

ICC-ES Evaluation Report

ESR-1153

Reissued May 2015

Revised March 2016

This report is subject to renewal May 2017.

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EVALUATION SUBJECT:
TJI® PREFABRICATED WOOD I-JOISTS
1.0 EVALUATION SCOPE
Compliance with the following codes:

- 2015, 2012 and 2009 *International Building Code*® (IBC)
- 2015, 2012 and 2009 *International Residential Code*® (IRC)

* ■ ~~2013 *Abu Dhabi International Building Code* (ADIBC)†~~

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Properties evaluated:

- Structural
- Sound ratings
- Fire-resistance ratings

2.0 USES

TJI joists are prefabricated wood I-joists used as floor joists, roof rafters, blocking panels and rim joists, 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; and Section R502.1.4 of the IRC.

3.0 DESCRIPTION
3.1 General:

TJI joists are prefabricated wood I-joists having wood or wood-based flanges and Performance Plus® oriented strand board (OSB) webs. Either the top and bottom flanges are parallel, forming a constant-depth joist; or the top flange has a single taper, forming a variable-depth joist. The web panels have the face grain oriented vertically, and the web-to-web connection is either butt jointed or serrated and glued to form a continuous web. The web-to-flange connection is a proprietary tongue-and-groove glued joint. Refer to Table 1 for TJI joist series and material descriptions. The TJI L65, TJI L90, TJI H90, TJI HD90, and TJI HS90, may also be trademarked as: TJI L460, TJI L560, TJI H560, TJI HD560, and TJI HS560, respectively.

3.2 Material Specifications:

3.2.1 Flanges: Flange material is either Microllam® laminated veneer lumber (LVL), TimberStrand® laminated strand lumber (LSL) or machine stress rated lumber (MSR). Microllam LVL and TimberStrand LSL are recognized in evaluation report [ESR-1387](#). Table 1 of this report specifies flange widths and depths. Flange material and grades are as specified in the quality control manual that contains Weyerhaeuser manufacturing standards.

3.2.2 Webs: Web material is Performance Plus® OSB conforming to DOC Voluntary Product Standard PS2, Exposure 1, along with further requirements set forth in the quality-control manual that contains Weyerhaeuser manufacturing standards. Web material thickness requirements are noted in Table 1 of this report.

3.2.3 Adhesives: Adhesives are of the types specified in the quality control manual that contains Weyerhaeuser manufacturing standards.

4.0 DESIGN AND INSTALLATION
4.1 General:

The design and installation of TJI joists described in this report must comply with Sections 4.2 through 4.16. Additionally, design of TJI joists is governed by the

applicable code and corresponding editions of ANSI/AWC *National Design Specification for Wood Construction*® (NDS).

4.2 Design Values:

Table 3 specifies reference design moments, reactions, vertical shear forces, and joist stiffness (EI). Reference design reactions are based on minimum bearing lengths of $1\frac{3}{4}$ inches, $2\frac{1}{2}$ inches and $3\frac{1}{2}$ inches (45, 64 and 89 mm), for simple spans; and $3\frac{1}{2}$, $5\frac{1}{4}$ and 7 inches (89, 133 and 178 mm) at intermediate support points for continuous spans. When joists are used as multiple span members, the calculated shear, used for design at the intermediate support, may be reduced by the percentage determined from the following formula and limited to the depths shown in Table 4:

$$R = W \div K_{red} \leq 18\%$$

where:

$$K_{red} = V_{12} \div 100.$$

R = The percent reduction.

V_{12} = The reference design shear for an $11\frac{7}{8}$ -inch-deep (302 mm) joist (pounds).

W = The uniform load (plf).

The reference design shear at the interior supports of multiple-span-member TJI joists up to 12 inches (305 mm) deep, used in residential floor construction, is permitted to be increased by 10 percent. This increase in reference design shear does not apply to the design shear at the ends of the joists.

4.3 Fasteners:

Reference lateral and withdrawal design loads for fasteners, installed parallel or perpendicular to Microllam LVL or TimberStrand LSL flange glue lines, must be determined in accordance with [ESR-1387](#) and the applicable code. Reference lateral and withdrawal design loads for fasteners installed into TJI joist sawn lumber flanges must be designed using the applicable code and a specific gravity of 0.42, such as for spruce-pine-fir.

Allowable nail spacings for TJI joist diaphragm applications must be as specified in Sections 4.14 and 4.15, and Table 2.

For nondiaphragm applications:

1. The spacing of fasteners installed into the face grain of Microllam LVL or TimberStrand LSL flanges must be greater than or equal to the closest permitted on-center spacing prescribed by the code for fasteners installed in sawn lumber.

The spacing of fasteners installed into the edge grain of Microllam LVL or TimberStrand LSL flanges must be greater than or equal to the closest permitted on-center spacing requirements detailed in [ESR-1387](#).

2. The spacing of fasteners installed into TJI joist sawn lumber flanges must be as prescribed by the code for fasteners installed in sawn lumber.

The allowable lateral load capacity of 10d by $1\frac{1}{2}$ -inch-long (38 mm) common nails used to connect minimum No. 18 gage [0.048 inch (1.2 mm) base-metal thickness] metal straps or tension-ties, recognized in a current ICC-ES evaluation report, to TJI joist flanges, in conformance with Figure 6 of this report, is 112 pounds-force (498 N) per nail.

4.4 Web Stiffeners:

Web stiffener requirements for reactions and concentrated loads are noted in Table 3 and Figure 1.

4.5 Lateral Support:

TJI joist compression flanges with widths less than 2.3 inches (58 mm) require lateral support every 18 inches (457 mm) on center. TJI joist compression flanges with widths equal to or greater than 2.3 inches (58 mm) require lateral support every 24 inches (610 mm) on center. Each connection must be capable of transmitting a 75-pound-force (334 N) horizontal load. All TJI joist ends require restraint to prevent rollover. Code-prescribed methods of lateral restraint specified for sawn lumber are acceptable. Bridging is not required for floor and roof TJI joist applications.

4.6 Holes in TJI Joist Web:

The tables in Figures 2 and 3 specify allowable sizes and location of round, square and rectangular holes in the TJI joist webs. TJI joists with holes located in the web in accordance with Figures 2 and 3 are permitted to be used in the fire-resistive-rated Assemblies B, C, D, E, F, G and H described in Figures 4B through 4H.

4.7 Duration of Load:

Adjustments for duration of load, in accordance with Part 2.3.2 of the NDS, apply to the TJI joists and their fastenings.

4.8 In-service Moisture Conditions:

TJI joists must be installed in dry service conditions, where the moisture content in-service is less than 16 percent, as in most covered structures.

4.9 Repetitive-member Use:

The repetitive-member use factor applicable to the resistive moment capacities listed in Table 3 is limited to 1.0.

4.10 Member Spans:

TJI joist spans must be determined in accordance with Part 3.2.1 of the NDS. Vertical shear calculations must include all loads within the span from face to face of supports.

4.11 Deflection:

Deflection of simple span TJI joists with either uniform load or a concentrated load at midspan is determined using the formulas in the footnotes to Table 3.

4.12 Blocking Panels:

Bearing walls perpendicular to and supported by TJI joists at the end or intermediate supports, or both, require full-depth blocking. TJI joists up to and including 16 inches (406 mm) in depth, when used as blocking panels, have a maximum vertical load transfer capacity of 2,100 plf (30 645 N/m). TJI joists over 16 inches (406 mm) and up to and including 20 inches (508 mm) in depth, when used as blocking panels, have a maximum vertical load transfer capacity of 1,550 plf (22 620 N/m).

4.13 Rim Joists:

TJI joists having depths of up to and including 16 inches (406 mm) may be used as rim joists and boundary members of horizontal wood structural diaphragms. The joists have a maximum vertical load transfer capacity of 2,100 plf (30,645 N/m). TJI joists used as rim joists must be laterally supported at the top and continuously supported at the bottom, and the gravity loads must be uniformly applied along the top. Other loading and support

conditions must be investigated and approved by a design professional.

4.14 TJI Joists as Prescriptive Diaphragm Framing Members:

TJI joists are permitted as framing members in prescriptive floor and roof diaphragm construction in accordance with Section 2308 of the IBC or Chapters 5 and 8 of the IRC. When TJI 110, TJI 210 or TJI 230 series I-joists are used in floor diaphragm construction, the thickness of the sheathing must be $19/32$ inch (15.1 mm) or greater.

4.15 TJI Joists as Engineered Diaphragm Framing Members:

TJI 110, TJI 210, TJI 230, TJI 360, TJI 560, TJI 560D, TJI s31, TJI s33, and TJI s47, joists may be used as framing members in blocked and unblocked engineered diaphragms designed using Table 2306.2.1(1) of the 2009 IBC, or Tables 4.2A and 4.2C of the ANSI/AWC Special Design Provisions for Wind and Seismic (SDPWS), subject to the limitations specified in Table 2 of this report.

TJI L65, TJI L90, TJI H90, TJI HD90 and TJI HS90 joists may be used as framing members in diaphragms designed in accordance with the applicable code. The closest permitted sheathing nail spacing in a single row is 3 inches (76 mm) on center for 10d common nails or 2 inches (51 mm) on center for 8d common nails.

4.16 Cantilevered TJI Joists:

TJI joists are permitted to be installed with cantilevered ends, provided the cantilevers have a maximum length equal to one-third of the adjacent span and support uniform loads only, unless designed by a design professional.

* ~~4.17 TJI Joists with Flak Jacket™ Protection Used in Fire Protected Floors:~~

~~TJI® Joists with Flak Jacket™ protection applied to both sides of the web and vertical sides of the bottom flange are an alternative to the 2 by 10 dimension lumber, prescribed in the 2015 IRC Section R302.13 Exception 4 (2012 IRC Section R501.3 Exception 4), and have met the requirements of a floor assembly demonstrating equivalent floor performance. TJI® Joists with Flak Jacket™ protection are identified in the field by a Flak Jacket™ Protection stamp or label placed on the web of the I-joist member. Flak Jacket™ protection is applied in accordance with the TJI® Joist with Flak Jacket™ Protection Manufacturing Standard and quality control program.~~

~~The TJI® Joist Flak Jacket™ protection is limited to TJI® 210, 230, 360, 560 and 560D I-joists which have a minimum flange depth of $1\frac{3}{8}$ inches (34.9 mm). The flooring attachment to the I-joists must include the application of construction adhesive complying with ASTM D3498.~~

4.18 Fire-resistance-rated Roof-ceiling or Floor-ceiling Assemblies:

See Figures 4A through 4F, and 4H, for details on one-hour fire-resistance-rated roof-ceiling or floor-ceiling assemblies. See Figure 4G for details on two-hour fire-resistance-rated roof-ceiling or floor-ceiling assemblies. When assemblies A, B, C, D, E, and F are used as floor-ceiling assemblies over unusable crawl spaces, it is permitted to omit the ceiling membrane. Additionally, flooring is permitted to be omitted where unusable attic space occurs above, provided the lateral support requirements of Section 4.5 are met. Alternate floor or roof systems using lightweight concrete or gypsum concrete are permitted in accordance with Table 5.

