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DIVISION: 06—WOOD AND PLASTICS
Section: 06170—Prefabricated Structural Wood

REPORT HOLDER:

INTERNATIONAL BEAMS INC.
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EVALUATION SUBJECT:

IB-400, IB-600, IB-800, IB-900 I-JOISTS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2003 *International Building Code*® (IBC)
- 2003 *International Residential Code*® (IRC)
- 1997 *Uniform Building Code*™ (UBC)
- BOCA® *National Building Code/1999* (BNBC)
- 1999 *Standard Building Code*® (SBC)

Properties evaluated:

Structural

2.0 USES

IB-400, IB-600, IB-800, IB-900 I-joists are prefabricated wood I-joists used as floor joists, roof rafters, and blocking panels to support code-required loads. Prefabricated wood I-joists described in this report comply with Section 2303.1.2 of the IBC, for allowable stress design; Section R502.1.4 of the IRC; Section 2313.5 of the BNBC; Section 2301.4.11 of the SBC; and Section 2303, Item 5.1, of the UBC.

3.0 DESCRIPTION

3.1 General:

IB I-joists are prefabricated wood I-joists with solid sawn lumber flanges and oriented strand board (OSB) webs. The top and bottom flanges are parallel, creating constant-depth joists. The web-to-web and web-to-flange connections are proprietary tongue-and-groove glued joints. The joists are manufactured in depths ranging from 9¹/₄ inches (235 mm) to 20 inches (508 mm) and in lengths up to 48 feet (14 640 mm). See Table 1 for joist dimensions.

3.2 Material Specifications:

3.2.1 Flanges: The flange lumber is spruce, complying with the specifications given in the I-joist manufacturer's quality

control documentation. The specifications are an in-house upgrade of the grading standard, resulting in an enhanced grade. See Table 1 for flange lumber grades and dimensions.

3.2.2 Webs: Web material for IB I-joists is Exposure 1 grade OSB as described in DOC PS2 and complying with the I-joist manufacturer's quality control documentation. See Table 1 for OSB thickness.

3.2.3 Adhesive: Adhesives used in the fabrication of the IB I-joists comply with ASTM D 2559, and are specified in the I-joist manufacturer's quality control manual and manufacturing standards.

4.0 INSTALLATION

4.1 General:

Design and installation of IB I-joists are to comply with Sections 4.2 through 4.12 of this report, the manufacturer's published installation instructions, and the applicable code. The manufacturer's published installation instructions are to be available at the jobsite at all times during installation.

4.2 Structural Capacity:

Table 2 specifies the allowable moments, allowable reactions, allowable vertical shear forces, joist stiffness (EI) and shear deflection coefficients (K) for the I-joists.

4.3 Fasteners:

Allowable capacities and required spacing of fasteners installed in the flanges are to be determined in accordance with the applicable code for fasteners installed in sawn lumber with a maximum specific gravity of 0.42.

4.4 Web Stiffeners:

See footnotes to Table 2 for stiffener requirements. See Figure 2 for typical web stiffener details.

4.5 Lateral Support:

The compression flange of the joists needs to have continuous lateral support. The joists need to be restrained at ends and bearing locations to prevent rollover. Code-prescribed methods of lateral restraint specified for sawn lumber are acceptable. Bridging is not required for floor and roof IB I-joist applications.

4.6 Holes:

Holes in joist webs are permitted for the conditions specified in Table 3. Sizes, locations, and other criteria for holes in joist webs not specified in Table 3 have not been evaluated and are outside the scope of this report.

4.7 Duration of Load:

Adjustments to the allowable loads for IB I-joists for duration of load are to be made in accordance with Section 2.3.2 of the AF&PA National Design Specification for Wood

referenced in the applicable code, or Items 5 and 6 of UBC Section 2316.2, as applicable.

4.8 In-service Moisture Conditions:

I-joists may only be installed where the in-service moisture content of the wood does not exceed 16 percent.

4.9 Repetitive-member Use:

The repetitive-member use factors applicable to the allowable moment capacities listed in Table 2 are limited to 1.0.

4.10 Member Spans:

Allowable shear values are to be compared to calculated shear loads which include all loads between support faces. Allowable moment and deflection values are to be compared to calculated moments and deflections based on the joist span from centerline of support to centerline of support.

4.11 Deflection:

Deflection of joists under design loads is not to exceed the maximum allowable deflection specified in the applicable code.

