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ICC-ES Evaluation Report

ESR-1225

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 17 33—Wood I-joists

REPORT HOLDER:

PACIFIC WOODTECH CORPORATION
POST OFFICE BOX 465
BURLINGTON, WASHINGTON 98233
(360) 707-2200
www.pacificwoodtech.com

EVALUATION SUBJECT:

PWI JOISTS

ADDITIONAL LISTEES:

ALLIANCE LUMBER
1800 WEST BROADWAY ROAD, SUITE 2
TEMPE, ARIZONA 85282

GEORGIA-PACIFIC WOOD PRODUCTS LLC
1000 NORTH PARK DRIVE
ROXBORO, NORTH CAROLINA 27573

HPM BUILDING SUPPLY
16-166 MELEKAHIWA STREET
KEAAU, HAWAII 96749

BLUELINX CORPORATION
4300 WILDWOOD PARKWAY
ATLANTA, GEORGIA 30339

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2012, 2009 and 2006 *International Building Code®* (IBC)
- 2012, 2009 and 2006 *International Residential Code®* (IRC)

Properties evaluated:

- Structural
- Fire-resistance-rated assemblies

2.0 USES

PWI joists are used as joists, rafters, headers and blocking panels.

3.0 DESCRIPTION

3.1 General:

PWI joists comply with IBC Section 2303.1.2 and IRC Section R502.1.4 for allowable stress design, and are manufactured in accordance with the approved Pacific Woodtech Corporation *I-Joist Quality Control Manual.* Joist descriptions are provided in Table 1. Pacific Woodtech Corporation private-labels PWI joists. The company names and associated product trade names for the PWI joists and private label I-joists are as follows:

COMPANY OR LISTEE	PRODUCT TRADE NAME
Pacific Woodtech Corporation	PWI
Georgia-Pacific Wood Products	GPI Wood I Beam®
Alliance Lumber	Integri-Joist™
HPM Building Supply	Ikaika
BlueLinx Corporation	BLI

All PWI joists, regardless of the private label, are identified as described in Section 7.0 of this report.

3.2 Materials:

3.2.1 Flanges: Structural composite or sawn lumber as specified in the approved quality control manual. See Table 1.

3.2.2 Webs: Wood structural panel sections as specified in the approved quality control manual. See Table 1.

3.2.3 Adhesives: Exterior-type, heat-durable adhesives complying with ASTM D2559 and D5055 as specified by the approved quality control manual.

4.0 DESIGN AND INSTALLATION

4.1 General:

The information provided in this report applies to the Allowable Stress Design method.

4.2 Web Stiffeners:

Web stiffeners are not required, with the following exceptions:

a. Web stiffeners are required at the ends of the I-joist in joist hangers that are not deep enough to laterally support the top flange of the joist. Refer to the hanger installation instructions.

b. Web stiffeners are required to accommodate special hanger nailing requirements. Refer to the hanger installation instructions.

c. Web stiffeners are required under concentrated loads applied to the top of the I-joist between supports, or along cantilevers beyond the support, when the concentrated load exceeds 1500 pounds (6672 N).

d. Web stiffeners are required at birdsmouth cuts at the low end support of sloped joists.

e. Web stiffeners are required for high reactions at supports.

See Table 2B for allowable reaction and web stiffener use requirements. See Figure 1 for illustrations as well as web stiffener dimensions and nail sizes.

4.3 Web Holes:

Tables 4 and 5 provide allowable locations for round, rectangular and duct holes in joists sized by means of Table 3. For engineered designs, refer to the notes in Tables 4 and 5 and use the following allowable hole shear values:

Round holes: $V_{hole} = \frac{d - Hole\ Diameter\ (inches)}{d} \times V_{joist}$

where:

V_{hole} = allowable joist shear at web hole (lbs).

d = joist depth (inches).

V_{joist} = allowable joist shear (lbs).

Rectangular holes: Substitute the longest side dimension divided by 0.75 for *Hole Diameter* in the round hole equation.

Duct holes (full height of web removed):

PWI 20/30 V_{hole} = 300 - 8.5 × width maximum width = 12 inches

PWI 50 V_{hole} = 360 - 11 × width maximum width = 14 inches

PWI 40/45/60/70/77/77w V_{hole} = 430 - 11.5 × width maximum width = 20 inches

PWI 90/93 V_{hole} = 515 - 12 × width maximum width = 24 inches

where:

V_{hole} = allowable joist shear at web hole (lbs).

Width = duct hole width (inches).

4.4 Fasteners:

Allowable capacities and spacing for nails into the flanges of PWI-40 and PWI-60 joists with MSR lumber flanges are in accordance with the NDS for solid-sawn lumber with specific gravities, respectively, of 0.42 and 0.46. Allowable capacities and spacing for nails into the top of flanges of PWI joists with LVL flanges are in accordance with the NDS for solid-sawn lumber with a specific gravity of 0.50. Allowable capacities and spacing for nails into the side of flanges of PWI joists with LVL flanges are in accordance with the NDS for solid-sawn lumber with a specific gravity of 0.50 for lateral values and 0.47 for withdrawal values.

4.5 Bridging:

Bridging is not required in the joist span unless specified by the building designer.

4.6 Lateral Support:

Provide lateral restraint at supports (e.g., blocking panels, rim board) and along the compression flange of each joist (e.g., wood structural panel sheathing, gypsum board ceiling, wood structural panel soffit).

4.7 One-hour Fire-resistive Construction for Roof-ceiling and Floor-ceiling Assemblies:

4.7.1 Assembly 1: The I-joists described in this report, with minimum flange size of $1^1/_2$ inches (38 mm) by $2^1/_2$ inches (64 mm), can be used with the assembly described in Figure 3 of ESR-1405.

4.7.2 Assembly 2: I-joists can be used in the construction of the assembly described in Table 720.1(3), Item 21-1.1, of the IBC. Minimum $9^1/_4$-inch-deep (235 mm) wood I-joists must be spaced a maximum of 24 inches (610 mm) on center. Minimum flange size is $1^5/_{16}$ inches thick by $1^1/_2$ inches wide (33 by 38 mm). Minimum web thickness is $^3/_8$ inch (10 mm).

4.7.3 Assembly 3: The I-joists described in this report can be used with the assembly details described in Section 4.2.2.3 of ESR-1405.

