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

REPORT HOLDER:

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EVALUATION SUBJECT:

JSI SERIES PREFABRICATED WOOD I-JOISTS: JSI 2000 SERIES, JSI 3000 SERIES, JSI 4000 SERIES, JSI 4400 SERIES

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2003 *International Building Code*® (IBC)
- 2003 *International Residential Code*® (IRC)
- 1997 *Uniform Building Code*™ (UBC)

Properties evaluated:

Structural

2.0 USES

The JSI Series Prefabricated Wood I-Joists described in this report are used as floor joists, roof rafters, and blocking panels.

3.0 DESCRIPTION

3.1 General:

JSI Series I-joists consist of solid-sawn finger-jointed lumber flanges and oriented strand board (OSB) webs bonded together with exterior-grade adhesives to form an I-shaped cross section. Top and bottom flanges are parallel, to create a constant-depth joist. The web-to-flange connection is a proprietary, glued, tongue-and-groove joint. The web is mechanically pressed into the flange groove, forming a self-locking joint. Web-to-web connections between the OSB panels consist of full-depth, V-shaped glued joints. JSI Series I-joists have depths ranging from 9¹/₄ inches (235 mm) to 20 inches (508 mm).

3.1.1 JSI 2000 Series: JSI 2000 Series joists are fabricated with machine-stress-rated (MSR) grade 1650f-1.5E sawn nominally 2-by-3 spruce-pine-fir (SPF) flanges. The joists have depths ranging from 9¹/₄ inches (235 mm) to 16 inches (406 mm).

3.1.2 JSI 3000 Series: JSI 3000 Series joists are fabricated with MSR grade 2100f-1.8E sawn nominally 2-by-3 SPF flanges. The joists have depths ranging from 9¹/₄ inches (235 mm) to 16 inches (406 mm).

3.1.3 JSI 4000 Series: JSI 4000 Series joists are fabricated with MSR grade 2100f-1.8E sawn nominally 2-by-4 SPF flanges. They have depths ranging from 9¹/₄ inches (235 mm) to 20 inches (508 mm).

3.1.4 JSI 4400 Series: JSI 4400 Series joists are fabricated with MSR grade 2400f-2.0E sawn nominally 2-by-4 SPF flanges. They have depths ranging from 11⁷/₈ inches (302 mm) to 20 inches (508 mm).

3.2 Material:

3.2.1 Flanges: Flanges consist of MSR lumber conforming to the specifications in the JSI Prefabricated Wood I-Joist Quality Control Manual. Flange species, grade, thickness and width are provided in Table 1 of this report.

3.2.2 Webs: Webs consist of ³/₈-inch-thick (9.5 mm) Exposure 1 OSB conforming to the Performance Standard for Wood-Based Structural Use Panels, PS-2, and specifications in the JSI Prefabricated Wood I-Joist Quality Control Manual.

3.2.3 Adhesives: The adhesive used in the fabrication of JSI Series I-joists is an exterior-type phenol-resorcinol formaldehyde resin, complying with ASTM D 2559 and the specifications in the JSI Prefabricated Wood I-Joist Quality Control Manual.

4.0 INSTALLATION

4.1 General:

Installation of JSI Series I-joists must comply with this report, the manufacturer's published installation instructions, and engineering calculations and details for the specific application. The manufacturer's published installation instructions must be available at the jobsite at all times during installation.

4.2 Allowable Design Values:

Allowable design values for JSI Series I-joists are given in Table 2. With the exception of EI and K, the allowable design values given in Table 2 may be adjusted for the appropriate load duration factor as permitted by the applicable code. The allowable reactions are based on bearing lengths of 1¹/₂ inches (38 mm) and 1³/₄ inches (44 mm) for end supports, and 3¹/₂ inches (89 mm) at intermediate supports for continuous spans. The repetitive member use factor for moment capacity of JSI Series I-joists is 1.00.

4.3 In-Service Moisture Conditions:

The joist properties and allowable loads in this report are based on interior installations with dry conditions of use. Dry

conditions of use are those environmental conditions represented by sawn lumber in which the equilibrium moisture content is less than 16 percent. Use of the I-joists in installations where the moisture content exceeds 16 percent is beyond the scope of this report.

4.4 Member Spans:

When use is as simply supported or continuous bending members, JSI joist spans are to be taken as the distance between the faces of the supports, plus one half of the required bearing length at each end. When use is as cantilevered bending members, JSI joist spans are to be taken as the distance from the end of the joist to the face of the support, plus one half of the required bearing length. When shear forces are calculated, it is not permitted to neglect loads within a distance from the supports equal to the depth of the joist.