4.19 Sound Ratings:

Fire-resistance-rated assemblies B, D and G, as described in Figures 4B, 4D and 4G, have sound transmission class (STC) and impact insulation class (IIC) ratings as given in Table 6, provided they are constructed with the additional assembly components and floor coverings specified in Table 6.

5.0 CONDITIONS OF USE

The TJI Prefabricated Wood I-joists described in this report comply with or are suitable alternatives to joists and rafters specified in the codes specifically listed in Section 1.0, subject to the following conditions:

- 5.1 TJI joists are designed in accordance with this report.
- 5.2 Drawings and design details verifying compliance with this report are submitted to the code official for approval.
- 5.3 Reference design values for TJI joists and their fasteners are permitted to be increased for duration of load in accordance with the applicable code.
- 5.4 Where one-hour or two-hour fire-resistance-rated construction is required, construction complies with this report.
- 5.5 No cutting or notching of TJI joist flanges is permitted.
- 5.6 Sound rated assemblies described in Table 6, with STC and or IIC ratings of less than 50, are only applicable in jurisdictions using the IRC.
- 5.7 TJI joists are produced at the Weyerhaeuser plants located in Castleberry, Alabama; Eugene, Oregon; and Natchitoches, Louisiana; and at the RedBuilt™ LLC plant located in Stayton, Oregon; and the Anthony-Domtar plant located in Sault Ste. Marie, Ontario, Canada; and at the Pacific Woodtech plant located in Burlington, Washington; under a quality control program with inspections by ICC-ES, PFS Corporation (AA-652), or APA—The Engineered Wood Association (AA-649).
- 5.8 TJI Joists with Flak Jacket™ protection are produced at the Weyerhaeuser plant located in Simsboro, LA, under a quality-control program with inspections by ICC-ES or PFS Corporation (AA-652).

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Prefabricated Wood I-joists (AC14), dated October 2013 (editorially revised January 2016).
- 6.2 Reports of fire tests conducted in accordance with ASTM E119.
- 6.3 Reports of sound transmission tests conducted in accordance with ASTM E90, ASTM E413 and ASTM E492.

7.0 IDENTIFICATION

TJI prefabricated wood I-joists are identified by a stamp that includes the product designation, evaluation report number (ESR-1153), manufacturer's name or logo (Trus Joist, Weyerhaeuser), plant number, production date, and the name or logo of the inspection agency (PFS Corporation or APA).

TABLE 1—TJI® JOIST DESCRIPTION

TJI JOIST SERIES	FLANGE SIZE, DEPTH × WIDTH (inches)	WEB THICKNESS (inches)	RANGE OF JOIST DEPTHS (inches)
TJI® 110	Minimum 1.25 x 1.75	$\frac{3}{8}$	9 $\frac{1}{2}$ - 16 14
TJI® 210	Minimum 1.25 x 2.08	$\frac{3}{8}$	9 $\frac{1}{2}$ - 16
TJI® 230	Minimum 1.25 x 2.3	$\frac{3}{8}$	9 $\frac{1}{2}$ - 16
TJI® 360	Minimum 1.375 x 2.3	$\frac{3}{8}$	9 $\frac{1}{2}$ - 20
TJI® 560	Minimum 1.375 x 3.5	$\frac{7}{16}$	9 $\frac{1}{2}$ - 20
TJI® 560D	1.5 x 3.5	$\frac{7}{16}$	9 $\frac{1}{2}$ - 30
TJI® s31	1.5 x 2.5	$\frac{3}{8}$	9 $\frac{1}{2}$ - 16
TJI® s33	1.5 x 2.5	$\frac{3}{8}$	9 $\frac{1}{2}$ - 16
TJI® s47	1.5 x 3.5	$\frac{7}{16}$	11 $\frac{7}{8}$ - 20
TJI® L65 (or TJI® L460)	1.5 x 2.5	$\frac{7}{16}$	9 $\frac{1}{2}$ - 30 (9 $\frac{1}{2}$ - 30 taper)
TJI® L90 (or TJI® L560)	1.5 x 3.5	$\frac{7}{16}$	9 $\frac{1}{2}$ - 30 (9 $\frac{1}{2}$ - 30 taper)
TJI® H90 (or TJI® H560)	1.75 x 3.5	$\frac{7}{16}$	11 $\frac{7}{8}$ - 30
TJI® HD90 (or TJI® HD560)	2.125 x 3.5	$\frac{1}{2}$	11 $\frac{7}{8}$ - 32
TJI® HS90 (or TJI® HS560)	2.5 x 3.5	$\frac{1}{2}$	11 $\frac{7}{8}$ - 32

For SI: 1 inch = 25.4 mm.

TABLE 2—TJI® JOIST ENGINEERED DIAPHRAGM FRAMING DESIGN INFORMATION¹

TJI JOIST SERIES	EQUIVALENT NOMINAL FRAMING WIDTH	EQUIVALENT SPECIFIC GRAVITY	CLOSEST PERMITTED NAIL SPACING (inches) ²			ALLOWABLE (UNIT SHEAR) SEISMIC DESIGN CAPACITY (plf) ^{1,3}			
			6d common	8d common	10d common	Blocked	Unblocked Case 1	Unblocked Case 3	Unblocked Cases 2, 4, 5, 6
TJI® 110 TJI® 210	2 in.	0.50	4	4	4	425	285	215	185 ⁴
TJI® 230	3 in.	0.50	4	4	4	480	320	240	205 ⁴
TJI® 360 TJI® 560 TJI® 560D	3 in.	0.50	3	3	4	720	320	240	240
TJI® s31 TJI® s33 TJI® s47	3 in.	0.42	3	3	4	660	295	220	220

For SI: 1 inch = 25.4 mm, 1 plf = 14.59 N/m.

¹Allowable shear loads for wood structural panel diaphragms with TJI joist framing must be determined in accordance with Tables 4.2A and 4.2C of the SDPWS or Table 2306.2.1(1) of the 2009 IBC, using the equivalent nominal framing width and specific gravities specified in Table 2, and must not exceed the maximum permitted design capacity given in Table 2.

²One row of nails is permitted along each sheathing panel end and edge. When nail spacing is less than 6 inches on center, adjacent nails within a row must be offset (staggered). The closest permitted nail spacing in Table 2 must not be exceeded. Solid sawn framing members must be used in lieu of TJI joist framing members where the fastener spacing required in SDPWS Tables 4.2A and 4.2C or 2009 IBC Table 2306.2.1(1) is closer than the closest permitted nail spacing given in Table 2 of this report.

³The maximum allowable seismic design capacities of Table 2 may be increased by a factor of 1.4 for wind design applications.

⁴The design unit shear capacities of unblocked diaphragms framed with TJI 110, TJI 210 or TJI 230 joists may be multiplied by a factor of 1.18 when non-polyurethane sub-floor adhesives are used in combination with mechanical fasteners for sheathing attachment. Continuous special inspection is not required for this adhesive application.

TABLE 3—REFERENCE DESIGN VALUES FOR TJI JOISTS^{1,2,3}

Joist Depth (in.)	Joist Weight ⁽⁸⁾ (plf)	REFERENCE DESIGN VALUES													
		Moment M _R (ft.-lbs.) ^(10, 12)	Shear V _R (lbs.)	EI x 10 ⁶ lbs.-in. ²	K	END REACTION R _{R,e} (lbs.) ^{4,5,6}					INTERMEDIATE REACTION R _{R,i} (lbs.) ^{4,5,6}				
						1 ³ / ₄ " 2 ¹ / ₂ " ⁽⁹⁾		3 ¹ / ₂ "		Nails Req'd for Web Stiff.	3 ¹ / ₂ " 5 ¹ / ₄ " ⁽⁷⁾		5 ¹ / ₄ " 7" ⁽⁷⁾		Nails Req'd for Web Stiff.
						Bearing Length		Bearing Length			Bearing Length		Bearing Length		
						Web Stiffeners		Web Stiffeners			Web Stiffeners		Web Stiffeners		
						NO	YES	NO	YES		NO	YES	NO	YES	
TJI 110															
9 ¹ / ₂	2.3	2500	1220	157	4.5	910	NA	1220	NA	NA	1935	NA	2350	NA	NA
11 ⁷ / ₈	2.5	3160	1560	267	4.5	910	1225	1375	1560	3-8d	1935	2295	2350	2705	3-8d
14	2.8	3740	1860	392	4.5	910	1225	1375	1735	3-8d	1935	2295	2350	2705	3-8d
16	3.0	4280	2145	535	4.5	910	1225	1375	1735	3-8d	1935	2295	2350	2705	3-8d
TJI 210															
9 ¹ / ₂	2.6	3000	1330	186	4.5	1005	NA	1330	NA	NA	2145	NA	2565	NA	NA
11 ⁷ / ₈	2.8	3795	1655	315	4.5	1005	1365	1460	1655	3-8d	2145	2505	2565	2925	3-8d
14	3.1	4490	1945	462	4.5	1005	1365	1460	1815	3-8d	2145	2505	2565	2925	3-8d
16	3.3	5140	2190	629	4.5	1005	1365	1460	1815	3-8d	2145	2505	2565	2925	3-8d
TJI 230															
9 ¹ / ₂	2.7	3330	1330	206	4.5	1060	NA	1330	NA	NA	2410	NA	2790	NA	NA
11 ⁷ / ₈	3.0	4215	1655	347	4.5	1060	1420	1485	1655	3-8d	2410	2765	2790	3150	3-8d
14	3.3	4990	1945	509	4.5	1060	1420	1485	1840	3-8d	2410	2765	2790	3150	3-8d
16	3.5	5710	2190	691	4.5	1060	1420	1485	1840	3-8d	2410	2765	2790	3150	3-8d
TJI 360															
9 ¹ / ₂	2.7	4790	1425	249	4.5	1080	NA	1425	NA	NA	2460	NA	3000	NA	NA
11 ⁷ / ₈	3.0	6180	1705	419	4.5	1080	1440	1505	1705	3-8d	2460	2815	3000	3360	3-8d
14	3.3	7335	1955	612	4.5	1080	1440	1505	1865	3-8d	2460	2815	3000	3360	3-8d
16	3.5	8405	2190	830	4.5	1080	1440	1505	1865	3-8d	2460	2815	3000	3360	3-8d
18	3.7	9465	2425	1085	4.5	1080	1440	1505	1865	3-8d	2460	2815	3000	3360	3-8d
20	4.0	10515	2660	1376	4.5	1080	1440	1505	1865	3-8d	2460	2815	3000	3360	3-8d

See notes at the end of the table.