Deflection of joists is to be calculated using the following formulae:

$$\Delta_{Total} = \Delta_{Bending} + \Delta_{Shear}$$

where:

$\Delta_{Bending}$ = Deflection due to bending using standard engineering formulae [inches (mm)].

Δ_{Shear} = $(8M)/K$.

where:

M = Design moment [inch-lbf (mm-N)].

K = Shear deflection coefficient from Table 2 [lbf (N)].

Deflection of a uniformly loaded, simple-span I-joist is to be determined using the following formula:

$$\Delta_{Total} = \frac{5wL^4}{384EI} + \frac{wL^2}{K}$$

Deflection of a simple-span I-joist with a concentrated load at mid-span is to be determined using the following formula:

$$\Delta_{Total} = \frac{PL^3}{48EI} + \frac{2PL}{K}$$

where:

Δ_{Total} = Total I-joist deflection [inches (mm)].

w = Applied uniform loads [lbf/inch (N/mm)].

P = Applied concentrated load [lbf (N)].

L = I-joist span [inches (mm)].

EI = I-joist stiffness from Table 2 [$\text{in}^2\text{-lbf}$ ($\text{mm}^2\text{-N}$)].

K = Shear deflection coefficient from Table 2 [lbf (N)].

4.12 Blocking Panels:

Bearing walls perpendicular to and supported by IB joists at the end or intermediate supports, or both, require full-depth blocking. IB joists up to 16 inches (406 mm) in depth, when used as blocking panels, have a maximum vertical load transfer capacity of 2,000 plf (28 186 N/m). IB joists over 16 inches (406 mm) and up to 20 inches (508 mm) in depth, when used as blocking panels, have a maximum vertical load transfer capacity of 1,250 plf (18 240 N/m).

5.0 CONDITIONS OF USE

The IB-400, IB-600, IB-800, and IB-900 I-joists described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 IB I-joists must be designed and installed in accordance with this report and the manufacturer's published installation instructions. In the event of a conflict, this report shall govern.
- 5.2 Drawings and design details verifying compliance with this report must be submitted to the code official for approval. The drawings and calculations are to be prepared by a registered design professional when required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.3 Cutting and notching of IB I-joist flanges is not permitted, except for cutting to proper length for installation.
- 5.4 IB I-joists are manufactured in Pohenegamook, Quebec, Canada, under a quality control program with inspections conducted by APA—The Engineered Wood Association (AA-649).

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Prefabricated Wood I-Joists (AC14), dated June 2004 (editorially corrected April 2005).

7.0 IDENTIFICATION

IB I-joists are stamped with the manufacturer's name (International Beams, Inc.), the joist series, the mill number, a date code, the name of the inspection agency (APA), and the evaluation report number (ESR-1290).

TABLE 1—DESCRIPTION OF IB I-JOISTS

SERIES	DEPTH (in.)	FLANGE			WEB THICKNESS (in.)
		Width (in.)	Thickness (in.)	Grade ¹	
IB-400	9 ¹ / ₄	2 ¹ / ₂	1 ¹ / ₂	#2 & better or MSR 1650F _b -1.5E	3 ³ / ₈
	9 ¹ / ₂				
	11 ¹ / ₄				
	11 ⁷ / ₈				
	14				
IB-600	9 ¹ / ₂	2 ¹ / ₂	1 ¹ / ₂	MSR 2100F _b -1.8E	3 ³ / ₈
	11 ⁷ / ₈				
	14				
IB-800	9 ¹ / ₂	3 ¹ / ₂	1 ¹ / ₂	MSR 2100F _b -1.8E	3 ³ / ₈
	11 ⁷ / ₈				
	14				
IB-900	11 ⁷ / ₈	3 ¹ / ₂	1 ¹ / ₂	MSR 2400F _b -2.0E	7 ⁷ / ₁₆
	14				
	16				
	18				
	20				

For SI: 1 inch = 25.4 mm.

¹These grades are enhanced in accordance with the manufacturer's quality control documentation.