4.5 Web Stiffeners:

Where required by Table 2 and the notes to Figure 1, web stiffeners must be installed. Web stiffeners must consist of either utility-grade SPF sawn lumber or better, or wood structural panel material meeting PS2. Requirements for web stiffener dimensions and installation are given in Table 3 and Figure 1.

4.6 Blocking:

Where JSI Series I-joists support load-bearing walls that are perpendicular to the length of the joists, full-depth blocking is required to transfer loads to the wall or foundation below. JSI Series I-joists up to 16 inches in depth may be used as full-depth blocking panels. When used as blocking panels, JSI Series I-joists that are 9¹/₄, 9¹/₂, 11¹/₄, 11⁷/₈, 14, and 16 inches (235, 241, 286, 302, 356, and 406 mm) in depth have a maximum vertical load transfer capacity of 2,000 pounds per linear foot (29.2 kN/m).

4.7 Lateral Support:

Compression flanges require continuous lateral support, and joist ends require restraint to prevent rollover. This may be provided either by sheathing attached to the top flange and to the end wall (where the top flange is in compression), or by blocking. Methods specified in the applicable code for lateral support of solid-sawn lumber are acceptable.

4.8 Holes in the Web:

Holes installed in the webs of JSI Series I-joists must comply with Figure 2 and Table 4.

4.9 Deflection:

The deflection of JSI Series I-joists must be calculated by using the standard engineering formulae for deflection due to bending and the following formula for deflection due to shear:

$$\Delta_{shear} = \frac{8M}{K}$$

The deflection of a simple-span JSI joist with a uniformly distributed load must be determined using the following formula:

$$\Delta = \frac{5\omega L^4}{384EI} + \frac{\omega L^2}{K}$$

The deflection of a simple-span JSI joist with a concentrated load applied at mid-span must be determined using the following equation:

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

where:

Δ = Deflection (in).

Δ_{shear} = Deflection due to shear (in).

M = Maximum bending moment (lb-in).

K = Shear deflection coefficient from Table 2 (lb).

ω = Uniform load (lb/in).

L = Effective span (in).

EI = Bending stiffness from Table 2 (lb-in²).

P = Concentrated load (lb).

5.0 CONDITIONS OF USE

The JSI Series Prefabricated Wood 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 Design calculations and details for specific applications must be furnished to the code official. Calculations and drawings must be prepared, signed, and sealed by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.2 Installation must be in accordance with this report, the manufacturer's published installation instructions, and engineering calculations and details for the specific application. If there are any conflicts between this report and the manufacturer's published instructions, the instructions within this report govern.
- 5.3 Use of JSI Series I-joists is limited to interior applications in accordance with Section 4.3.
- 5.4 No cutting or drilling of the flanges is permitted. The location and size of holes in the webs must conform to the requirements set forth in Figure 2 and Table 4.
- 5.5 JSI Series I-joists are manufactured under an approved quality control program at Jager Building Systems, Inc., plants located in Blainville, Quebec, Canada; Bolton, Ontario, Canada; and Calgary, Alberta, Canada; 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

Each JSI joist must be marked with the product trademark (JSI); the joist series (2000, 3000, 4000, or 4400); the production date; the evaluation report number (ESR-2077); the trademark of the inspection agency (APA); the name and logo of the manufacturer (Jager); and the manufacturer's plant location or number. See Figure 3.

TABLE 1—FLANGE MATERIAL SPECIFICATIONS FOR JSI SERIES I-JOISTS

JOIST SERIES	NOMINAL DIMENSIONS (in.)	SPECIES	GRADE
JSI 2000	2x3	Spruce-pine-fir	MSR 1650f-1.5E
JSI 3000	2x3	Spruce-pine-fir	MSR 2100f-1.8E
JSI 4000	2x4	Spruce-pine-fir	MSR 2100f-1.8E
JSI 4400	2x4	Spruce-pine-fir	MSR 2400f-2.0E