TABLE 3—REFERENCE DESIGN VALUES FOR TJI JOISTS^{1,2,3} (Continued)

Joist Depth (in.)	Joist Weight ⁽⁸⁾ (plf)	REFERENCE DESIGN VALUES													
		Moment M _R (ft.-lbs.) ^(10, 12)	Shear V _R (lbs.)	EI x 10 ⁶ lbs.-in. ²	K	END REACTION R _{R,e} (lbs.) ^{4,5,6}					INTERMEDIATE REACTION R _{R,i} (lbs.) ^{4,5,6}				
						1 ³ / ₄ " 2 ¹ / ₂ " ⁽⁹⁾		3 ¹ / ₂ "		Nails Req'd for Web Stiff.	3 ¹ / ₂ " 5 ¹ / ₄ " ⁽⁷⁾		5 ¹ / ₄ " 7" ⁽⁷⁾		Nails Req'd for Web Stiff.
						Bearing Length		Bearing Length			Bearing Length		Bearing Length		
						Web Stiffeners		Web Stiffeners			Web Stiffeners		Web Stiffeners		
						NO	YES	NO	YES		NO	YES	NO	YES	
TJI 560															
9 ¹ / ₂	3.6	7355	1670	378	5.3	1265	NA	1670	NA	NA	3000	NA	3455	NA	NA
11 ⁷ / ₈	4.0	9500	2050	636	5.3	1265	1740	1725	2050	3-16d	3000	3475	3455	3930	3-16d
14	4.2	11275	2390	926	5.3	1265	1740	1725	2200	3-16d	3000	3475	3455	3930	3-16d
16	4.5	12925	2710	1252	5.3	1265	1740	1725	2200	3-16d	3000	3475	3455	3930	3-16d
18	4.8	14550	3030	1631	5.3	1265	1740	1725	2200	3-16d	3000	3475	3455	3930	3-16d
20	5.1	16165	3345	2064	5.3	1265	1740	1725	2200	3-16d	3000	3475	3455	3930	3-16d
TJI 560D															
9 ¹ / ₂	3.8	7415	1740	381	5.3	1400	NA	1740	NA	NA	3350	NA	3965	NA	NA
11 ⁷ / ₈	4.2	9605	2255	643	5.3	1400	1875	1885	2255	3-16d	3350	3825	3965	4440	3-16d
14	4.5	11430	2540	940	5.3	1400	1875	1885	2355	3-16d	3350	3825	3965	4440	3-16d
16	4.7	13115	2810	1273	5.3	1400	2030	1885	2515	4-16d	3350	3980	3965	4600	4-16d
18	5.0	14785	3080	1661	5.3	1400	2030	1885	2515	4-16d	3350	3980	3965	4600	4-16d
20	5.3	16435	3345	2105	5.3	1400	2190	1885	2675	5-16d	3350	4140	3965	4755	5-16d
22	5.6	18075	3615	2606	5.3	NA	2345	NA	2830	6-16d	NA	5090	NA	5705	11-16d
24	5.8	19700	3400	3165	5.3	NA	2345	NA	2830	6-16d	NA	5405	NA	6020	13-16d
26	6.1	21315	3400	3783	5.3	NA	2450	NA	2990	7-16d	NA	6180 ⁽⁷⁾	NA	6795 ⁽⁷⁾	14-16d
28	6.4	22915	3400	4463	5.3	NA	2450	NA	3145	8-16d	NA	6335 ⁽⁷⁾	NA	6800 ⁽⁷⁾	15-16d
30	6.6	24510	3400	5205	5.3	NA	2450	NA	3145	8-16d	NA	6655 ⁽⁷⁾	NA	6800 ⁽⁷⁾	17-16d
TJI s31															
9 ¹ / ₂	2.6	3000	1205	205	4.5	1080	NA	1205	NA	NA	2755	NA	3120	NA	NA
11 ⁷ / ₈	2.9	3795	1530	348	4.5	1200	1530	1470	1530	3-8d	2755	3110	3185	3540	3-8d
14	3.1	4490	1820	511	4.5	1200	1555	1470	1820	3-8d	2755	3110	3185	3540	3-8d
16	3.4	5140	2065	696	4.5	1200	1555	1470	1825	3-8d	2755	3110	3185	3540	3-8d
TJI s33															
9 ¹ / ₂	2.6	3805	1205	242	4.5	1080	NA	1205	NA	NA	2755	NA	3120	NA	NA
11 ⁷ / ₈	2.9	4925	1530	411	4.5	1200	1530	1470	1530	3-8d	2755	3110	3185	3540	3-8d
14	3.1	5930	1820	602	4.5	1200	1555	1470	1820	3-8d	2755	3110	3185	3540	3-8d
16	3.4	6880	2065	818	4.5	1200	1555	1470	1825	3-8d	2755	3110	3185	3540	3-8d
TJI s47															
11 ⁷ / ₈	3.6	6970	1925	574	5.3	1280	1755	1490	1925	3-16d	2760	3235	3195	3670	3-16d
14	3.8	8395	2125	840	5.3	1280	1755	1490	1965	3-16d	3020	3495	3385	3860	3-16d
16	4.0	9735	2330	1140	5.3	1280	1755	1490	1965	3-16d	3200	3675	3550	4025	3-16d
18	4.3	11005	2535	1489	5.3	1280	1755	1490	1965	3-16d	3200	3675	3595	4070	3-16d
20	4.5	12180	2740	1889	5.3	1280	1755	1490	1965	3-16d	3200	3675	3595	4070	3-16d
TJI L65															
9 ¹ / ₂	3.0	5215	1675	263	5.3	1375	NA	1675	NA	NA	2745	NA	3365	NA	NA
11 ⁷ / ₈	3.3	6750	1925	450	5.3	1375	1745	1885	1925	3-8d	2745	3120	3365	3735	3-8d
14	3.6	8030	2125	666	5.3	1375	1750	1885	2125	5-8d	2745	3365	3365	3985	5-8d
16	3.9	9210	2330	913	5.3	1375	1750	1885	2330	6-8d	2745	3490	3365	4105	6-8d
18	4.2	10380	2535	1205	5.3	1375	1750	1885	2535	7-8d	2745	3615	3365	4230	7-8d
20	4.4	11540	2740	1545	5.3	NA	1750	NA	2740	8-8d	NA	3740	NA	4355	8-8d
22	4.7	12690	2935	1934	5.3	NA	1750	NA	2935	9-8d	NA	3860	NA	4480	9-8d
24	5.0	13830	3060	2374	5.3	NA	1750	NA	3060	10-8d	NA	3875	NA	4605	10-8d
26	5.3	14960	2900	2868	5.3	NA	1750	NA	2900	11-8d	NA	4725 ⁽⁷⁾	NA	5345 ⁽⁷⁾	11-8d
28	5.5	16085	2900	3417	5.3	NA	1750	NA	2900	12-8d	NA	4850 ⁽⁷⁾	NA	5470 ⁽⁷⁾	12-8d
30	5.8	17205	2900	4025	5.3	NA	1750	NA	2900	13-8d	NA	4975 ⁽⁷⁾	NA	5590 ⁽⁷⁾	13-8d

See notes at the end of the table.

TABLE 3 REFERENCE DESIGN VALUES FOR TJI JOISTS^{1,2,3} (Continued)