TABLE 2—ALLOWABLE DESIGN VALUES¹

SERIES	DEPTH (in.)	BENDING STIFFNESS, EI x10 ⁶ (lbf-in ²)	ALLOWABLE MOMENT, M ² (lbf-ft)	ALLOWABLE SHEAR, V (lbf)	END REACTION, ER ³ (lbf)	INTERMEDIATE REACTION, IR ⁴ (lbf)	K x10 ⁶ (lbf)
IB-400	9 ¹ / ₄	185	2,715	1,155	1,080	2160	4.81
	9 ¹ / ₂	198	2,800	1,185			4.94
	11 ¹ / ₄	296	3,410	1,405	1,200	2500	5.85
	11 ⁷ / ₈	336	3,630	1,480			6.18
	14	494	4,370	1,750			7.28
	16	673	5,065	2,000			8.32
IB-600	9 ¹ / ₂	235	3,860	1,185	1,080	2160	4.94
	11 ⁷ / ₈	399	5,000	1,480	1,200	2500	6.18
	14	585	6,020	1,750			7.28
	16	799	6,980	2,000			8.32
IB-800	9 ¹ / ₂	326	5,465	1,185	1,100	2390	4.94
	11 ⁷ / ₈	552	7,080	1,480	1,280	2760	6.18
	14	807	8,530	1,750		3020	7.28
	16	1,094	9,890	2,000		8.32	
IB-900	11 ⁷ / ₈	604	8,825	1,925	1,400	3355	6.18
	14	884	10,630	2,125			7.28
	16	1,199	12,325	2,330			8.32
	18	1,570	13,490	2,525	1,230	3025	9.36
20	1,980	14,980	2,720	10.40			

For SI: 1 inch = 25.4 mm; 1 lbf. = 4.45N; 1 lbf.-in.² = 2.87 kN-mm²; 1 lbf.-ft. = 1.345 N-m.

¹The tabulated values are design values for normal duration of load. All values, except for EI and K, shall be permitted to be adjusted for other load durations as permitted by the code for solid sawn lumber.

²Moment capacity (M) of the IB-joint is not permitted to be increased by any code-allowed repetitive member use factor.

³End reaction (ER) of the IB-joint with a minimum bearing length of 1³/₄ inches without bearing stiffeners. Higher end reactions are permitted. For a bearing length of 4 inches (5 inches for 14-, 16-, 18- and 20-inch-deep joists), the end reaction may be set equal to the tabulated shear value. Interpolation of the end reaction between 1³/₄ and 4 inches (5 inches for 14-, 16-, 18- and 20-inch-deep joists) bearing is permitted. For end reaction values over 1550 lbf, bearing stiffeners are required.

⁴Intermediate reaction (IR) of the IB-joint with a minimum bearing length of 3¹/₂ inches without bearing stiffeners.

TABLE 3—HOLE SIZES AND MINIMUM ALLOWABLE DISTANCE FROM FACE OF ALL JOIST SUPPORTS TO CENTER OF HOLE

Joist Designation	Joist Depth	Span Adjustment Factor	MINIMUM DISTANCE FROM INSIDE OF ANY SUPPORT TO CENTER OF HOLE (ft-in.)																			
			Round Hole Diameter (in.)																			
			2	3	4	5	6	6 ¹ / ₄	7	8	8 ⁵ / ₈	9	10	10 ³ / ₄	11	12	12 ³ / ₄	13	14	14.8	15	16
IB 400	9 ¹ / ₄	14.17	2-6	3-6	4-6	5-6	6-6															
	9 ¹ / ₂	14.42	2-6	3-6	4-6	5-6	6-6	6-6														
	11 ¹ / ₄	15.92	1-6	2-6	3-6	4-6	5-6	5-6	6-6	7-6	8-0											
	11 ⁷ / ₈	16.42	1-0	2-0	3-0	4-0	5-0	5-6	6-0	7-0	7-6											
	14	18	0-6	1-0	2-0	3-0	4-0	4-0	5-0	6-0	6-6	7-0	8-0	8-6								
	16	19.42	0-6	0-6	0-6	2-0	3-0	3-0	4-0	5-0	5-6	6-0	7-0	7-6	8-0	9-0	9-6					
IB 600	9.5	16.92	3-6	4-6	5-6	6-6	7-6	8-0														
	11 ⁷ / ₈	19.33	2-6	3-6	4-6	5-6	6-6	7-0	7-6	8-6	9-0											
	14	20.00	1-0	2-0	3-0	4-0	5-0	5-0	6-0	7-0	7-6	8-0	9-0	9-6								
	16	20.00	0-6	0-6	1-0	2-0	3-0	3-6	4-0	5-0	5-6	6-0	7-0	8-0	8-0	9-0	10-0					
IB 800	9.5	18.92	4-6	5-6	6-6	7-6	8-6	9-0														
	11 ⁷ / ₈	22.00	4-0	5-0	6-0	7-0	8-0	8-0	9-0	10-0	10-6											
	14	24.08	3-0	4-0	5-0	6-0	7-0	7-0	8-0	9-0	9-6	10-0	11-0	11-6								
	16	24.08	1-0	2-0	3-0	4-0	5-0	5-6	6-0	7-0	7-6	8-0	9-0	10-0	10-0	11-0	12-0					
IB 900	11 ⁷ / ₈	23.00	1-6	3-0	4-6	5-6	7-0	7-0	8-0	9-6	10-0											
	14	26.08	1-6	3-0	4-0	5-0	6-6	6-6	7-6	9-0	9-6	10-0	11-0	12-0								
	16	26.83	0-6	1-6	2-6	4-0	5-0	5-6	6-0	7-6	8-0	8-6	9-6	10-6	11-0	12-0	13-0					
	18	24.17	0-6	0-6	0-6	1-0	2-0	2-0	3-0	4-0	5-0	5-6	6-6	7-6	7-6	8-6	9-6	10-0	11-0	11-6		
	20	24.17	0-6	0-6	0-6	0-6	0-6	0-6	1-6	2-6	3-0	3-6	4-6	5-6	5-6	7-0	7-6	8-0	9-0	10-0	10-0	11-0