4.7.4 Assembly 4:

4.7.4.1 Finish Flooring (Optional): Hardwood or softwood flooring on building paper; or resilient flooring, parquet floor, felt-synthetic-fiber floor coverings, carpeting, or ceramic tile on $^3/_8$-inch-thick (10 mm) panel-type underlayment; or ceramic tile on $1^1/_4$-inch (32 mm) mortar bed.

4.7.4.2 Subfloor: Wood structural sheathing in compliance with the provisions of PS1 or PS2 and the applicable building code.

4.7.4.3 Wood Structural Members: Minimum $9^1/_2$-inch-deep (241 mm) wood I-joists spaced a maximum of 24 inches (610 mm) on center. Minimum flange size is $1^1/_2$ inches thick by $1^1/_2$ inches wide (38 by 38 mm). Minimum web thickness is $^3/_8$ inch (10 mm).

4.7.4.4 Insulation (Optional): $3^1/_2$-inch (89 mm) glass fiber batts, or $3^1/_2$-inch (89 mm) mineral wool batts.

4.7.4.5 Resilient Channels: Minimum 0.018-inch-thick (0.5 mm) resilient channels are installed in continuous rows at a maximum spacing of 24 inches (610 mm) on center, and are perpendicular to the joists. The channels are attached to the bottom of each joist with a $1^1/_4$-inch-long (32 mm) screw. Additional channels may be installed between continuous rows at the locations of end joints in the first layer of ceiling. The additional channel may be extended a minimum of 2 inches (51 mm) beyond the joists adjacent to each side of the gypsum board panels in the first layer of ceiling.

4.7.4.6 Ceiling: Two layers of $^1/_2$-inch-thick (13 mm), Type X gypsum board in compliance with ASTM C36. The long edge of each layer must be perpendicular to the channels (parallel to the joists). End and side joints must be staggered at least 16 inches (406 mm) from layer to layer. The first layer must be fastened to the resilient channels with $1^1/_4$-inch (32 mm), Type S screws at 12 inches (305 mm) on center. Screws must be installed a minimum of $^3/_8$ inch (10 mm) from end joints and a minimum of $1^1/_2$ inches (38 mm) from side joints. The second layer must be fastened to the resilient channels with $1^5/_8$-inch (41 mm), Type S screws at 12 inches (305 mm) on center. Screws must be installed a minimum of $^1/_2$ inch (13 mm) from end and side joints. One-and-one-half-inch (38 mm), Type G screws may be substituted at end joints in the second layer when end joints fall between channels.

4.7.5 Other Assemblies: PWI joists with $1^1/_2$-by-$1^1/_2$-inch flanges (38 mm by 38 mm) satisfy the minimum 2.3-square-inch (14.4 cm^2), flange-cross-sectional area criterion of IBC Table 720.1(3), Item Number 23-1.1.

5.0 CONDITIONS OF USE

The Pacific Woodtech Corporation and private label 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 I-joists are manufactured at the Pacific Woodtech facility in Burlington, Washington, under a quality control program with inspections by APA-EWS.

5.2 Design and installation must comply with the applicable building code, this report and the manufacturer's published installation instructions. In the event of a conflict, the code and this report must govern.

5.3 For applications based on Tables 2A and 2B, design calculations and details for specific applications must be furnished to the code official, when requested, when the permit is applied for. Calculations and drawings shall 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.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Prefabricated Wood I-joists (AC14), dated June 2013 (Editorially revised July 2013).

7.0 IDENTIFICATION

Each I-joist must be marked with the product trade name or trademark; the joist series; the production date; the evaluation report number (ESR-1225); the name or trademark of the inspection agency (APA-EWS); the name of the manufacturer (Pacific Woodtech); and the manufacturer's APA mill number (1048).

TABLE 1—JOIST DESCRIPTION

Joist Series	Joist Depths [in]		Flange			Web	
	Minimum	Maximum	Material	Width [in]	Depth [in]	Material	Thick. [in]
PWI-20	$9^1/_2$	14	LVL	$1^3/_4$	$1^3/_8$	OSB	$^3/_8$
PWI-30	$9^1/_2$	$11^7/_8$	LVL	$1^1/_2$	$1^1/_2$	OSB	$^3/_8$
PWI-40	$9^1/_4$	16	LVL	$2^5/_{16}$	$1^3/_8$	OSB	$^3/_8$
PWI-40	$9^1/_2$	16	MSR	$2^1/_2$	$1^1/_2$	OSB	$^3/_8$
PWI-45	$9^1/_2$	16	LVL	$2^1/_{16}$	$1^3/_8$	OSB	$^3/_8$
PWI-50	$9^1/_2$	16	LVL	$1^3/_4$	$1^1/_2$	OSB	$^3/_8$
PWI-60	$9^1/_4$	16	LVL	$2^5/_{16}$	$1^3/_8$	OSB	$^3/_8$
PWI-60	$9^1/_2$	16	MSR	$2^1/_2$	$1^1/_2$	OSB	$^3/_8$
PWI-70	$11^7/_8$	20	LVL	$2^5/_{16}$	$1^1/_2$	OSB	$^3/_8$
PWI-93	$11^7/_8$	16	LVL	$3^1/_2$	$1^1/_2$	OSB	$^3/_8$
PWI-77	$9^1/_2$	24	LVL	$2^5/_{16}$	$1^1/_2$	OSB	$^7/_{16}$
PWI-77w	$9^1/_2$	24	LVL	$2^1/_2$	$1^1/_2$	OSB	$^7/_{16}$
PWI-90	$9^1/_2$	24	LVL	$3^1/_2$	$1^1/_2$	OSB	$^7/_{16}$

For **SI:** 1 inch = 25.4 mm.