TABLE 2—ALLOWABLE DESIGN VALUES FOR JSI SERIES I-JOISTS¹

JOIST DEPTH (in)	JOIST SERIES	SELF WEIGHT (lb/ft)	MOMENT ⁷ (lb-ft)	SHEAR (lb)	END REACTION ² (lb)		INTERMEDIATE REACTION ⁴ (lb)	E ^f (lb-in ² ×10 ⁶)	K ⁶ (lb×10 ⁶)
					BEARING LENGTH				
					1½ in.	1¾ in.			
9¼	JSI 2000	2.49	2675	1080	1060	1065	2120	181	4.81
	JSI 3000	2.59	3665	1080	1060	1065	2120	216	4.81
	JSI 4000	3.34	5190	1080	1060	1065	2435	301	4.81
9½	JSI 2000	2.52	2735	1120	1070	1080	2160	193	4.94
	JSI 3000	2.62	3780	1120	1070	1080	2160	231	4.94
	JSI 4000	3.37	5355	1120	1070	1080	2470	320	4.94
11¼	JSI 2000	2.71	3360	1340	1145	1165	2410	289	5.85
	JSI 3000	2.81	4605	1340	1145	1165	2410	344	5.85
	JSI 4000	3.56	6525	1340	1145	1165	2680	478	5.85
11⅞	JSI 2000	2.78	3545	1420	1160	1200	2500	330	6.18
	JSI 3000	2.88	4900	1420	1160	1200	2500	396	6.18
	JSI 4000	3.63	6940	1420	1200	1280	2760	547	6.18
	JSI 4400	3.76	8485	1420	1200	1280	2760	600	6.18
14	JSI 2000	3.02	4270	1710	1160	1200	2500	482	7.28
	JSI 3000	3.11	5895	1710	1160	1200	2500	584	7.28
	JSI 4000	3.87	8360	1710	1200	1280	3020	802	7.28
	JSI 4400	4.00	10215	1710	1200	1280	3020	876	7.28
16	JSI 2000	3.24	4950	1970	1160	1200	2500	657	8.32
	JSI 3000	3.34	6835	1970	1160	1200	2500	799	8.32
	JSI 4000	4.09	9690	1970	1200	1280	3020	1092	8.32
	JSI 4400	4.22	11845	1970	1200	1280	3020	1186	8.32
18	JSI 4000	4.31	10960	2230	1700 ³	1990 ³	3020	1398	9.36
	JSI 4400	4.44	13390	2230	1700 ³	1990 ³	3020	1546	9.36
20	JSI 4000	4.53	12130	2490	1700 ³	1990 ³	3020	1771	10.40
	JSI 4400	4.66	14825	2490	1700 ³	1990 ³	3020	1956	10.40

For **SI**: 1 inch = 25.4 mm, 1 pound = 4.4482 N, 1 lb-ft = 1.3558 N-m, 1 lb-in² = 2.8698 kN-mm², 1 lb/ft = 14.594 N/m.

¹Allowable design values, except EI and K, may be adjusted for the appropriate load duration factor as permitted by the applicable code.

²Allowable end reactions of I-joists with a bearing length of 1½ inches (38 mm) or 1¾ inches (44 mm) are for I-joists without bearing stiffeners; except as shown in shaded areas. For a bearing length of 4 inches (102 mm), the allowable end reaction may be set equal to the tabulated allowable shear value. Interpolation of allowable end reactions between the 1½-inch (38 mm) and 4-inch (102 mm) bearing lengths is permitted. For end reaction values over 1550 lb (6.89 kN), bearing stiffeners are required.

³For the 18- and 20-inch (457 and 508 mm) joist depths, bearing stiffeners must be used at end reactions.

⁴Allowable intermediate reactions are for I-joists without bearing stiffeners, and a minimum intermediate reaction bearing length of 3½ inches (89 mm). For the 18- and 20-inch (457 and 508 mm) joist depths, the allowable intermediate may be set equal to 3980 lb (17.7 kN) where bearing stiffeners are used.

⁵Bending stiffness (EI) for the I-joist.

⁶Coefficient of shear deflection (K) for the I-joist.

⁷Repetitive member use factor is equal to 1.00.

TABLE 3—WEB STIFFENER MATERIAL, SIZE AND FASTENER REQUIREMENTS^{1,2,3}

JOIST SERIES	WEB STIFFENER MATERIAL	MIN. STIFFENER CROSS-SECTION DIMENSION (in.)	FASTENERS
JSI 2000 & 3000	Wood structural panel	1" x 2 ⁵ / ₁₆ "	Four 8d box nails
	Sawn lumber	1 ¹ / ₂ " x 2 ¹ / ₂ "	Four 10d box nails
JSI 4000 & 4400	Wood structural panel	1" x 2 ⁵ / ₁₆ "	Four 8d box nails
	Sawn lumber	1 ¹ / ₂ " x 2 ¹ / ₂ "	Four 10d box nails

For SI: 1 inch = 25.4 mm.