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 psf = 47.88 Pa.

¹This table may be used for I-joists spaced 24 inches on center or less and is valid for maximum simple or multiple spans based on 20 psf dead load and 40 psf live load.

²Hole location distance is measured from inside face of supports to center of hole.

³Distances in this chart are based on uniformly loaded joists that meet the span requirements.

⁴For continuous joists with more than one span, use the longest span to determine hole location in either span.

⁵The sides of square holes or longest sides of rectangular holes should not exceed three fourths of the diameter of the maximum round hole permitted at that location.

⁶Where more than one hole is necessary, the distance between adjacent hole edges must exceed twice the diameter of the largest round hole or twice the size of the largest square hole or twice the length of the longest side of the longest rectangular hole, and each hole must be sized and located in accordance with the requirements of Table 3.

⁷A 1¹/₂-inch-diameter hole can be placed anywhere in the web provided that it meets the requirements of Note 6 above.

⁸A group of round holes at approximately the same location are permitted if they meet the requirements for a single round hole circumscribed around them.

⁹This table is based on I-joists being used at their maximum span. If the I-joists are placed at less than their full allowable span, the minimum distance from the centerline of the hole to the face of any support, as given above, may be reduced as follows:

$$D_{reduced} = \frac{L_{actual} \times D}{SAF}$$

where:

$D_{reduced}$ = Distance from the inside face of any support to center of hole, reduced for less than maximum span applications (ft). The reduced distance shall not be less than that shown in Table 4, below.

L_{actual} = The actual measured span distance between the inside faces of supports (ft).

SAF = Span Adjustment Factor given in Table 3.

D = The distance from the inside face of any support to center of hole given in Table 3.

TABLE 4—REDUCED DISTANCES

Hole diameter in inches	2	3	4	5	6	6 ¹ / ₄	7	8	8 ⁵ / ₈	9	10	10 ³ / ₄	11	12	12 ³ / ₄
Minimum distance in feet	0.5	0.5	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2

For SI: 1 inch = 25.4 mm; 1 foot = 305 mm.

Note: Reduced distances for holes greater than 12³/₄ inches in diameter must be justified to the satisfaction of the code official.