TABLE 2A. REFERENCE ALLOWABLE STRESS DESIGN VALUES FOR PWI JOISTS [1, 2]

Joist Series	Joist Depth	EI [3, 8]	k [4, 8]	M [5]	V [6]	Vert. Load [7]
PWI-20	$9^1/_2$"	145	4.94	2520	1120	2400
	$11^7/_8$"	253	6.19	3265	1420	2400
	14"	373	7.33	3890	1710	2400
PWI-30	$9^1/_2$"	161	4.94	3225	1120	2400
	$11^7/_8$"	280	6.18	4170	1420	2400
PWI-40	$9^1/_4$"	181	4.80	2650	1080	2400
	$9^1/_2$"	193	4.94	2735	1120	2400
	$11^7/_8$"	330	6.18	3545	1420	2400
	14"	482	7.28	4270	1710	2400
	16"	657	8.32	4950	1970	2400
PWI-45	$9^1/_2$"	193	4.94	3345	1120	2400
	$11^7/_8$"	330	6.18	4315	1420	2400
	14"	486	7.28	5140	1710	2400
	16"	665	8.32	5880	1970	2400
PWI-50	$9^1/_2$	186	4.94	3800	1120	2400
	$11^7/_8$"	322	6.18	4915	1420	2400
	14"	480	7.28	5860	1710	2400
	16"	663	8.32	6715	1970	2400
PWI-60	$9^1/_4$"	218	4.80	3665	1080	2400
	$9^1/_2$"	231	4.94	3780	1120	2400
	$11^7/_8$"	396	6.18	4900	1420	2400
	14"	584	7.28	5895	1710	2400
	16"	799	8.32	6835	1970	2400
PWI-70	$11^7/_8$"	440	6.19	6730	1420	2400
	14"	644	7.33	8030	1710	2400
	16"	873	8.42	9200	1970	2400
	18"	1141	9.53	10355	2239	1850
	20"	1447	10.63	11495	2506	1850
PWI-77/77w	$9^1/_2$"	261	5.57	5155	1430	2850
	$11^7/_8$"	442	6.92	6675	1925	2850
	14"	648	8.17	7960	2125	2850
	16"	881	9.35	9120	2330	2850
	18"	1152	10.55	10265	2535	2300
	20"	1463	11.76	11395	2740	2300
	22"	1815	12.97	12520	2935	1700
	24"	2209	14.18	13630	3060	1700
PWI-90	$9^1/_2$"	392	5.57	7915	1430	2850
	$11^7/_8$"	661	6.92	10255	1925	2850
	14"	965	8.17	12235	2125	2850
	16"	1306	9.35	14020	2330	2850
	18"	1703	10.55	15780	2535	2300
	20"	2155	11.76	17520	2740	2300
	22"	2664	12.97	19245	2935	1700
	24"	3232	14.18	20955	3060	1700

For **SI:** 1 inch = 25.4 mm, 1 lb = 4.448 N, 1 ft-lb = 1.35 N-m, 1 lb-in^2 = 179 N-mm^2.

1. Applicable adjustment factors must be applied to reference design values in accordance with Section 7.3 of the NDS.
2. Reference design values reflect dry service conditions, where the moisture content in service is less than 16%, as in most covered structures.
3. Bending stiffness [10^6 lb-in^2]
4. Coefficient of shear deflection [10^6 lb]
5. Moment capacity [ft-lb]. Reference moment values must be multiplied by the repetitive member factor, $C_r = 1.0$.
6. Shear capacity [lb]
7. Blocking panel and rim joist vertical load capacity [plf]

8. Use Equations 1 and 2 to calculate uniform and center point load deflections in a simple-span application.

Uniform Load:
$$\delta = \frac{5w\ell^4}{384EI} + \frac{w\ell^2}{k} \qquad [1]$$

Center-Point Load:
$$\delta = \frac{P\ell^3}{48EI} + \frac{2P\ell}{k} \qquad [2]$$

Where: δ = calculated deflection in inches
w = uniform load in pounds per inch
P = concentrated load in pounds
ℓ = design span in inches
EI = I-joist bending stiffness in pounds-inches squared
k = coefficient of shear deflection in pounds

TABLE 2B. REFERENCE ALLOWABLE STRESS REACTION VALUES FOR PWI JOISTS [1, 2]

