were designed in accordance with CAN/CSA-O86-01.

**Table A1. Additional Test Information for “JSI 2000, 3000 and 4000 Series I-joists”**

Property	Test Information
Shear Resistance	The shear capacity of “JSI 2000, 3000 and 4000 Series I-joists” was established in accordance with ASTM D 5055-04. Shear values for these series are based on the test data from a minimum of ten (10) specimens at each web/flange combination and at the critical depths as per Section 6.2.3 of ASTM D 5055-04.
Bending Moment Resistance	The moment capacity qualification was carried out using the analytical method in accordance with ASTM D 5055-04. Data from flange tension quality control (QC) tests have been used to establish the applicable coefficient of variation, CV <sub>w</sub> , and the reliability normalization factor from CSA O86-01 was used to determine the factored bending moment resistance.
Stiffness	Stiffness capacity was tested in accordance with Section 6.5.2 of ASTM D 5055-04. The following formula was used to predict mid-span deflection:  $\text{deflection} = \frac{5wL^4}{384EI} + \frac{wL^2}{K}$ <p>where w = load (kN/m), L = span (mm), EI (kN·mm<sup>2</sup>) is taken from Table 4.1.1.1, and K = shear constant is taken from Table 4.1.1.1.</p>
End joints	End joints were qualified as part of the flange tension qualification. The flanges are in-plant finger-joined, and regular tension testing is conducted.
Creep	“JSI 2000, 3000 and 4000 Series I-joists” specimens were tested for creep performance as per ASTM D 5055-04, whereby the specimens are loaded to 1.5 times the resistive moment capacity (design) and the average deflection recovery must exceed 90% of the basic dead load deflection. The specimens recovered more than 90% of the basic dead load deflection.
Bearing length	The maximum end and intermediate reaction properties given in Table 4.1.1.1 were tested on at least ten (10) samples of each critical I-joist configuration and flange width for each I-joist depth. The reaction capacity exceeded the design reaction capacity for all tests. Linear interpolation of the end reaction capacity between the design reaction capacity at 38 mm of bearing and the design shear capacity at 102 mm of bearing is permitted.
Adhesive qualification	The adhesives used comply with CSA O112.7-M1977, “Resorcinol and Phenol Resorcinol, Resin Adhesives for Wood (Room- and Intermediate-Temperature

	Curing).” (CCMC 13051-L, CCMC 13057-L)
Web stock	The web stock complies with CAN/CSA-O325.0-92, “Construction Sheathing.” and/or PS2.
Manufacturing Quality Assurance	The manufacturing quality assurance program includes requirements specified in ASTM D 5055-04 and is verified by the third-party agency, APA-EWS, as part of the product certification. The quality assurance program also includes proprietary grading, random sampling and on-going testing at the plant. The third-party certification agency ensures that the quality control measures are adequate to maintain the published design values at each plant.