Joist Depth (in.)	Joist Weight ⁽⁸⁾ (plf)	REFERENCE DESIGN VALUES													
		Moment M _R (ft.-lbs.) ⁽¹⁰⁾	Shear V _R (lbs.)	EI x 10 ⁶ lbs.-in. ²	K	END REACTION R _{R,e} (lbs.) ^{4,5,6}					INTERMEDIATE REACTION R _{R,i} (lbs.) ^{4,5,6}				
						1 ³ / ₄ " 2 ¹ / ₂ " ⁽⁹⁾		3 ¹ / ₂ "		Nails Req'd for Web Stiff.	3 ¹ / ₂ " 5 ¹ / ₄ " ⁽⁷⁾		5 ¹ / ₄ " 7" ⁽⁷⁾		Nails Req'd for Web Stiff.
						Bearing Length		Bearing Length			Bearing Length		Bearing Length		
						Web Stiffeners		Web Stiffeners			Web Stiffeners		Web Stiffeners		
						NO	YES	NO	YES		NO	YES	NO	YES	
TJI L90															
9 ¹ / ₂	3.8	7415	1675	365	5.3	1400	NA	1675	NA	NA	3350	NA	3965	NA	NA
11 ⁷ / ₈	4.2	9605	1925	621	5.3	1400	1715	1885	1925	2-16d	3350	3665	3965	4285	2-16d
14	4.5	11430	2125	913	5.3	1400	1875	1885	2125	3-16d	3350	3825	3965	4440	3-16d
16	4.7	13115	2330	1246	5.3	1400	2030	1885	2330	4-16d	3350	3980	3965	4600	4-16d
18	5.0	14785	2535	1635	5.3	1400	2030	1885	2515	4-16d	3350	3980	3965	4600	4-16d
20	5.3	16435	2740	2085	5.3	NA	2190	NA	2675	5-16d	NA	4140	NA	4755	5-16d
22	5.6	18075	2935	2597	5.3	NA	2345	NA	2830	6-16d	NA	5090	NA	5705	11-16d
24	5.8	19700	3060	3172	5.3	NA	2345	NA	2830	6-16d	NA	5405	NA	6020	13-16d
26	6.1	21315	2900	3814	5.3	NA	2450	NA	2900	7-16d	NA	5800 ⁽⁷⁾	NA	5800 ⁽⁷⁾	14-16d
28	6.4	22915	2900	4525	5.3	NA	2450	NA	2900	8-16d	NA	5800 ⁽⁷⁾	NA	5800 ⁽⁷⁾	15-16d
30	6.6	24510	2900	5306	5.3	NA	2450	NA	2900	8-16d	NA	5800 ⁽⁷⁾	NA	5800 ⁽⁷⁾	17-16d
TJI H90															
11 ⁷ / ₈	4.6	10960	1925	687	5.3	1400	1715	1885	1925	2-16d	3495	3810	4100	4420	2-16d
14	4.9	13090	2125	1015	5.3	1400	1875	1885	2125	3-16d	3495	3970	4100	4575	3-16d
16	5.2	15065	2330	1389	5.3	1400	2030	1885	2330	4-16d	3495	4130	4100	4735	4-16d
18	5.4	17010	2535	1827	5.3	1400	2030	1885	2515	4-16d	3495	4130	4100	4735	4-16d
20	5.7	18945	2740	2331	5.3	NA	2190	NA	2675	5-16d	NA	4285	NA	4890	5-16d
22	6.0	20855	2935	2904	5.3	NA	2345	NA	2830	6-16d	NA	5235	NA	5840	11-16d
24	6.3	22755	3060	3549	5.3	NA	2345	NA	2830	6-16d	NA	5425	NA	6155	13-16d
26	6.5	24645	2900	4266	5.3	NA	2450	NA	2900	7-16d	NA	5800 ⁽⁷⁾	NA	5800 ⁽⁷⁾	14-16d
28	6.8	26520	2900	5059	5.3	NA	2450	NA	2900	8-16d	NA	5800 ⁽⁷⁾	NA	5800 ⁽⁷⁾	15-16d
30	7.1	28380	2900	5930	5.3	NA	2450	NA	2900	8-16d	NA	5800 ⁽⁷⁾	NA	5800 ⁽⁷⁾	17-16d
TJI HD90															
11 ⁷ / ₈	5.4	14075	2320	826	6.0	1835 ⁽⁹⁾	2320 ⁽⁹⁾	2150	2320	4-16d	3995	4650	4690	5345	4-16d
14	5.7	16920	2565	1232	6.0	1835 ⁽⁹⁾	2565 ⁽⁹⁾	2150	2565	6-16d	3995	4980	4690	5670	6-16d
16	6.0	19550	2790	1695	6.0	1835 ⁽⁹⁾	2790 ⁽⁹⁾	2150	2790	6-16d	3995	4980	4690	5670	6-16d
18	6.3	22150	3020	2239	6.0	1835 ⁽⁹⁾	3020 ⁽⁹⁾	2150	3020	8-16d	3995	5310	4690	6000	8-16d
20	6.7	24725	3250	2866	6.0	NA	3250 ⁽⁹⁾	NA	3250	10-16d	NA	5425	NA	6330	10-16d
22	7.0	27280	3480	3579	6.0	NA	3475 ⁽⁹⁾	NA	3480	10-16d	NA	5425	NA	6330	10-16d
24	7.3	29815	3710	4380	6.0	NA	3500 ⁽⁹⁾⁽¹¹⁾	NA	3710	12-16d	NA	5425	NA	6655	12-16d
26	7.6	32330	3940	5272	6.0	NA	3500 ⁽⁹⁾⁽¹¹⁾	NA	3940	14-16d	NA	6985 ⁽⁷⁾	NA	7675 ⁽⁷⁾	14-16d
28	7.9	34830	4165	6258	6.0	NA	3500 ⁽⁹⁾⁽¹¹⁾	NA	4165	14-16d	NA	6985 ⁽⁷⁾	NA	7675 ⁽⁷⁾	14-16d
30	8.2	37310	4375	7339	6.0	NA	3500 ⁽⁹⁾⁽¹¹⁾	NA	4375	16-16d	NA	7310 ⁽⁷⁾	NA	8005 ⁽⁷⁾	16-16d
32	8.5	39785	4375	8519	6.0	NA	3500 ⁽⁹⁾⁽¹¹⁾	NA	4375	18-16d	NA	7640 ⁽⁷⁾	NA	8335 ⁽⁷⁾	18-16d
TJI HS90															
11 ⁷ / ₈	6.0	16050	2320	900	6.0	1835 ⁽⁹⁾	2320 ⁽⁹⁾	2150	2320	4-16d	3995	4650	4690	5345	4-16d
14	6.3	19425	2565	1355	6.0	1835 ⁽⁹⁾	2565 ⁽⁹⁾	2150	2565	6-16d	3995	4980	4690	5670	6-16d
16	6.6	22550	2790	1876	6.0	1835 ⁽⁹⁾	2790 ⁽⁹⁾	2150	2790	6-16d	3995	4980	4690	5670	6-16d
18	7.0	25640	3020	2488	6.0	1835 ⁽⁹⁾	3020 ⁽⁹⁾	2150	3020	8-16d	3995	5310	4690	6000	8-16d
20	7.3	28695	3250	3195	6.0	NA	3250 ⁽⁹⁾	NA	3250	10-16d	NA	5425	NA	6330	10-16d
22	7.6	31725	3480	3998	6.0	NA	3475 ⁽⁹⁾	NA	3480	10-16d	NA	5425	NA	6330	10-16d
24	7.9	34730	3710	4901	6.0	NA	3500 ⁽⁹⁾⁽¹¹⁾	NA	3710	12-16d	NA	5425	NA	6655	12-16d
26	8.2	37715	3940	5905	6.0	NA	3500 ⁽⁹⁾⁽¹¹⁾	NA	3940	14-16d	NA	6985 ⁽⁷⁾	NA	7675 ⁽⁷⁾	14-16d
28	8.5	40680	4165	7014	6.0	NA	3500 ⁽⁹⁾⁽¹¹⁾	NA	4165	14-16d	NA	6985 ⁽⁷⁾	NA	7675 ⁽⁷⁾	14-16d
30	8.8	43630	4375	8230	6.0	NA	3500 ⁽⁹⁾⁽¹¹⁾	NA	4375	16-16d	NA	7310 ⁽⁷⁾	NA	8005 ⁽⁷⁾	16-16d
32	9.1	46560	4375	9555	6.0	NA	3500 ⁽⁹⁾⁽¹¹⁾	NA	4375	18-16d	NA	7640 ⁽⁷⁾	NA	8335 ⁽⁷⁾	18-16d

See notes at the end of the table.

For SI: 1 inch = 25.4 mm, 1 plf = 14 59 N/m, 1 ft.-lb. = 1.356 N-m, 1 lb.-in.² = 2.87 kN-mm.²

FOOTNOTES FOR TABLE 3:¹Refer to Figure 1 for web stiffener details²Deflection is calculated as follows:

$$\text{Uniform load : } \Delta = \frac{22.5WL^4}{EI} + \frac{12WL^2}{Kdx10^5}$$

$$\text{Concentrated load at midspan : } \Delta = \frac{36PL^3}{EI} + \frac{24PL}{Kdx10^5}$$

Where:

P = Concentrated load, pounds.

d = Out-to-out depth of joist, inches.

L = Clear span in feet

W = Uniform load in pounds per lineal foot.

EI = From table.

K = From table.

³The stated reference design values are for loads of normal duration. Adjustments to the reference design values must be in accordance with the applicable code, with the exception noted in footnote 10 below.⁴Interpolation between bearing lengths and joist depths is permitted for reference design reactions.⁵The minimum bearing length is permitted to be reduced for joists supported by hangers if supplemental nail attachment is provided to the web stiffener.⁶Required bearing lengths have been determined based on Weyerhaeuser TJI Joist products. Allowable bearing stresses on supporting members must be checked.⁷Referenced design reactions require 5¹/₄-inch and 7-inch bearing lengths at intermediate supports.⁸Joist weights shown are calculated on a rational basis, are based on the heavier of eastern or western species products and are suitable for dead load calculation. Contact the producing plant for shipping weight information if needed.⁹Applicable to TJI HD90 and TJI HS90 joists only. Tabulated values indicate reference design bearing reactions for a 2¹/₂-inch bearing length at end supports. 1³/₄-inch end bearing lengths are also permitted; with reference design reactions of 1600 lbs. without web stiffeners for depths up to and including 18 inches; with web stiffeners the reference design reaction is 2255 lbs. for the 11¹/₈ inch depth and 2450 lbs. for all other depths.¹⁰The reference design moment values listed in Table 3 may not be increased by any code allowed repetitive-member use factor.¹¹Applicable to TJI HD90 and TJI HS90 joists only. Reference design reaction values are based on applicable hanger seat length (interpolated as per note 4 above) may be increased 510 lbs. when supported by Simpson Strong-Tie Co. HWI or WPU joist hangers with a minimum of 4, 10d common nails installed through the joist hanger stirrups and into the joist web stiffener and web.¹²Use 90% of the published TJI® 210, 230, 360, and 560 joist bending capacity for TJI® joists with Flak Jacket™ protection when used in one-hour fire-resistance-rated Assembly H described in Figure 4H of this report.**TABLE 4—PROPERTIES FOR USE IN SECTION 4.2**

TJI JOIST SERIES	TJI JOIST DEPTH (inches)	V ₁₂ (lbs.)	K _{red}
TJI® 110	≤ 46 14	1560	15.60
TJI® 210, TJI® 230	≤ 16	1655	16.55
TJI® 360	≤ 16	1705	17.05
TJI® 560	≤ 16	2050	20.50
TJI® 560D	≤ 24	2255	20.50
TJI® s31, TJI® s33	≤ 16	1530	15.30
TJI® s47	≤ 20	1925	19.25
TJI® L65, TJI® L90, TJI® H90	≤ 24	1925	19.25
TJI® HD90, TJI® HS90	≤ 24	2320	23.20

For SI: 1 inch = 25.4 mm, 1 lb. = 4.448 N, 1 plf = 14.59 N/m.

Web Stiffener Requirements:

- ¹Web stiffeners must be installed at bearing points as required in Table 3.
- ²Web stiffeners must be installed at points of concentrated loads greater than 1500 pounds and are to be nailed in accordance with the intermediate reaction schedule in Table 3.
- ³Web stiffeners are to be installed on each side of the web as shown, with nails equally spaced vertically.
- ⁴A gap must be left at the top of web stiffeners as shown at all bearing conditions. In the case of concentrated loads, web stiffeners are required as shown and the gap must be at the bottom.
- ⁵Web stiffener material must be sheathing meeting the requirements of PS-1 or PS-2 with the face grain parallel to the long axis of the stiffener.
- ⁶Some hangers require web stiffeners to comply with nailing requirements through side plates.
- ⁷If web stiffeners are not used in hanger support, the side of the hanger must extend up to laterally support the top flange.
- ⁸See manufacturer's published installation instructions for additional details and requirements for web stiffeners.

Web stiffener specifications are as follows:

TJI® JOIST SERIES	MINIMUM DIMENSIONS		GRADE
	"W" (inches)	"T" (inches)	
TJI® 110	2 ⁵ / ₁₆	⁵ / ₈	See Note 5
TJI® 210	2 ⁵ / ₁₆	23/32	See Note 5
TJI® 230, TJI® 360, TJI® L65	2 ⁵ / ₁₆	⁷ / ₈	See Note 5
TJI® s31, TJI® s33	2 ⁵ / ₁₆	1.0	See Note 5
TJI® s47, TJI® 560, TJI® 560D, TJI® L90, TJI® H90	3 ¹ / ₂	1 ¹ / ₂	Construction Grade 2x4
TJI® HD90, TJI® HS90	3 ¹ / ₂	1 ¹ / ₂	1.3E minimum grade TimberStrand LSL