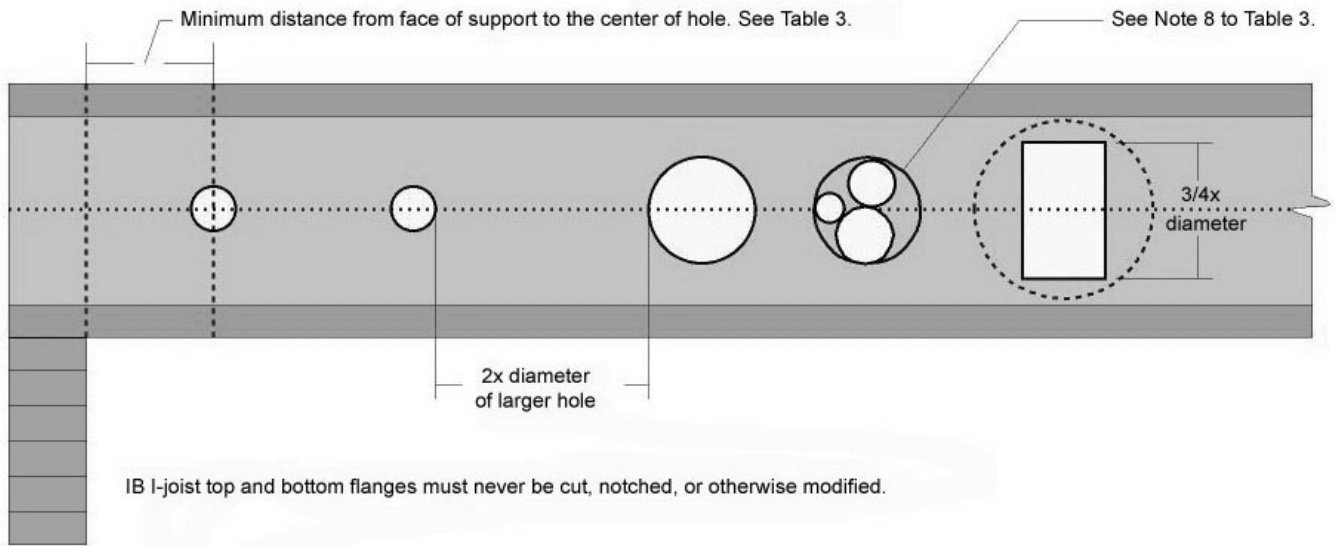


FIGURE 1—HOLES

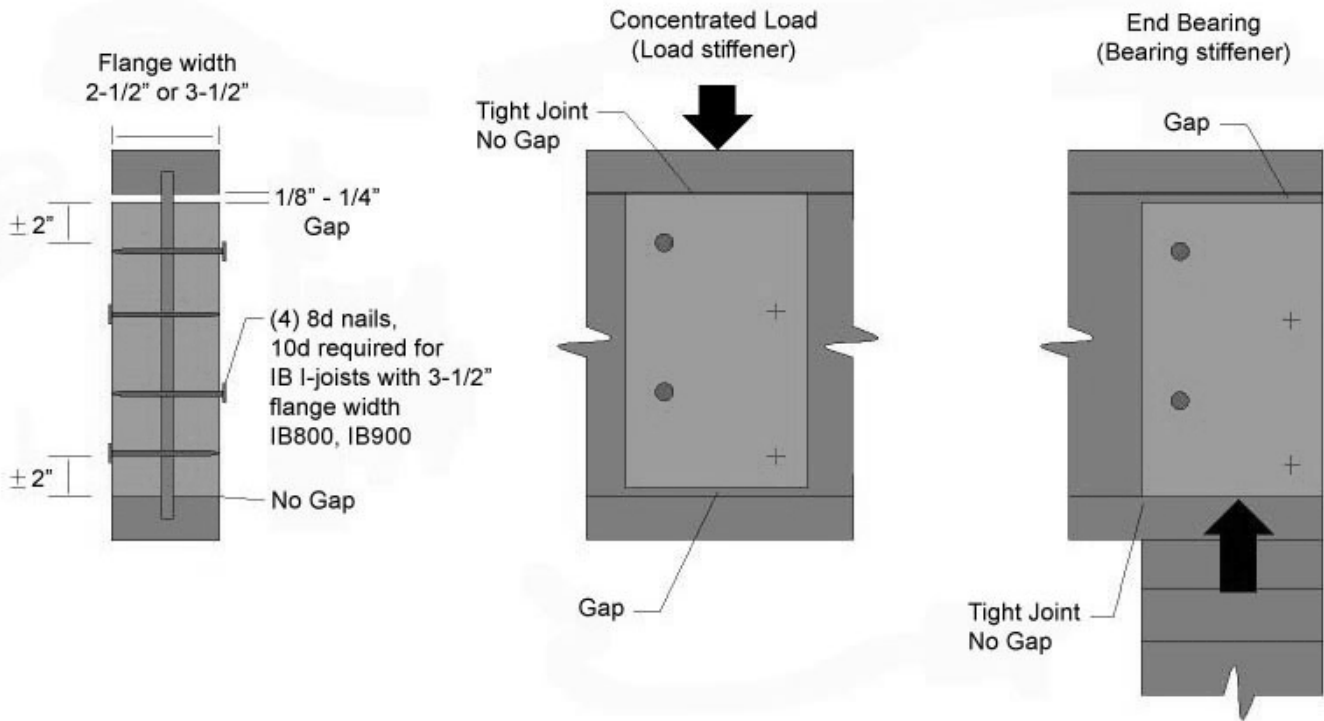


FIGURE 2—WEB STIFFENERS