Joist Series	Joist Depth	ER ($1^3/_4" \leq \ell_b \leq 3^1/_2"$)[3] No Web Stiffeners	With Web Stiffeners	WS[5] Nails	IR ($3^1/_2" \leq \ell_b \leq 5^1/_4"$)[4] No Web Stiffeners	With Web Stiffeners	WS[5] Nails	b_{EFF} [6]
PWI-20	$9^1/_2"$	$117.1 \times \ell_b + 710$	$0.0 \times \ell_b + 1120$	4	$142.9 \times \ell_b + 1490$	$0.0 \times \ell_b + 2240$	4	
	$11^7/_8"$	$222.9 \times \ell_b + 525$	$0.0 \times \ell_b + 1420$	4	$245.7 \times \ell_b + 1130$	$211.4 \times \ell_b + 1535$	4	1.62
	14"	$222.9 \times \ell_b + 525$	$97.1 \times \ell_b + 1370$	4	$245.7 \times \ell_b + 1130$	$211.4 \times \ell_b + 1535$	4	
PWI-30	$9^1/_2"$	$77.7 \times \ell_b + 809$	$77.7 \times \ell_b + 809$	4	$0.0 \times \ell_b + 1905$	$0.0 \times \ell_b + 1905$	4	1.37
	$11^7/_8"$	$210.9 \times \ell_b + 576$	$210.9 \times \ell_b + 576$	4	$0.0 \times \ell_b + 1905$	$0.0 \times \ell_b + 1905$	4	
PWI-40	$9^1/_4"$	$0.0 \times \ell_b + 1080$	$0.0 \times \ell_b + 1080$	4	$0.0 \times \ell_b + 2160$	$0.0 \times \ell_b + 2160$	4	
	$9^1/_2"$	$17.7 \times \ell_b + 1049$	$17.7 \times \ell_b + 1049$	4	$0.0 \times \ell_b + 2160$	$0.0 \times \ell_b + 2160$	4	
	$11^7/_8"$	$97.7 \times \ell_b + 1029$	$97.7 \times \ell_b + 1029$	4	$0.0 \times \ell_b + 2500$	$0.0 \times \ell_b + 2500$	4	2.18
	14"	$155.4 \times \ell_b + 928$	$226.9 \times \ell_b + 803$	4	$0.0 \times \ell_b + 2500$	$0.0 \times \ell_b + 2500$	4	
	16"	$155.4 \times \ell_b + 928$	$342.3 \times \ell_b + 601$	4	$0.0 \times \ell_b + 2500$	$0.0 \times \ell_b + 2500$	4	
PWI-45	$9^1/_2"$	$80.0 \times \ell_b + 840$	$0.0 \times \ell_b + 1120$	4	$0.0 \times \ell_b + 2240$	$0.0 \times \ell_b + 2240$	4	
	$11^7/_8"$	$245.7 \times \ell_b + 550$	$0.0 \times \ell_b + 1420$	4	$180.0 \times \ell_b + 1620$	$137.1 \times \ell_b + 2120$	4	1.93
	14"	$245.7 \times \ell_b + 550$	$80.0 \times \ell_b + 1430$	4	$180.0 \times \ell_b + 1620$	$240.0 \times \ell_b + 1760$	4	
	16"	$245.7 \times \ell_b + 550$	$228.6 \times \ell_b + 1170$	4	$180.0 \times \ell_b + 1620$	$240.0 \times \ell_b + 1760$	4	
PWI-50	$9^1/_2"$	$46.9 \times \ell_b + 933$	$46.9 \times \ell_b + 933$	4	$0.0 \times \ell_b + 2040$	$0.0 \times \ell_b + 2040$	4	
	$11^7/_8"$	$180.0 \times \ell_b + 700$	$180.0 \times \ell_b + 700$	4	$0.0 \times \ell_b + 2040$	$0.0 \times \ell_b + 2040$	4	1.62
	14"	$164.6 \times \ell_b + 727$	$213.7 \times \ell_b + 641$	4	$0.0 \times \ell_b + 2040$	$0.0 \times \ell_b + 2040$	4	
	16"	$164.6 \times \ell_b + 727$	$293.7 \times \ell_b + 501$	4	$0.0 \times \ell_b + 2040$	$0.0 \times \ell_b + 2040$	4	
PWI-60	$9^1/_4"$	$0.0 \times \ell_b + 1080$	$0.0 \times \ell_b + 1080$	4	$0.0 \times \ell_b + 2160$	$0.0 \times \ell_b + 2160$	4	
	$9^1/_2"$	$17.7 \times \ell_b + 1049$	$17.7 \times \ell_b + 1049$	4	$0.0 \times \ell_b + 2160$	$0.0 \times \ell_b + 2160$	4	
	$11^7/_8"$	$97.7 \times \ell_b + 1029$	$97.7 \times \ell_b + 1029$	4	$0.0 \times \ell_b + 2500$	$0.0 \times \ell_b + 2500$	4	2.18
	14"	$155.4 \times \ell_b + 928$	$226.9 \times \ell_b + 803$	4	$0.0 \times \ell_b + 2500$	$0.0 \times \ell_b + 2500$	4	
	16"	$155.4 \times \ell_b + 928$	$342.3 \times \ell_b + 601$	4	$0.0 \times \ell_b + 2500$	$0.0 \times \ell_b + 2500$	4	
PWI-70	$11^7/_8"$	$148.6 \times \ell_b + 900$	$0.0 \times \ell_b + 1420$	4	$288.6 \times \ell_b + 1325$	$41.7 \times \ell_b + 2621$	4	
	14"	$260.0 \times \ell_b + 705$	$67.4 \times \ell_b + 1474$	4	$305.7 \times \ell_b + 1265$	$305.7 \times \ell_b + 1697$	4	
	16"	$260.0 \times \ell_b + 705$	$216.0 \times \ell_b + 1214$	4	$305.7 \times \ell_b + 1265$	$305.7 \times \ell_b + 1697$	4	2.18
	18"	$260.0 \times \ell_b + 705$	$246.3 \times \ell_b + 1377$	6	$305.7 \times \ell_b + 1265$	$305.7 \times \ell_b + 2129$	8	
	20"	$260.0 \times \ell_b + 705$	$260.0 \times \ell_b + 1353$	6	$305.7 \times \ell_b + 1265$	$305.7 \times \ell_b + 2129$	8	
PWI-77 PWI-77w	$9^1/_2"$	$82.9 \times \ell_b + 1140$	$0.0 \times \ell_b + 1430$	4	$94.3 \times \ell_b + 2365$	$0.0 \times \ell_b + 2860$	4	
	$11^7/_8"$	$271.4 \times \ell_b + 810$	$20.0 \times \ell_b + 1855$	4	$260.0 \times \ell_b + 1785$	$345.7 \times \ell_b + 1820$	4	
	14"	$271.4 \times \ell_b + 810$	$134.3 \times \ell_b + 1655$	4	$260.0 \times \ell_b + 1785$	$345.7 \times \ell_b + 1820$	4	
	16"	$271.4 \times \ell_b + 810$	$251.4 \times \ell_b + 1450$	4	$260.0 \times \ell_b + 1785$	$345.7 \times \ell_b + 1820$	4	2.18
	18"	$271.4 \times \ell_b + 810$	$225.7 \times \ell_b + 1745$	6	$260.0 \times \ell_b + 1785$	$194.3 \times \ell_b + 3090$	8	
	20"	$271.4 \times \ell_b + 810$	$291.4 \times \ell_b + 1630$	6	$260.0 \times \ell_b + 1785$	$194.3 \times \ell_b + 3090$	8	
	22"	NA	$291.4 \times \ell_b + 1880$	8	NA	$171.4 \times \ell_b + 3525$	10	
	24"	NA	$291.4 \times \ell_b + 1880$	8	NA	$171.4 \times \ell_b + 3525$	10	
PWI-90	$9^1/_2"$	$17.1 \times \ell_b + 1370$	$0.0 \times \ell_b + 1430$	4	$0.0 \times \ell_b + 2860$	$0.0 \times \ell_b + 2860$	4	
	$11^7/_8"$	$285.7 \times \ell_b + 900$	$14.3 \times \ell_b + 1875$	4	$282.9 \times \ell_b + 2365$	$0.0 \times \ell_b + 3850$	4	
	14"	$285.7 \times \ell_b + 900$	$128.6 \times \ell_b + 1675$	4	$351.4 \times \ell_b + 2125$	$225.7 \times \ell_b + 3065$	4	
	16"	$285.7 \times \ell_b + 900$	$245.7 \times \ell_b + 1470$	4	$351.4 \times \ell_b + 2125$	$351.4 \times \ell_b + 2625$	4	3.37
	18"	$285.7 \times \ell_b + 900$	$220.0 \times \ell_b + 1765$	6	$351.4 \times \ell_b + 2125$	$351.4 \times \ell_b + 3125$	8	
	20"	$285.7 \times \ell_b + 900$	$285.7 \times \ell_b + 1650$	6	$351.4 \times \ell_b + 2125$	$351.4 \times \ell_b + 3125$	8	
	22"	NA	$285.7 \times \ell_b + 1900$	8	NA	$351.4 \times \ell_b + 3375$	10	
	24"	NA	$285.7 \times \ell_b + 1900$	8	NA	$351.4 \times \ell_b + 3375$	10	

For **SI:** 1 inch = 25.4 mm, 1 lb = 4.448 N.