¹Stiffeners of equal size and material must be applied opposite each other on both sides of the web.

²See Figure 1 for details on stiffener placement and application.

³Minimum allowable nail dimensions for equivalent air gun nail substitution:

8d box = 2.5" long x 0.109" diameter

10d box = 3.0" long x 0.120" diameter

TABLE 4—ALLOWABLE LOCATION OF ROUND HOLES IN WEBS OF JSI SERIES I-JOISTS^{1,2,3,4,5,6}

JOIST DEPTH (in.)	JOIST SERIES	MINIMUM DISTANCE FROM INSIDE FACE OF ANY SUPPORT TO CENTER OF HOLE														
		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
9 ¹ / ₄	JSI 2000	1'-0"	2'-6"	3'-6"	5'-0"	6'-6"										
	JSI 3000	2'-6"	4'-0"	5'-6"	7'-0"	8'-6"										
	JSI 4000	3'-6"	5'-0"	6'-6"	8'-0"	10'-0"										
9 ¹ / ₂	JSI 2000	1'-0"	2'-0"	3'-6"	5'-0"	6'-6"	6'-6"									
	JSI 3000	2'-6"	4'-0"	5'-0"	6'-6"	8'-0"	8'-6"									
	JSI 4000	3'-6"	5'-0"	6'-6"	8'-0"	9'-6"	10'-0"									
11 ¹ / ₄	JSI 2000	0'-6"	1'-0"	2'-0"	3'-6"	5'-0"	5'-0"	6'-6"	8'-0"							
	JSI 3000	1'-6"	3'-0"	4'-0"	5'-6"	7'-0"	7'-0"	8'-6"	10'-6"							
	JSI 4000	3'-0"	4'-0"	5'-6"	7'-0"	8'-6"	9'-0"	10'-6"	12'-6"							
11 ⁷ / ₈	JSI 2000	0'-6"	0'-6"	1'-6"	3'-0"	4'-6"	4'-6"	5'-6"	7'-0"	8'-6"						
	JSI 3000	1'-0"	2'-6"	3'-6"	5'-0"	6'-6"	6'-6"	8'-0"	9'-6"	11'-0"						
	JSI 4000	2'-6"	4'-0"	5'-0"	6'-6"	8'-0"	8'-6"	10'-0"	12'-0"	13'-0"						
	JSI 4400	2'-6"	4'-0"	5'-0"	6'-6"	8'-6"	9'-0"	10'-6"	12'-6"	13'-6"						
14	JSI 2000	0'-6"	0'-6"	0'-6"	1'-0"	2'-6"	2'-6"	3'-6"	5'-0"	6'-0"	6'-6"	8'-0"	10'-0"			
	JSI 3000	0'-6"	0'-6"	1'-0"	2'-0"	3'-6"	4'-0"	5'-6"	7'-0"	8'-0"	9'-0"	11'-0"	13'-0"			
	JSI 4000	1'-0"	2'-6"	3'-6"	5'-0"	6'-6"	6'-6"	8'-0"	10'-0"	11'-0"	12'-0"	14'-0"	15'-6"			
	JSI 4400	1'-0"	2'-6"	3'-6"	5'-0"	7'-0"	7'-6"	8'-6"	10'-6"	11'-6"	12'-6"	14'-6"	16'-0"			
16	JSI 2000	0'-6"	0'-6"	0'-6"	0'-6"	0'-6"	1'-0"	2'-0"	3'-6"	4'-0"	4'-6"	6'-0"	7'-0"	7'-6"	9'-6"	11'-6"
	JSI 3000	0'-6"	0'-6"	0'-6"	0'-6"	0'-6"	1'-0"	2'-6"	4'-0"	5'-0"	5'-6"	8'-0"	9'-6"	10'-0"	12'-6"	15'-0"
	JSI 4000	0'-6"	0'-6"	1'-0"	2'-6"	4'-0"	4'-6"	6'-0"	7'-6"	8'-6"	9'-6"	11'-0"	13'-0"	13'-6"	16'-0"	18'-0"
	JSI 4400	0'-6"	0'-6"	1'-0"	2'-6"	4'-0"	4'-6"	6'-0"	7'-6"	9'-0"	9'-6"	12'-0"	13'-6"	14'-0"	17'-0"	18'-6"
18	JSI 4000	0'-6"	0'-6"	2'-0"	3'-0"	4'-6"	5'-0"	6'-0"	7'-0"	8'-0"	8'-6"	10'-0"	11'-0"	11'-6"	13'-6"	15'-0"
	JSI 4400	0'-6"	2'-0"	3'-0"	4'-6"	6'-0"	6'-0"	7'-0"	8'-6"	9'-6"	10'-0"	11'-6"	13'-0"	13'-0"	15'-0"	16'-6"
20	JSI 4000	0'-6"	0'-6"	0'-6"	1'-6"	3'-0"	3'-0"	4'-0"	5'-6"	6'-6"	7'-0"	8'-0"	9'-6"	9'-6"	11'-0"	12'-6"
	JSI 4400	0'-6"	0'-6"	0'-6"	2'-0"	3'-0"	3'-6"	4'-6"	6'-0"	7'-0"	7'-6"	9'-6"	10'-6"	11'-0"	13'-0"	14'-6"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