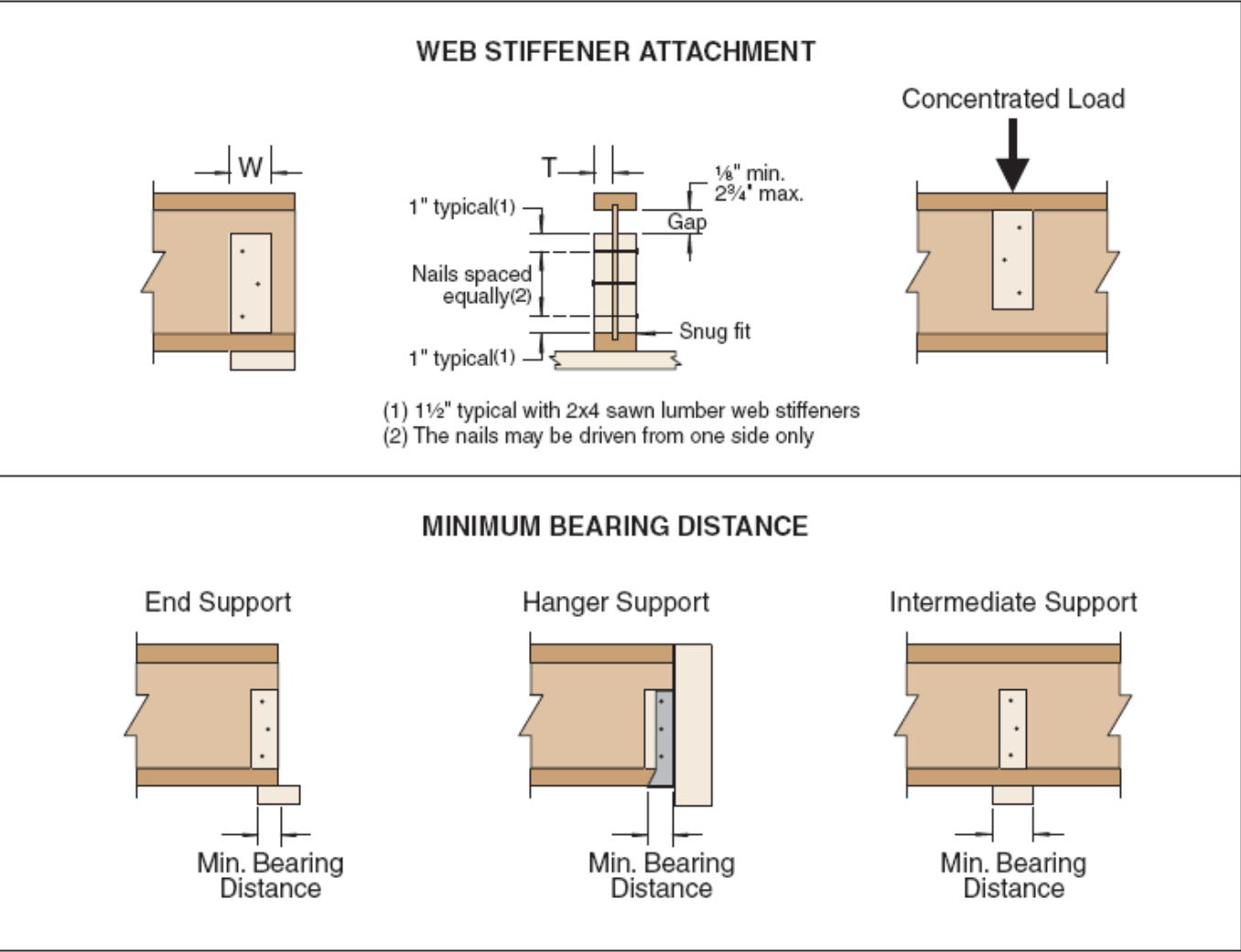
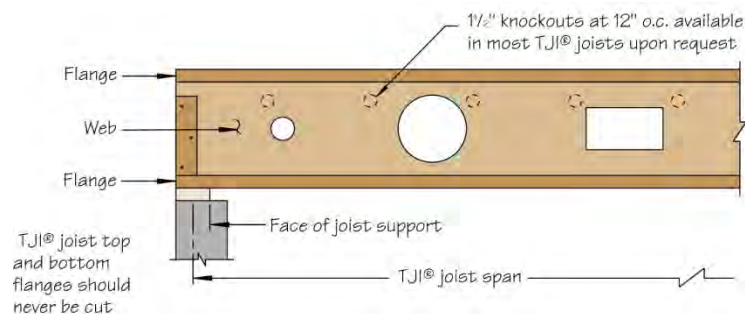


FIGURE 1—WEB STIFFENER NOTES AND DETAILS



Hole Factors and Locations Chart

Round Hole Size (inches)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Rectangular Hole Size (inches)	1 1/4	1 3/4	2 1/4	3	3 1/2	4	4 3/4	5 1/4	6	6 1/2	7	7 3/4	8 1/4	9	9 1/2	10	10 3/4	11 1/4	12
Joist depth (inches)	11 7/8	A	A	B	C	E													
	14	A	A	B	C	C	D	E											
	16	A	A	A	B	C	C	D	E	E									
	18	4"	1'-3"	A	A	B	C	C	D	E	E								
	20	4"	1'-3"	A	A	B	B	C	C	D	D	E	E						
	22	4"	1'-3"	1'-3"	A	A	B	B	C	C	D	D	E	E					
	24	4"	4"	1'-3"	A	A	A	B	B	C	C	D	D	E	E	E			
	26	4"	4"	1'-3"	A	A	A	B	B	B	C	C	D	D	D	E	E		
	28	4"	4"	1'-3"	1'-3"	A	A	A	B	B	B	C	C	D	D	D	E	E	E
	30	4"	4"	4"	1'-3"	1'-3"	A	A	A	B	B	B	C	C	C	D	D	E	E

Hole Locations Chart

Joist Span (center to center of support, feet)	Hole Factor				
	A	B	C	D	E
14	1'-3"	2'-0"	2'-6"	3'-9"	5'-0"
15	1'-3"	2'-0"	3'-0"	4'-0"	5'-3"
16	1'-3"	2'-3"	3'-3"	4'-6"	5'-9"
17	1'-6"	2'-9"	3'-9"	5'-0"	6'-3"
18	1'-6"	3'-0"	4'-3"	5'-6"	6'-9"
19	1'-9"	3'-0"	4'-3"	5'-6"	7'-0"
20	1'-9"	3'-0"	4'-3"	5'-6"	7'-0"
21	2'-0"	3'-0"	4'-3"	5'-9"	7'-3"
22	2'-0"	3'-0"	4'-3"	5'-9"	7'-3"
23	2'-0"	3'-3"	4'-3"	5'-9"	7'-6"
24	2'-3"	3'-3"	4'-6"	5'-9"	7'-6"
25	2'-3"	3'-6"	4'-9"	5'-9"	7'-9"
26	2'-3"	3'-9"	4'-9"	6'-0"	7'-9"
27	2'-6"	3'-9"	5'-0"	6'-3"	7'-9"
28	2'-6"	4'-0"	5'-3"	6'-6"	8'-0"
29	2'-6"	4'-0"	5'-6"	6'-9"	8'-3"
30	2'-9"	4'-3"	5'-9"	7'-0"	8'-6"
31	3'-0"	4'-3"	5'-9"	7'-3"	8'-9"
32	3'-0"	4'-6"	6'-0"	7'-6"	9'-3"
33	3'-0"	4'-9"	6'-3"	7'-9"	9'-6"
34	3'-0"	5'-0"	6'-6"	8'-0"	9'-9"
35	3'-3"	5'-0"	6'-6"	8'-3"	10'-0"
36	3'-3"	5'-0"	6'-9"	8'-6"	10'-3"

Notes to Figure 2:

- Charts are based on simple spans and uniform load applications or applicable building code provisions for concentrated loads (2000 lbs. over 2.5 square feet) with 25 psf dead load and 20 psf partition load.
- For uniformly loaded multiple span applications holes must be located 1.0 inch farther from the support for each foot of joist span, than the values indicated in the Charts.
- Holes are not allowed in cantilever areas unless specifically designed by a qualified design professional.
- Where more than one hole is to be cut in the web, the clear distance between holes must be twice the length of the longest dimension of the largest adjacent hole.
- Hole sizes shown are hole sizes, not duct sizes.
- Rectangular hole sizes are based on measurement of the longest side.
- Hole locations are measured from inside face of joist support to nearest edge of hole. See Figure 3.