1. Reaction values are permitted to be adjusted for load duration in accordance with Section 7.3.2 of the NDS, provided the adjusted value is less than or equal to the limiting value calculated in footnote 6 to this table.
2. Reference design values reflect dry service conditions, where moisture content in service is less than 16%, as in most covered structures.
3. End reaction capacity [lb]. For $1^3/_4 \leq \ell_b \leq 3^1/_2$, where ℓ_b is the bearing length in inches. See Note 6.
4. Intermediate reaction capacity [lb]. For $3^1/_2 \leq \ell_b \leq 5^1/_4$, where ℓ_b is the bearing length in inches. See Note 6.

5. Number of web stiffener nails. Refer to Figure 1 for web stiffener and nail dimensions.
6. Effective flange width [in]. ER shall not exceed $b_{EFF} \times \ell_b \times F_{c\perp}$ and IR shall not exceed $b_{EFF} \times \ell_b \times F_{c\perp} \times C_b$, where ℓ_b is the bearing length in inches, $F_{c\perp}$ is the reference compression design value perpendicular to grain in pounds per square inch and $C_b = (\ell_b + 0.375) \div \ell_b$. For LVL flanges, $F_{c\perp} = 510$ psi. For PWI-40 and PWI-60 MSR flanges, $F_{c\perp} = 425$ psi and 525 psi respectively. Do not adjust $F_{c\perp}$ for load duration. Compression of the support surface must also be checked.

TABLE 3—ALLOWABLE RESIDENTIAL FLOOR SPANS – 40 PSF LIVE LOAD AND 10 PSF DEAD LOAD[1 – 7]

Joist Series	Joist Depth	Simple Span				Two or More Continuous Spans			
		12" o.c.	16" o.c.	19.2" o.c.	24" o.c.	12" o.c.	16" o.c.	19.2" o.c.	24" o.c.
PWI-20	$9^1/_2$"	16'-8"	15'-3"	14'-5"	13'-6"	18'-6"	17'-0"	15'-7"	13'-11"
	$11^7/_8$"	19'-11"	18'-3"	17'-3"	16'-0"	22'-3"	19'-6"	17'-10"	15'-8"
	14"	22'-8"	20'-9"	19'-6"	17'-5"	24'-8"	21'-4"	19'-6"	15'-8"
PWI-30	$9^1/_2$"	17'-1"	15'-8"	14'-10"	13'-10"	19'-0"	17'-5"	16'-5"	15'-0"
	$11^7/_8$"	20'-6"	18'-9"	17'-9"	16'-7"	22'-10"	20'-10"	18'-9"	15'-0"
PWI-40	$9^1/_4$"	17'-7"	16'-1"	15'-2"	14'-2"	19'-7"	17'-7"	16'-0"	14'-4"
	$9^1/_2$"	18'-0"	16'-5"	15'-6"	14'-6"	20'-0"	17'-10"	16'-3"	14'-6"
	$11^7/_8$"	21'-5"	19'-7"	18'-6"	16'-8"	23'-7"	20'-4"	18'-7"	16'-7"
	14"	24'-4"	22'-3"	20'-6"	18'-4"	25'-11"	22'-5"	20'-5"	18'-3"
	16"	26'-11"	24'-2"	22'-1"	19'-9"	27'-11"	24'-1"	22'-0"	19'-8"
PWI-45	$9^1/_2$"	18'-0"	16'-5"	15'-6"	14'-6"	20'-0"	18'-3"	17'-3"	16'-1"
	$11^7/_8$"	21'-5"	19'-7"	18'-6"	17'-3"	23'-11"	21'-10"	20'-6"	17'-9"
	14"	24'-4"	22'-3"	21'-0"	19'-5"	27'-2"	24'-7"	22'-3"	17'-9"
	16"	27'-0"	24'-8"	23'-4"	19'-5"	30'-2"	26'-4"	22'-3"	17'-9"
PWI-50	$9^1/_2$"	17'-10"	16'-3"	15'-5"	14'-5"	19'-10"	18'-1"	17'-1"	15'-11"
	$11^7/_8$"	21'-4"	19'-6"	18'-5"	17'-2"	23'-9"	21'-8"	20'-2"	16'-1"
	14"	24'-4"	22'-2"	21'-0"	19'-7"	27'-1"	24'-3"	20'-2"	16'-1"
	16"	27'-0"	24'-8"	23'-4"	20'-1"	30'-2"	24'-3"	20'-2"	16'-1"
PWI-60	$9^1/_4$"	18'-7"	16'-11"	16'-0"	14'-11"	20'-8"	18'-10"	17'-9"	16'-6"
	$9^1/_2$"	18'-11"	17'-3"	16'-4"	15'-3"	21'-1"	19'-2"	18'-1"	16'-10"
	$11^7/_8$"	22'-7"	20'-8"	19'-6"	18'-2"	25'-2"	22'-11"	21'-8"	19'-6"
	14"	25'-8"	23'-5"	22'-2"	20'-8"	28'-8"	26'-1"	24'-0"	19'-9"
	16"	28'-6"	26'-0"	24'-7"	22'-11"	31'-10"	28'-5"	24'-9"	19'-9"
PWI-70	$11^7/_8$"	23'-4"	21'-3"	20'-1"	18'-8"	26'-0"	23'-8"	22'-3"	18'-5"
	14"	26'-5"	24'-2"	22'-9"	21'-3"	29'-6"	26'-10"	23'-1"	18'-5"
	16"	29'-3"	26'-9"	25'-2"	23'-0"	32'-8"	27'-9"	23'-1"	18'-5"
	18"	32'-0"	29'-3"	27'-7"	23'-0"	35'-9"	27'-9"	23'-1"	18'-5"
	20"	34'-8"	31'-7"	28'-10"	23'-0"	37'-1"	27'-9"	23'-1"	18'-5"
PWI-93	$11^7/_8$"	26'-3"	23'-11"	22'-6"	20'-11"	29'-3"	26'-7"	25'-0"	21'-10"
	14"	29'-10"	27'-1"	25'-6"	23'-9"	33'-2"	30'-2"	28'-4"	23'-11"
	16"	33'-0"	30'-0"	28'-3"	25'-5"	36'-9"	33'-5"	29'-11"	23'-11"
PWI-77 PWI-77w	$9^1/_2$"	19'-8"	17'-11"	16'-11"	15'-10"	21'-11"	20'-0"	18'-10"	17'-7"
	$11^7/_8$"	23'-5"	21'-4"	20'-2"	18'-10"	26'-1"	23'-9"	22'-5"	20'-11"
	14"	26'-7"	24'-3"	22'-11"	21'-4"	29'-8"	27'-0"	25'-6"	21'-4"
	16"	29'-5"	26'-10"	25'-4"	23'-8"	32'-10"	29'-11"	26'-8"	21'-4"
	18"	32'-2"	29'-4"	27'-9"	25'-6"	35'-11"	32'-1"	26'-8"	21'-4"
	20"	34'-10"	31'-10"	30'-0"	25'-6"	38'-11"	32'-1"	26'-8"	21'-4"
	22"	37'-5"	34'-2"	32'-3"	30'-1"	41'-10"	38'-2"	35'-1"	31'-5"
	24"	40'-0"	36'-6"	34'-5"	32'-2"	44'-8"	40'-2"	36'-8"	32'-9"
PWI-90	$9^1/_2$"	22'-2"	20'-2"	19'-0"	17'-8"	24'-8"	22'-5"	21'-1"	19'-8"
	$11^7/_8$"	26'-5"	24'-0"	22'-7"	21'-1"	29'-5"	26'-9"	25'-2"	23'-4"
	14"	29'-11"	27'-3"	25'-8"	23'-11"	33'-4"	30'-4"	28'-6"	26'-6"
	16"	33'-1"	30'-2"	28'-5"	26'-5"	36'-11"	33'-7"	31'-7"	26'-7"
	18"	36'-2"	32'-11"	31'-0"	27'-10"	40'-4"	36'-8"	33'-3"	26'-7"
	20"	39'-2"	35'-8"	33'-7"	27'-10"	43'-8"	39'-9"	33'-3"	26'-7"
	22"	42'-0"	38'-3"	36'-1"	33'-7"	46'-11"	42'-8"	40'-2"	36'-7"
	24"	44'-10"	40'-10"	38'-6"	35'-10"	50'-1"	45'-6"	42'-10"	36'-7"