¹Distances in this table apply to uniformly loaded joists, simple or continuous span, with dead loads of 10 psf (479 Pa) and live loads of 40 psf (1920 Pa).

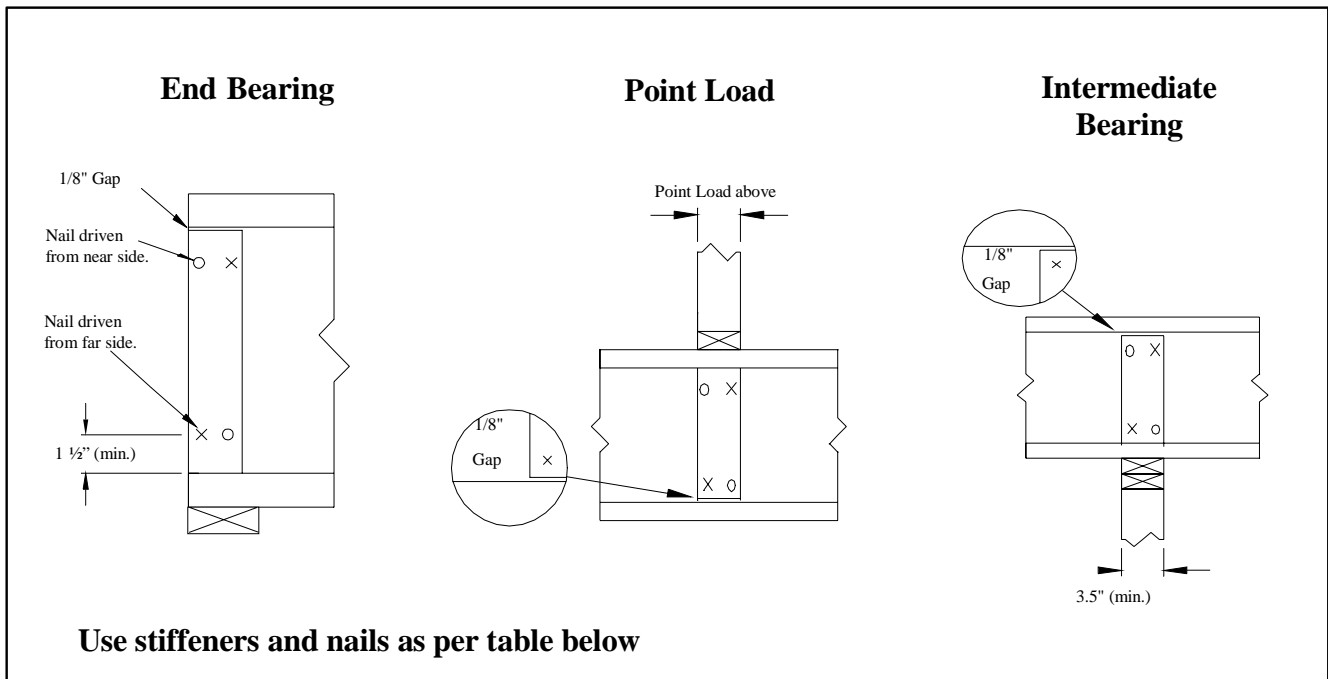
²Hole location distance is measured from inside face of support to center of hole.

³Minimum distances are valid for I-joist spacing of 24 inches (610 mm) o.c. or less, where decking is glued and nailed to top flanges. Where joist spacing is 24 inches (610 mm) o.c., min. 2³/₃₂-inch (18.3 mm) OSB decking must be used. Where spacing is less than 24 inches (610 mm) o.c., min. 1⁹/₃₂-inch (15.1 mm) OSB decking must be used.