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

FIGURE 2—ALLOWABLE HOLE SIZE AND LOCATION FOR THE TJI L65, TJI L90, TJI H90, TJI HD90 AND TJI HS90 JOISTS ONLY

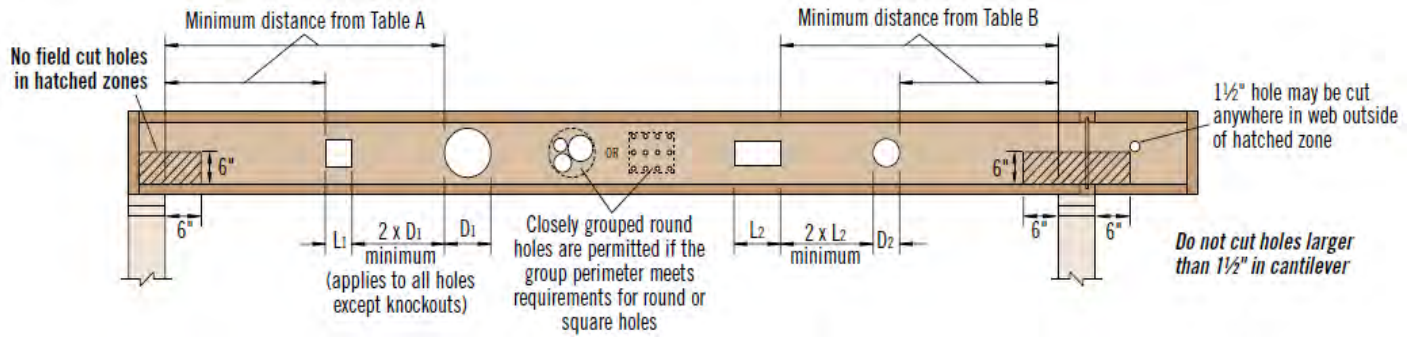


TABLE A—MINIMUM DISTANCE FROM INSIDE FACE OF END SUPPORT TO NEAREST EDGE OF HOLE

JOIST DEPTH (inches)	TJI JOIST SERIES	ROUND HOLE SIZE (inches)							SQUARE OR RECTANGULAR HOLE SIZE (inches)						
		2	3	4	6 1/2	8 7/8	11	13	2	3	4	6 1/2	8 7/8	11	13
9 1/2	TJI 110	1'-0"	1'-6"	2'-0"	5'-0"				1'-0"	1'-6"	2'-6"	4'-6"			
	TJI 210	1'-0"	1'-6"	2'-6"	5'-6"				1'-0"	2'-0"	2'-6"	5'-0"			
	TJI 230	1'-6"	2'-0"	2'-6"	5'-6"				1'-0"	2'-0"	3'-0"	5'-0"			
11 7/8	TJI 110	1'-0"	1'-0"	1'-0"	2'-6"	5'-6"			1'-0"	1'-6"	2'-0"	4'-6"	6'-0"		
	TJI 210	1'-0"	1'-6"	2'-0"	3'-0"	6'-0"			1'-0"	1'-6"	2'-6"	5'-0"	6'-6"		
	TJI 230	1'-0"	1'-6"	2'-0"	3'-0"	6'-6"			1'-0"	2'-0"	2'-6"	5'-6"	7'-0"		
	TJI 360	1'-0"	1'-0"	1'-6"	4'-6"	7'-0"			1'-0"	1'-0"	2'-6"	6'-6"	7'-6"		
	TJI 560	1'-0"	1'-0"	1'-6"	5'-0"	8'-0"			1'-0"	2'-0"	3'-6"	7'-0"	8'-0"		
14	TJI 110	1'-0"	1'-0"	1'-0"	1'-6"	3'-0"	5'-6"		1'-0"	1'-0"	1'-6"	3'-6"	6'-0"	8'-0"	
	TJI 210	1'-0"	1'-0"	1'-0"	2'-0"	3'-6"	6'-0"		1'-0"	1'-0"	2'-0"	4'-0"	6'-6"	8'-6"	
	TJI 230	1'-0"	1'-0"	1'-0"	2'-6"	4'-0"	7'-0"		1'-0"	1'-0"	2'-0"	4'-0"	7'-0"	9'-0"	
	TJI 360	1'-0"	1'-0"	1'-0"	2'-6"	5'-6"	8'-0"		1'-0"	1'-0"	1'-0"	5'-6"	8'-0"	9'-6"	
	TJI 560	1'-0"	1'-0"	1'-0"	2'-6"	6'-0"	9'-0"		1'-0"	1'-0"	1'-6"	6'-6"	9'-0"	10'-0"	
16	TJI 110	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"	3'-0"	5'-0"	1'-0"	1'-0"	1'-0"	3'-0"	5'-6"	7'-6"	10'-0"
	TJI 210	1'-0"	1'-0"	1'-0"	1'-0"	2'-6"	3'-6"	6'-0"	1'-0"	1'-0"	1'-0"	3'-0"	6'-6"	8'-0"	11'-0"
	TJI 230	1'-0"	1'-0"	1'-0"	1'-6"	3'-0"	4'-0"	7'-0"	1'-0"	1'-0"	1'-0"	3'-6"	7'-0"	9'-0"	11'-0"
	TJI 360	1'-0"	1'-0"	1'-0"	1'-0"	3'-0"	6'-0"	9'-0"	1'-0"	1'-0"	1'-0"	4'-0"	9'-0"	10'-0"	11'-6"
	TJI 560	1'-0"	1'-0"	1'-0"	1'-0"	3'-0"	6'-6"	10'-0"	1'-0"	1'-0"	1'-0"	5'-0"	10'-0"	11'-0"	12'-0"

See notes below Table F.

TABLE B—MINIMUM DISTANCE FROM INSIDE FACE OF INTERMEDIATE OR CANTILEVER SUPPORT TO NEAREST EDGE OF HOLE

JOIST DEPTH (inches)	TJI JOIST SERIES	ROUND HOLE SIZE (INCHES)							SQUARE OR RECTANGULAR HOLE SIZE (inches)						
		2	3	4	6 1/2	8 7/8	11	13	2	3	4	6 1/2	8 7/8	11	13
9 1/2	TJI 110	2'-0"	2'-6"	3'-6"	7'-6"				1'-6"	2'-6"	3'-6"	6'-6"			
	TJI 210	2'-0"	2'-6"	3'-6"	8'-0"				2'-0"	3'-0"	4'-0"	7'-6"			
	TJI 230	2'-6"	3'-0"	4'-0"	8'-6"				2'-0"	3'-6"	4'-6"	7'-6"			
11 7/8	TJI 110	1'-0"	1'-0"	1'-6"	4'-0"	8'-6"			1'-0"	1'-6"	2'-6"	7'-0"	9'-6"		
	TJI 210	1'-0"	1'-0"	2'-0"	4'-6"	9'-0"			1'-0"	2'-0"	3'-0"	8'-0"	10'-0"		
	TJI 230	1'-0"	2'-0"	2'-6"	5'-0"	10'-0"			1'-0"	2'-6"	3'-6"	8'-6"	10'-6"		
	TJI 360	2'-0"	3'-0"	4'-0"	7'-0"	11'-0"			2'-0"	3'-6"	5'-0"	9'-6"	11'-0"		
	TJI 560	1'-6"	3'-0"	4'-6"	8'-0"	12'-0"			3'-0"	4'-6"	6'-0"	10'-6"	12'-0"		
14	TJI 110	1'-0"	1'-0"	1'-0"	2'-0"	4'-6"	8'-6"		1'-0"	1'-0"	1'-0"	5'-0"	9'-0"	12'-0"	
	TJI 210	1'-0"	1'-0"	1'-0"	2'-6"	5'-6"	9'-6"		1'-0"	1'-0"	2'-0"	6'-0"	10'-0"	13'-0"	
	TJI 230	1'-0"	1'-0"	1'-0"	3'-6"	6'-0"	10'-6"		1'-0"	1'-0"	2'-6"	6'-6"	11'-0"	13'-6"	
	TJI 360	1'-0"	1'-0"	2'-0"	5'-6"	8'-6"	12'-6"		1'-0"	2'-0"	4'-0"	9'-0"	12'-0"	14'-0"	
	TJI 560	1'-0"	1'-0"	1'-6"	5'-6"	9'-6"	13'-6"		1'-0"	3'-0"	5'-0"	10'-0"	13'-6"	15'-0"	
16	TJI 110	1'-0"	1'-0"	1'-0"	1'-0"	2'-6"	5'-0"	8'-6"	1'-0"	1'-0"	1'-0"	3'-6"	8'-6"	11'-6"	15'-0"
	TJI 210	1'-0"	1'-0"	1'-0"	1'-0"	3'-6"	6'-0"	10'-0"	1'-0"	1'-0"	1'-0"	4'-6"	10'-0"	12'-6"	16'-0"
	TJI 230	1'-0"	1'-0"	1'-0"	1'-6"	4'-0"	6'-6"	11'-0"	1'-0"	1'-0"	1'-0"	5'-0"	10'-6"	13'-6"	16'-6"
	TJI 360	1'-0"	1'-0"	1'-0"	3'-0"	6'-6"	10'-0"	13'-6"	1'-0"	1'-0"	2'-0"	7'-6"	13'-0"	14'-6"	17'-0"
	TJI 560	1'-0"	1'-0"	1'-0"	2'-6"	7'-0"	11'-0"	15'-0"	1'-0"	1'-0"	3'-6"	9'-0"	14'-6"	16'-0"	18'-0"

See notes below Table F.

FIGURE 3—ALLOWABLE HOLE SIZE AND LOCATION FOR THE TJI 110, TJI 210, TJI 230, TJI 360 AND TJI 560 JOISTS (TABLES A AND B)

* Deleted by the City of Los Angeles

TABLE C—MINIMUM DISTANCE FROM INSIDE FACE OF END SUPPORT TO NEAREST EDGE OF HOLE

JOIST DEPTH (inches)	TJI JOIST SERIES	ROUND HOLE SIZE (inches)									SQUARE OR RECTANGULAR HOLE SIZE (inches)								
		2	3	4	6 ¹ / ₄	8 ⁵ / ₈	10 ³ / ₄	12 ³ / ₄	14 ³ / ₄	16 ³ / ₄	2	3	4	6 ¹ / ₄	8 ⁵ / ₈	10 ³ / ₄	12 ³ / ₄	14 ³ / ₄	16 ³ / ₄
9 ¹ / ₂	s31	1'-0"	2'-0"	2'-6"	5'-6"						1'-0"	1'-6"	2'-6"	4'-6"					
	s33	1'-6"	2'-6"	3'-0"	6'-0"						1'-0"	2'-0"	3'-0"	5'-0"					
11 ⁷ / ₈	s31	1'-0"	1'-0"	1'-6"	3'-0"	6'-0"					1'-0"	1'-0"	2'-0"	4'-6"	6'-0"				
	s33	1'-0"	1'-0"	2'-0"	3'-6"	7'-0"					1'-0"	1'-0"	2'-6"	5'-6"	7'-0"				
	s47	1'-0"	1'-0"	1'-0"	3'-6"	7'-0"					1'-0"	1'-6"	2'-6"	6'-6"	7'-6"				
14	s31	1'-0"	1'-0"	1'-0"	1'-6"	3'-0"	6'-0"				1'-0"	1'-0"	1'-0"	3'-6"	6'-0"	7'-6"			
	s33	1'-0"	1'-0"	1'-0"	2'-0"	4'-6"	8'-0"				1'-0"	1'-0"	1'-0"	4'-0"	7'-0"	8'-6"			
	s47	1'-0"	1'-0"	1'-0"	1'-0"	4'-6"	8'-6"				1'-0"	1'-0"	1'-0"	5'-0"	8'-0"	9'-6"			
16	s31	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"	3'-6"	6'-0"			1'-0"	1'-0"	1'-0"	2'-6"	6'-0"	7'-0"	9'-6"		
	s33	1'-0"	1'-0"	1'-0"	1'-0"	2'-6"	5'-0"	8'-0"			1'-0"	1'-0"	1'-0"	3'-0"	7'-0"	9'-0"	10'-6"		
	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"	5'-6"	9'-0"			1'-0"	1'-0"	1'-0"	3'-6"	8'-6"	10'-0"	11'-0"		
18	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"	5'-6"	9'-6"		1'-0"	1'-0"	1'-0"	1'-6"	6'-6"	10'-6"	12'-0"	13'-6"	
20	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"	6'-0"	10'-0"	1'-0"	1'-0"	1'-0"	1'-0"	4'-6"	10'-0"	11'-6"	13'-0"	14'-6"

See notes below Table F.