For **SI:** 1 inch = 25.4 mm.

1. Table values apply to uniformly loaded, residential floor joists.
2. Span is measured from face to face of supports.
3. Deflection is limited to L/240 at total load and L/480 at live load.
4. Table values are based on sheathing that is glued and nailed to the joists ($^{23}/_{32}$" panels for joists at 24" o.c. and $^{19}/_{32}$" panels for joists at 19.2" o.c. and less). Reduce spans by 12" if sheathing is nailed only.
5. Provide at least $1^3/_4$" of bearing length at end supports and $3^1/_2$" at intermediate supports. Web stiffeners are not required when joists are used at these spans and spacings, except as might be required by joist hanger manufacturers.
6. Provide lateral restraint at supports (e.g. blocking panels, rim board) and along the compression flange of each joist (e.g. wood structural panel sheathing, gypsum board ceiling, wood structural panel soffit).
7. Use other means to analyze conditions outside the scope of this table (e.g. commercial floors, different bearing conditions, concentrated loads) or for multiple span joists if the length of any span is less than half the length of an adjacent span.

TABLE 4—DUCT HOLES

Minimum Distance 'D' From Any Support to the Centerline of the Hole (See Figure 2)

Joist Series	Joist Span	Duct Hole Width				
		8"	10"	12"	14"	16"
PWI-20	8 ft.	3'-7"	3'-8"	3'-10"		
	12 ft.	5'-5"	5'-7"	5'-9"		
	16 ft.	7'-3"	7'-5"	7'-8"		
	20 ft.	9'-1"	9'-4"	9'-7"		
PWI-30	8 ft.	3'-9"	3'-10"	3'-11"		
	12 ft.	5'-8"	5'-9"	5'-11"		
	16 ft.	7'-6"	7'-8"	7'-11"		
	20 ft.	9'-5"	9'-8"	9'-10"		
PWI-40/60	8 ft.	3'-7"	3'-8"	3'-9"	3'-11"	
	12 ft.	5'-5"	5'-7"	5'-8"	5'-10"	
	16 ft.	7'-3"	7'-5"	7'-7"	7'-10"	
	20 ft.	9'-1"	9'-4"	9'-6"	9'-9"	
	24 ft.	10'-11"	11'-2"	11'-5"	11'-9"	
	28 ft.	12'-9"	13'-1"	13'-4"	13'-8"	
PWI-45	8 ft.	3'-5"	3'-7"	3'-8"	3'-9"	3'-10"
	12 ft.	5'-2"	5'-4"	5'-6"	5'-8"	5'-10"
	16 ft.	6'-11"	7'-2"	7'-5"	7'-7"	7'-9"
	20 ft.	8'-8"	9'-0"	9'-3"	9'-6"	9'-9"
	24 ft.	10'-5"	10'-9"	11'-1"	11'-4"	11'-8"
	28 ft.	12'-2"	12'-7"	12'-11"	13'-3"	13'-8"
PWI-50	8 ft.	3'-8"	3'-9"	3'-10"	3'-11"	
	12 ft.	5'-6"	5'-7"	5'-9"	5'-11"	
	16 ft.	7'-4"	7'-6"	7'-9"	7'-11"	
	20 ft.	9'-2"	9'-5"	9'-8"	9'-11"	
	24 ft.	11'-0"	11'-3"	11'-7"	11'-11"	
	28 ft.	12'-10"	13'-2"	13'-7"	13'-11"	
PWI-70	12 ft.	5'-3"	5'-5"	5'-7"	5'-9"	5'-11"
	16 ft.	7'-1"	7'-3"	7'-5"	7'-8"	7'-10"
	20 ft.	8'-10"	9'-1"	9'-4"	9'-7"	9'-10"
	24 ft.	10'-7"	10'-11"	11'-2"	11'-6"	11'-10"
	28 ft.	12'-5"	12'-9"	13'-1"	13'-5"	13'-9"
	32 ft.	14'-2"	14'-7"	14'-11"	15'-4"	15'-9"
PWI-93	8 ft.	3'-7"	3'-8"	3'-9"	3'-10"	3'-11"
	12 ft.	5'-5"	5'-6"	5'-7"	5'-9"	5'-10"
	16 ft.	7'-2"	7'-4"	7'-6"	7'-8"	7'-10"
	20 ft.	9'-0"	9'-2"	9'-5"	9'-7"	9'-9"
	24 ft.	10'-10"	11'-0"	11'-3"	11'-6"	11'-9"
	28 ft.	12'-7"	12'-11"	13'-2"	13'-5"	13'-9"
PWI-77/77w depth ≤ 20"	12 ft.	5'-8"	5'-9"	5'-11"		
	16 ft.	7'-6"	7'-8"	7'-10"		
	20 ft.	9'-5"	9'-8"	9'-10"		
	24 ft.	11'-4"	11'-7"	11'-10"		
	28 ft.	13'-2"	13'-6"	13'-9"		
	32 ft.	15'-1"	15'-5"	15'-9"		
PWI-90 depth ≤ 20"	12 ft.	5'-7"	5'-8"	5'-10"	5'-11"	
	16 ft.	7'-6"	7'-7"	7'-9"	7'-11"	
	20 ft.	9'-4"	9'-6"	9'-8"	9'-10"	
	24 ft.	11'-3"	11'-5"	11'-8"	11'-10"	
	28 ft.	13'-1"	13'-4"	13'-7"	13'-10"	
	32 ft.	15'-0"	15'-3"	15'-6"	15'-10"	