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

⁵See Figure 2 for illustration of hole placement.

⁶Based on a maximum live load deflection of L/360.

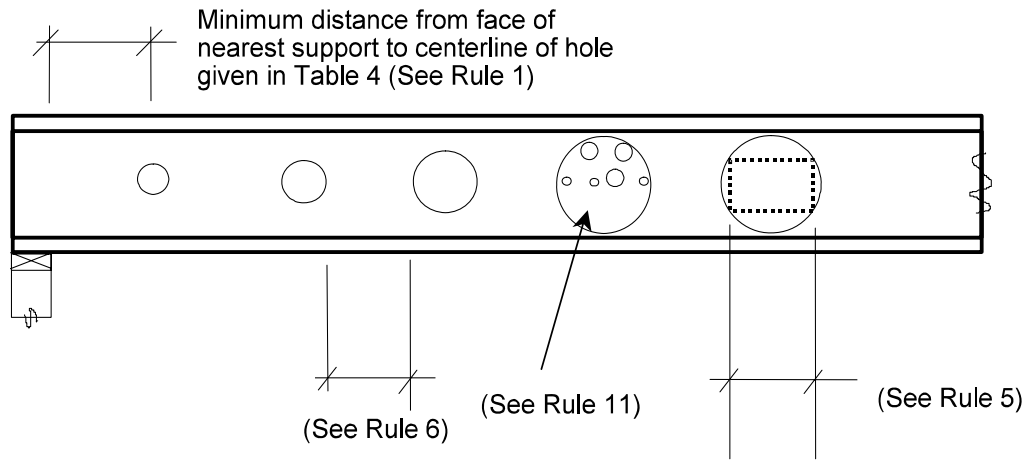


Requirements for web stiffeners:

Web stiffeners must be placed on each side of the I-joist web at the following locations:

1. Hangers with side nailing.
2. Hangers with a side, which do not support top flanges of the I-joist.
3. Locations where concentrated loads in excess of 1,500 lb (6.67 kN) are applied to the top flange of the I-joist between supports, or in the case of cantilever, anywhere between the cantilever tip and the support.
4. At exterior supports in engineered applications where concentrated loads cause exterior reaction loads to exceed 1,550 lb (6.89 kN).
5. At locations noted in Table 2.

FIGURE 1— WEB STIFFENER SPECIFICATIONS FOR JSI SERIES I-JOISTS



Rules for cutting holes in the web of JSI Series I-Joists

1. The distance between the inside edge of the support and the centerline of any hole must be in compliance with the requirements of Table 4.
2. I-joist top and bottom flanges must never be cut, notched, or otherwise modified.
3. Whenever possible field-cut holes should be centered on the middle of the web.
4. The maximum size hole that may be cut into an I-joist web is equal the clear distance between the flanges minus $\frac{1}{4}$ inch (6.35 mm). A minimum of $\frac{1}{8}$ inch (3.18 mm) must always be maintained between the top or bottom of the hole and the adjacent I-joist flange.
5. The sides of square holes or longest sides of rectangular holes must not exceed $\frac{3}{4}$ of the diameter of the maximum round hole permitted at that location.
6. Where more than one hole is necessary, the distance between adjacent hole edges shall equal or 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 compliance with the requirements of Table 4.
7. No more than 3 maximum size holes are permitted per span.
8. $1\frac{1}{2}$ inch (38 mm) diameter holes are permitted anywhere in a cantilevered section of a JSI Series I-Joist. Holes of greater size may be permitted, subject to verification by a design professional or the I-joist manufacturer.
9. A $1\frac{1}{2}$ inch (38 mm) diameter hole can be placed anywhere in the web provided that it meets the requirements of Rule 6 above.
10. For I-joists with more than one span, use the longest span to determine hole location in either span.
11. A group of round holes at approximately the same location shall be permitted if they meet the requirements for a single round hole circumscribed around them.

FIGURE 2—HOLE SPECIFICATIONS FOR JSI SERIES I-JOISTS

JSI 4000	Jager	CCMC 12655 - R	0
PRI-80	APA EWS	ICC ESR- 2077	3
	Plant #: 1075	HUD SEB -1130	7
	MADE IN CANADA	NY City MEA 393-91-M Vol II	0
			6

FIGURE 3—EXAMPLE OF LABEL USED ON I-JOISTS