TABLE D—MINIMUM DISTANCE FROM INSIDE FACE OF INTERMEDIATE OR CANTILEVER SUPPORT TO NEAREST EDGE OF HOLE

JOIST DEPTH (inches)	TJI JOIST SERIES	ROUND HOLE SIZE (inches)									SQUARE OR RECTANGULAR HOLE SIZE (inches)								
		2	3	4	6 ¹ / ₄	8 ⁵ / ₈	10 ³ / ₄	12 ³ / ₄	14 ³ / ₄	16 ³ / ₄	2	3	4	6 ¹ / ₄	8 ⁵ / ₈	10 ³ / ₄	12 ³ / ₄	14 ³ / ₄	16 ³ / ₄
9 ¹ / ₂	s31	2'-0"	3'-0"	4'-0"	8'-6"						2'-0"	3'-0"	4'-0"	6'-6"					
	s33	2'-6"	3'-6"	5'-0"	9'-0"						2'-0"	3'-6"	4'-6"	7'-6"					
11 ⁷ / ₈	s31	1'-6"	2'-0"	2'-6"	4'-6"	9'-0"					1'-6"	2'-6"	3'-6"	7'-0"	9'-0"				
	s33	2'-0"	3'-0"	3'-6"	5'-6"	10'-6"					2'-0"	3'-0"	4'-0"	8'-6"	10'-0"				
	s47	1'-0"	1'-0"	2'-0"	5'-6"	11'-0"					2'-0"	3'-6"	5'-0"	9'-6"	11'-0"				
14	s31	1'-0"	1'-0"	1'-6"	3'-0"	5'-0"	9'-0"				1'-0"	1'-6"	2'-6"	5'-6"	9'-0"	11'-6"			
	s33	1'-0"	1'-0"	2'-0"	4'-0"	6'-6"	12'-0"				1'-0"	2'-0"	3'-6"	6'-6"	11'-0"	13'-0"			
	s47	1'-0"	1'-0"	1'-0"	4'-0"	7'-6"	12'-6"				1'-0"	2'-6"	4'-0"	8'-0"	12'-0"	13'-6"			
16	s31	1'-0"	1'-0"	1'-0"	2'-0"	3'-6"	5'-6"	9'-6"			1'-0"	1'-0"	1'-6"	4'-6"	9'-0"	11'-0"	14'-0"		
	s33	1'-0"	1'-0"	1'-0"	2'-6"	5'-0"	7'-6"	12'-6"			1'-0"	1'-0"	2'-0"	5'-6"	11'-0"	13'-6"	15'-6"		
	s47	1'-0"	1'-0"	1'-0"	2'-0"	5'-6"	9'-0"	14'-0"			1'-0"	1'-6"	3'-0"	7'-0"	13'-0"	15'-0"	16'-6"		
18	s47	1'-0"	1'-0"	1'-0"	1'-0"	3'-0"	6'-6"	9'-6"	14'-6"		1'-0"	1'-0"	1'-6"	6'-0"	11'-0"	15'-6"	17'-0"	18'-6"	
20	s47	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	3'-6"	7'-0"	10'-6"	15'-0"	1'-0"	1'-0"	1'-0"	4'-0"	9'-0"	15'-0"	16'-6"	18'-0"	19'-6"

See notes below Table F.

FIGURE 3—ALLOWABLE HOLE SIZE AND LOCATION FOR THE TJI s31, TJI s33, and TJI s47 JOISTS (TABLES C AND D) (Continued)

TABLE E—MINIMUM DISTANCE FROM INSIDE FACE OF END SUPPORT TO NEAREST EDGE OF HOLE^{1,2,3,4,5}

JOIST DEPTH (inches)	TJI JOIST SERIES	ROUND HOLE SIZE (inches)									SQUARE OR RECTANGULAR HOLE SIZE (inches)								
		2	4	6	8	10	12	16	18	20	2	4	6	8	10	12	16	18	20
9 ¹ / ₂	560D	2'-0"	4'-0"	6'-0"							2'-0"	4'-0"	5'-6"						
11 ⁷ / ₈		1'-6"	3'-0"	5'-0"	6'-6"						3'-0"	4'-6"	6'-6"	7'-6"					
14		1'-0"	2'-0"	4'-0"	5'-6"	8'-0"					2'-0"	4'-0"	6'-6"	8'-6"	9'-0"				
16		1'-0"	1'-6"	3'-0"	5'-0"	6'-6"	9'-0"				2'-0"	4'-0"	6'-0"	8'-6"	10'-0"	11'-0"			
18		1'-0"	1'-0"	1'-6"	3'-6"	5'-6"	7'-6"				1'-0"	3'-0"	5'-6"	8'-0"	10'-6"	11'-6"			
20		1'-0"	1'-0"	1'-0"	2'-6"	4'-6"	6'-0"	10'-6"			1'-0"	2'-6"	5'-0"	7'-0"	10'-0"	12'-6"	14'-6"		
22		1'-0"	1'-0"	1'-0"	1'-6"	3'-6"	5'-0"	8'-6"	11'-6"		1'-0"	1'-0"	3'-6"	6'-6"	14'-6"	15'-0"	16'-0"	16'-6"	
24		1'-0"	1'-0"	1'-0"	2'-0"	3'-6"	5'-0"	8'-0"	10'-0"	12'-6"	1'-0"	1'-6"	4'-0"	6'-6"	9'-6"	15'-0"	16'-0"	16'-6"	17'-0"
26		1'-0"	1'-0"	1'-0"	2'-6"	3'-6"	5'-0"	7'-6"	9'-0"	11'-0"	1'-0"	2'-0"	4'-0"	6'-6"	8'-6"	15'-6"	16'-6"	17'-0"	17'-0"
28		1'-0"	1'-0"	1'-6"	2'-6"	4'-0"	5'-0"	7'-0"	8'-6"	10'-0"	1'-0"	2'-6"	4'-0"	6'-0"	8'-6"	11'-0"	16'-6"	17'-0"	17'-0"
30		1'-0"	1'-0"	1'-6"	2'-6"	3'-6"	5'-0"	7'-0"	8'-0"	9'-6"	1'-0"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	16'-6"	17'-0"	17'-6"

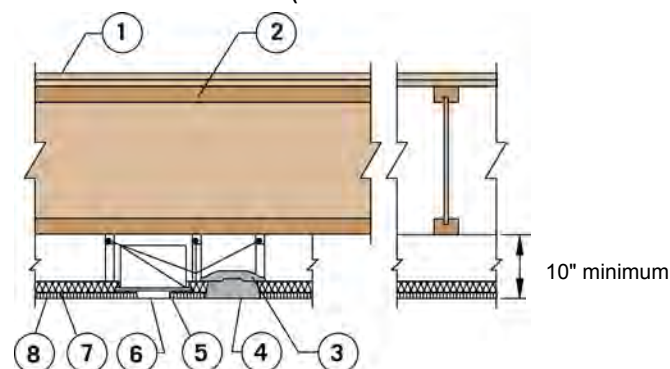
See notes below Table F.

TABLE F—MINIMUM DISTANCE FROM INSIDE FACE OF INTERMEDIATE OR CANTILEVER SUPPORT TO NEAREST EDGE OF HOLE^{1,2,3,4,5}

JOIST DEPTH (inches)	TJI JOIST SERIES	ROUND HOLE SIZE (inches)									SQUARE OR RECTANGULAR HOLE SIZE (inches)								
		2	4	6	8	10	12	16	18	20	2	4	6	8	10	12	16	18	20
9 ¹ / ₂	560D	4'-0"	6'-0"	9'-6"							4'-0"	6'-6"	8'-0"						
11 ⁷ / ₈		2'-0"	4'-6"	7'-0"	10'-0"						4'-0"	6'-6"	10'-0"	10'-6"					
14		1'-0"	3'-0"	5'-6"	8'-6"	11'-6"					2'-6"	6'-0"	9'-0"	12'-0"	13'-6"				
16		1'-0"	1'-0"	3'-6"	6'-6"	10'-0"	13'-0"				1'-0"	5'-0"	8'-6"	12'-6"	14'-6"	16'-0"			
18		1'-0"	1'-0"	1'-0"	4'-6"	7'-6"	11'-0"				1'-0"	3'-0"	7'-6"	11'-6"	16'-0"	17'-0"			
20		1'-0"	1'-0"	1'-0"	1'-0"	4'-6"	8'-6"	16'-0"			1'-0"	1'-0"	5'-6"	10'-0"	15'-0"	18'-0"	20'-0"		
22		1'-0"	1'-0"	2'-6"	4'-6"	6'-6"	8'-0"	13'-0"	16'-6"		1'-0"	3'-6"	6'-6"	10'-0"	19'-0"	20'-0"	21'-0"	21'-6"	
24		1'-0"	2'-6"	4'-0"	5'-6"	7'-0"	8'-6"	12'-6"	15'-0"	17'-6"	2'-0"	5'-0"	7'-6"	10'-6"	14'-0"	20'-0"	21'-0"	21'-6"	22'-0"
26		3'-0"	4'-0"	5'-6"	6'-6"	7'-6"	9'-0"	12'-0"	14'-0"	16'-0"	4'-0"	6'-0"	8'-0"	10'-6"	13'-0"	20'-6"	21'-6"	22'-0"	22'-0"
28		3'-0"	4'-0"	5'-6"	6'-6"	7'-6"	9'-0"	11'-6"	13'-0"	15'-0"	4'-0"	6'-0"	8'-0"	10'-6"	13'-0"	16'-0"	21'-6"	22'-0"	22'-0"
30		3'-0"	4'-0"	5'-6"	6'-6"	8'-0"	9'-0"	11'-6"	13'-0"	14'-6"	4'-0"	6'-0"	8'-0"	10'-6"	12'-6"	15'-0"	21'-6"	22'-0"	22'-6"

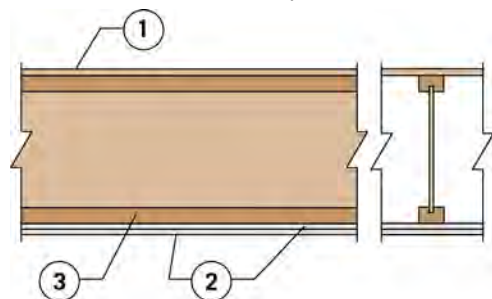
For **SI**: 1 inch = 25.4 mm, 1 foot = 304.8 mm.¹The clear distance between multiple holes must be twice the length of the longest dimension of the largest hole.²Holes may be located vertically anywhere within the web. Leave ¹/₈ inch of web minimum at top and bottom of hole.³Tables A, C and E (simple and continuous spans) and Tables B, D and F (continuous spans) are based on uniform load applications, within the limitations of the applicable Weyerhaeuser literature.⁴TJI joists are manufactured with 1¹/₂-inch diameter perforated knockouts in the web at approximately 12 inches on center along the length of the joist.⁵For simple span (5 foot minimum) uniformly loaded joists, one maximum size hole may be located in the web at the center of the joist span provided no other holes occur in the joist.**FIGURE 3—ALLOWABLE HOLE SIZE AND LOCATION FOR THE TJI 560D JOISTS (TABLES E AND F) (Continued)**

FIGURE 4A—ASSEMBLY A (One-hour Fire-resistance-rated Roof-ceiling or Floor-ceiling Assembly):