For **SI:** 1 inch = 25.4 mm.

1. Table values apply to joists sized by means of Table 3.
2. Web holes may be located anywhere between the joist flanges. Leave at least $1/8$ inch clearance between the edges of holes and the flanges.
3. Do not cut holes larger than $1^1/_2$ inches in diameter in cantilevers.
4. The horizontal clearance between the edges of adjacent holes must be at least twice the diameter (or longest side) of the larger hole. Exception: A $1^1/_2$-inch diameter hole may be drilled anywhere in the web. Provide at least 3 inches of horizontal clearance from adjacent holes of any size.
5. For depths ≥ 22", refer to the engineered design recommendations in Section 4.3.

TABLE 5—ROUND AND RECTANGULAR HOLES

Minimum Distance 'D' From Any Support to the Centerline of the Hole (See Figure 2)

Round Hole Diameter			2"	3"	4"	5"	6"	6¼"	8⅝"	10"	10¾"	12"	12¾"	14¾"	16¾"
Rectangular Hole Side			1½"	2¼"	3"	3¾"	4½"	4½"	6¼"	7½"	8"	9"	9½"	11"	12½"
9¼" Joist	Span	8 ft.	1'-0"	1'-7"	2'-1"	2'-8"	3'-2"								
		12 ft.	1'-7"	2'-5"	3'-2"	4'-0"	4'-10"								
		16 ft.	2'-1"	3'-2"	4'-3"	5'-4"	6'-5"								
9½" Joist	Span	8 ft.	1'-0"	1'-6"	2'-1"	2'-7"	3'-1"	3'-3"							
		12 ft.	1'-6"	2'-4"	3'-1"	3'-11"	4'-8"	4'-11"							
		16 ft.	2'-1"	3'-1"	4'-2"	5'-3"	6'-3"	6'-6"							
11⅞" Joist	Span	8 ft.	1'-0"	1'-1"	1'-7"	2'-0"	2'-5"	2'-6"	3'-7"						
		12 ft.	1'-0"	1'-8"	2'-4"	3'-0"	3'-8"	3'-10"	5'-4"						
		16 ft.	1'-5"	2'-3"	3'-2"	4'-0"	4'-10"	5'-1"	7'-2"						
		20 ft.	1'-9"	2'-10"	3'-11"	5'-0"	6'-1"	6'-4"	8'-11"						
14" Joist	Span	12 ft.	1'-0"	1'-1"	1'-5"	2'-0"	2'-7"	2'-9"	4'-2"	5'-0"	5'-6"				
		16 ft.	1'-0"	1'-1"	1'-10"	2'-8"	3'-6"	3'-8"	5'-7"	6'-9"	7'-4"				
		20 ft.	1'-0"	1'-4"	2'-4"	3'-4"	4'-4"	4'-7"	7'-0"	8'-5"	9'-2"				
		24 ft.	1'-0"	1'-7"	2'-10"	4'-0"	5'-3"	5'-7"	8'-5"	10'-1"	11'-0"				
16" Joist	Span	12 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-4"	1'-6"	2'-11"	3'-9"	4'-3"	5'-0"	5'-6"		
		16 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-10"	2'-0"	3'-11"	5'-1"	5'-8"	6'-8"	7'-4"		
		20 ft.	1'-0"	1'-1"	1'-2"	1'-3"	2'-3"	2'-6"	4'-11"	6'-4"	7'-1"	8'-5"	9'-2"		
		24 ft.	1'-0"	1'-1"	1'-2"	1'-6"	2'-9"	3'-0"	5'-11"	7'-7"	8'-6"	10'-1"	11'-0"		
		28 ft.	1'-0"	1'-1"	1'-2"	1'-9"	3'-2"	3'-7"	6'-11"	8'-11"	10'-0"	11'-9"	12'-10"		
18" Joist	Span	12 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	1'-7"	2'-5"	2'-11"	3'-8"	4'-2"	5'-5"	
		16 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	2'-1"	3'-3"	3'-10"	4'-11"	5'-7"	7'-3"	
		20 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	2'-7"	4'-1"	4'-10"	6'-2"	6'-11"	9'-1"	
		24 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	3'-2"	4'-11"	5'-10"	7'-5"	8'-4"	10'-10"	
		28 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	3'-8"	5'-8"	6'-10"	8'-8"	9'-9"	12'-8"	
20" Joist	Span	16 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	1'-4"	1'-9"	2'-5"	3'-5"	4'-0"	5'-8"	7'-4"
		20 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	1'-4"	2'-3"	3'-0"	4'-3"	5'-1"	7'-1"	9'-2"
		24 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	1'-4"	2'-8"	3'-8"	5'-2"	6'-1"	8'-6"	11'-0"
		28 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	1'-4"	3'-2"	4'-3"	6'-0"	7'-1"	9'-11"	12'-10"
		32 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	1'-5"	3'-7"	4'-10"	6'-11"	8'-1"	11'-5"	14'-8"
22" Joist	Span	16 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	2'-6"	3'-3"	3'-8"	4'-5"	4'-10"	5'-11"	7'-0"
		20 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-4"	1'-6"	3'-2"	4'-1"	4'-8"	5'-6"	6'-0"	7'-5"	8'-10"
		24 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-7"	1'-10"	3'-10"	4'-11"	5'-7"	6'-7"	7'-3"	8'-11"	10'-7"
		28 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-11"	2'-2"	4'-5"	5'-9"	6'-6"	7'-9"	8'-6"	10'-5"	12'-4"
		32 ft.	1'-0"	1'-1"	1'-2"	1'-2"	2'-2"	2'-5"	5'-1"	6'-7"	7'-5"	8'-10"	9'-8"	11'-11"	14'-1"
24" Joist	Span	16 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	1'-9"	2'-6"	2'-11"	3'-7"	4'-0"	5'-1"	6'-1"
		20 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	2'-3"	3'-2"	3'-8"	4'-6"	5'-0"	6'-4"	7'-8"
		24 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	2'-8"	3'-10"	4'-5"	5'-5"	6'-0"	7'-7"	9'-2"
		28 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	3'-2"	4'-5"	5'-2"	6'-4"	7'-0"	8'-10"	10'-9"
		32 ft.	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	3'-7"	5'-1"	5'-11"	7'-3"	8'-0"	10'-2"	12'-3"

For **SI:** 1 inch = 25.4 mm.

1. Table values apply to joists sized by means of Table 3.
2. Web holes may be located anywhere between the joist flanges. Leave at least ⅛ inch clearance between the edges of holes and the flanges.
3. Do not cut holes larger than 1½ inches in diameter in cantilevers.
4. The horizontal clearance between the edges of adjacent holes must be at least twice the diameter (or longest side) of the larger hole. Exception: A 1½-inch diameter hole may be drilled anywhere in the web. Provide at least 3 inches of horizontal clearance from adjacent holes of any size.
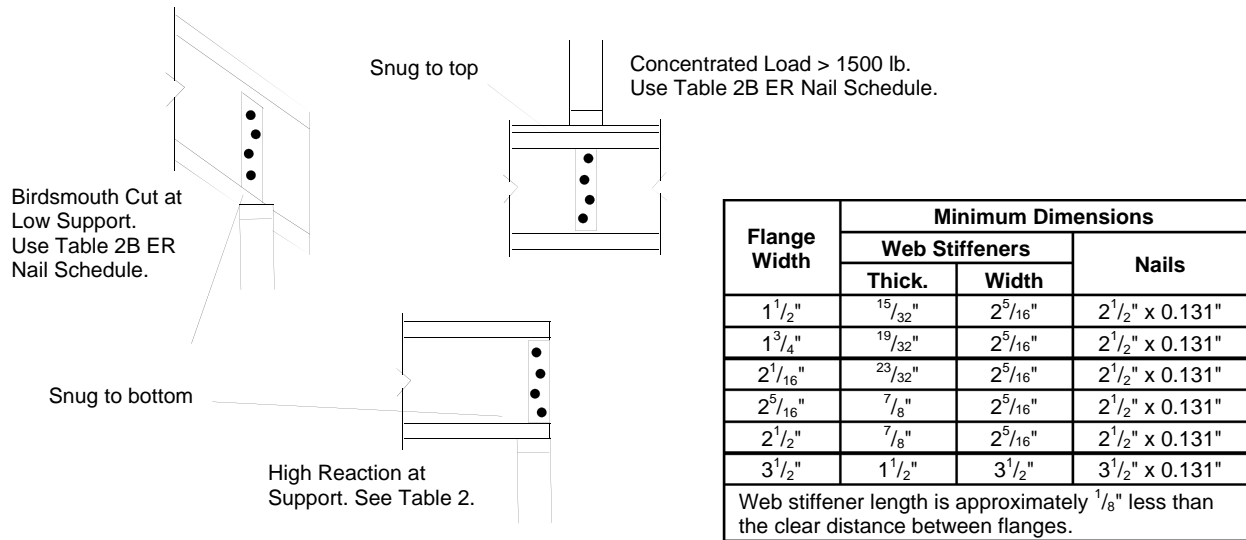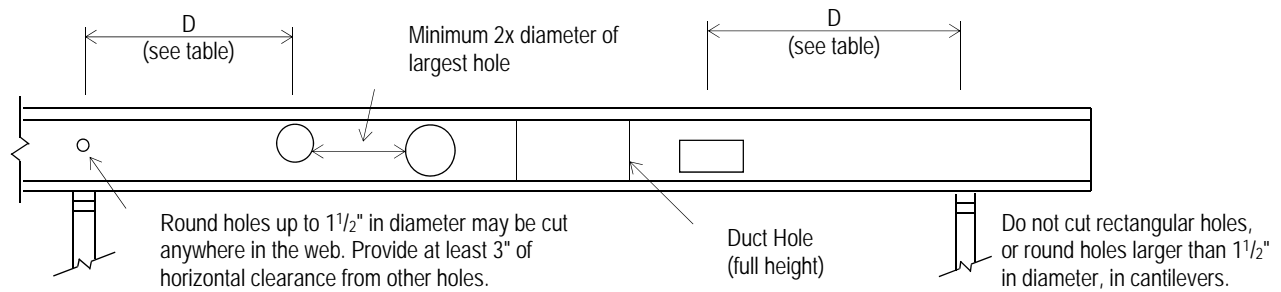
Snug to top

Concentrated Load > 1500 lb.
Use Table 2B ER Nail Schedule.

Birdsmouth Cut at
Low Support.
Use Table 2B ER
Nail Schedule.

Snug to bottom

High Reaction at
Support. See Table 2.

Flange Width	Minimum Dimensions		
	Web Stiffeners		Nails
	Thick.	Width	
$1^1/_2$"	$^{15}/_{32}$"	$2^5/_{16}$"	$2^1/_2$" x 0.131"
$1^3/_4$"	$^{19}/_{32}$"	$2^5/_{16}$"	$2^1/_2$" x 0.131"
$2^1/_{16}$"	$^{23}/_{32}$"	$2^5/_{16}$"	$2^1/_2$" x 0.131"
$2^5/_{16}$"	$^7/_8$"	$2^5/_{16}$"	$2^1/_2$" x 0.131"
$2^1/_2$"	$^7/_8$"	$2^5/_{16}$"	$2^1/_2$" x 0.131"
$3^1/_2$"	$1^1/_2$"	$3^1/_2$"	$3^1/_2$" x 0.131"
Web stiffener length is approximately $^1/_8$" less than the clear distance between flanges.			

FIGURE 1

D
(see table)

Minimum 2x diameter of
largest hole

D
(see table)

Round holes up to $1^1/_2$" in diameter may be cut
anywhere in the web. Provide at least 3" of
horizontal clearance from other holes.

Duct Hole
(full height)

Do not cut rectangular holes,
or round holes larger than $1^1/_2$"
in diameter, in cantilevers.

FIGURE 2