Assembly Component		Component Specifications	Installation
1	Double Wood Floor	<ul style="list-style-type: none"> Subfloor of nominal 1-inch-thick, tongue-and-groove sheathing or 32/16 span-rated sheathing (Exposure 1) and a second layer of nominal 1-inch-thick, tongue-and-groove finish flooring. Alternatively, finish flooring is permitted to be 40/20 span-rated sheathing (Exposure 1), or Type-1 Grade-1 particleboard not less than $\frac{5}{8}$-inch thick. When used as a roof-ceiling assembly, a single layer of square-edged span-rated sheathing (Exposure 1), complying with the code, is permitted to be used for roof sheathing. 	All butt joints of the sheathing must be located over framing members.
2	TJI® Joist	Minimum flange depth of 1½ inches.	Installed in accordance with this report, at a maximum spacing of 48 inches on center.
3	Fixture Protection	See Recessed Light Fixture Installation.	See Recessed Light Fixture Installation.
4	Recessed Light Fixture (Optional)	<ul style="list-style-type: none"> 24 inch x 48 inch, maximum. The aggregate area of the lighting fixture may not exceed 12 square feet per 100 square feet of ceiling area. 	<ul style="list-style-type: none"> Installed in the ceiling. Must be protected by insulation as described below. A 24-inch-by-48-inch fixture is used as an example: <ul style="list-style-type: none"> A 2¼-inch-by-48-inch, minimum 1¼-inch-thick piece of minimum 4 pcf Thermafiber rigid mineral fiber board or Fibrex-FBX 1240 Industrial Board or Fibrex-IF 1240 Flex Batt light fixture protection, is laid along the long sides of the fixture, and against adjacent suspension members Two pieces of the same insulation, measuring 19-½ inches by 48 inches, are laid over the top of the fixture, and A 4½-inch-by-24-inch piece of the same insulation is laid at each end and tied, at the corners of the fixture, to the top pieces using No. 18 SWG steel wire. See Figure 5 for details.
5	Channels	Cold rolled.	Spaced not more than 48 inches on center.
6	Air Diffuser	<ul style="list-style-type: none"> Air diffusers, up to a maximum of 12 inches in diameter, are permitted. The aggregate area must not exceed 113 square inches per 100 square feet of ceiling area. 	Openings must be protected with approved fire dampers.
7	Mineral Wool Blankets	Minimum 1-inch-thick, 4 pcf minimum, Thermafiber® Sound Attenuation Fire Blankets, or Fibrex®-FBX 1240 industrial boards, or Fibrex®-IF 1240 Flex Batts, or IIG MinWool®-1240 Industrial Board, or IIG MinWool®-1240 Flexible Batt.	Installed over the acoustical board.
8	Suspended Ceiling	<ul style="list-style-type: none"> $\frac{5}{8}$-inch acoustical panels. 24" x 24" or 24" x 48" USG FIRECODE AURATONE lay-in acoustical board. 	<ul style="list-style-type: none"> Supported by an approved exposed fire-resistance-rated suspension system attached to joist bottom flange or to cold-rolled channels. When TJI® joists are spaced more than 24 inches on center, framing perpendicular to the joists must be installed at 24 inches on center to support the ceiling. The distance from the bottom of the TJI® joists to the soffit of the ceiling must be a minimum of 10 inches.

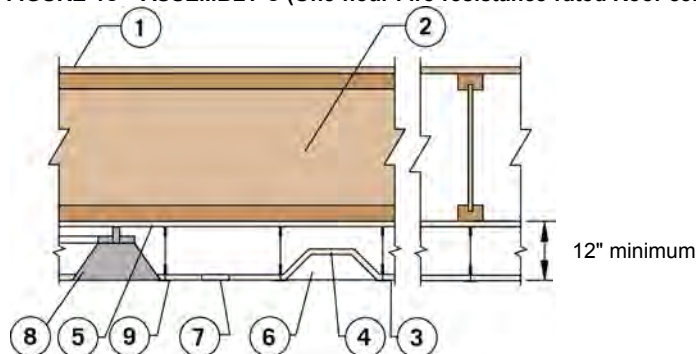
FIGURE 4B—ASSEMBLY B (One-hour Fire-resistance-rated Roof-ceiling or Floor-ceiling Assembly):



Optional resilient channels directly applied to joists or trusses at 16 inches on-center, supporting both layers of gypsum board, are necessary to achieve sound ratings.

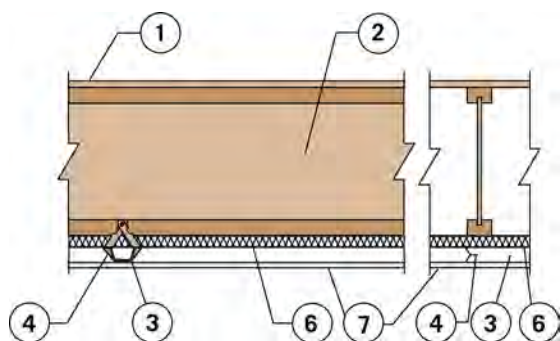
Assembly Component		Component Specifications	Installation
1	Sheathing	<ul style="list-style-type: none"> Single layer of 48/24 span-rated, tongue-and-groove, sheathing (Exposure 1). When used as a roof-ceiling assembly, the decking is permitted to be any wood deck recognized in the code. 	<ul style="list-style-type: none"> Nailed and glued to the top of the TJI® joists. Construction adhesive conforming to ASTM D3498 must be applied to the top of the joists prior to placing sheathing. All butt joints of the sheathing must be located over framing members.
2	Gypsum Board	<ul style="list-style-type: none"> Two layers of 1/2-inch-thick NGC Gold Bond® Fire-Shield C gypsum board, or Two layers of 1/2-inch-thick USG SHEETROCK® Brand FIRECODE® C gypsum panels, or Two layers of 5/8-inch-thick, Type X gypsum board complying with ASTM C 1396. 	<ul style="list-style-type: none"> For TJI® joists spaced 24 inches on-center or less, attach ceiling to joist bottom flange. The first layer of gypsum board must be installed perpendicular to the TJI joists and attached using 1 5/8-inch-long, Type S screws spaced 12 inches on-center. The second layer must be installed with the joints staggered from the first layer. The second layer must be fastened to the TJI joists with 2-inch-long, Type S screws spaced 12 inches on-center in the field and 8 inches on-center at the butt joints. Type G screws, 1 1/2 inches long, must be spaced 8 inches on-center and 6 inches from each side of the transverse joints of the second layer. The second layer must be finished with joint tape and compound.
3	TJI® Joist	TJI® joist.	<ul style="list-style-type: none"> Installed in accordance with this report, with a maximum spacing of 24 inches on-center for floor-ceiling assemblies. When used in roof-ceiling assemblies, the joists are permitted to be spaced a maximum of 48 inches on-center.
(not shown)	Optional Glass Fiber Insulation	Minimum 3 1/2-inch-thick glass fiber insulation or glass fiber insulation rated R-30 or less.	<ul style="list-style-type: none"> May be installed in the joist plenum when resilient channels are used. The insulation must be placed above the resilient channels between the joist bottom flanges.
(not shown)	Optional Resilient Channels	RC-1 resilient channels spaced 16 inches on-center (may be increased to 24 inches on-center if the joists are spaced 16 inches on-center).	<ul style="list-style-type: none"> Fasten perpendicular to the TJI joists using 1-inch-long, Type S screws. When resilient channels are used, the first layer of the ceiling membrane must be installed perpendicular to the channels and attached to the resilient channels using 1-inch-long, Type S screws spaced 12 inches on-center. The second layer must be installed with the joints staggered from the first layer and attached using 1 5/8-inch-long, Type S screws. The screw spacing for the second layer of gypsum board must be a maximum of 12 inches on-center in the field and 8 inches on-center at the butt joints. Type G screws, 1 1/2 inches long, must be spaced 8 inches on-center and 6 inches from each side of the transverse joints of the second layer. The second layer must be finished with joint tape and compound.
(not shown)	Stripping	Minimum of nominal 2-by-4 construction-grade Douglas fir lumber for spans up to 5 feet.	<ul style="list-style-type: none"> In roof-ceiling assemblies in which the TJI® joists are spaced more than 24 inches on-center, the ceiling, including the resilient channels, must be applied to stripping spaced 24 inches on-center. The attachment of the ceiling membrane to the stripping members must be similar to the attachment of the ceiling membrane to the TJI® joists. Attached to the joist bottom flange using a minimum of two 10d box nails into each bottom flange. Stripping materials of equivalent strength and attachment are permitted when approved by the code official.

FIGURE 4C—ASSEMBLY C (One-hour Fire-resistance-rated Roof-ceiling or Floor-ceiling Assembly):



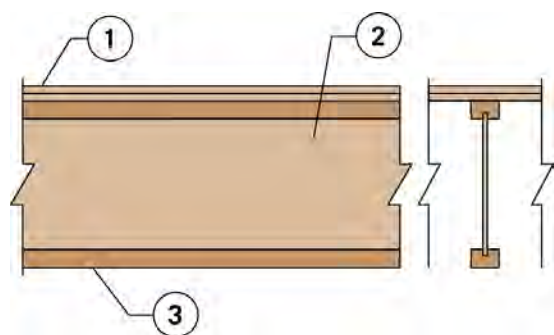
Assembly Component		Component Specifications	Installation
1	Sheathing	<ul style="list-style-type: none"> Single layer of 48/24 span-rated, tongue-and-groove, sheathing (Exposure 1). When used as a roof-ceiling assembly, a single layer of square-edged span-rated sheathing (Exposure 1), complying with the code, is permitted to be used for roof sheathing. 	<ul style="list-style-type: none"> Nailed and glued to the top of the TJI® joists. Construction adhesive conforming to ASTM D3498 must be applied to the top of the joists prior to placing sheathing. All butt joints of the sheathing must be located over framing members.
2	TJI® Joist	TJI® joist.	<ul style="list-style-type: none"> Installed in accordance with this report, at a maximum spacing of 24 inches on center for floor-ceiling assemblies. When used in roof-ceiling assemblies the joists are permitted to be spaced a maximum of 48 inches on center. When the joist spacing exceeds 24 inches on center, framing perpendicular to the joists must be installed at 24 inches on center to support the ceiling.
(not shown)	Optional Insulation	Glass fiber batt insulation rated R-30 or less.	Installed above the gypsum board, in the cavity between the joists.
3	Ceiling Panel	24 inch x 24 inch, 5/8-inch-thick, USG FIRECODE AURATONE ceiling panel.	Installed on steel suspension grid.
4	Fixture Protection	Ceiling grid panels.	Light fixture protection must consist of 6-inch-wide pieces of ceiling grid panels that are 48 inches long for the sides, and 24 inches long for the ends, with a full grid panel placed on top.
5	Gypsum Board	<ul style="list-style-type: none"> Single layer of, 1/2-inch-thick NGC Gold Bond® Fire-Shield C gypsum board, or 5/8-inch-thick, Type X gypsum board complying with ASTM C 1396. 	<ul style="list-style-type: none"> Attached to the joists, or to stripping spaced 24 inches on-center or less. Installed perpendicular to the TJI joists or stripping. The gypsum board must be fastened using 1 5/8-inch-long, Type S screws located 6 inches on-center at end joints and 8 inches on-center in the field.
6	Light Fixture (Optional)	24 inch x 48 inch recessed light.	Protected with ceiling panels per Fixture Protection above.
(not shown)	Optional Duct	Galvanized steel duct.	<ul style="list-style-type: none"> A duct is permitted for each 200 square feet of ceiling. Air return opening and steel diffuser are required.
7	Air Return Opening	Maximum 6 inch x 12 inch opening per 200 square feet of ceiling.	Required if steel duct is used.
8	Diffuser	<ul style="list-style-type: none"> Steel diffuser without damper. Maximum of 12 inches in diameter per 200 square feet of ceiling. 	Required if steel duct is used.
9	Suspension Grid	Approved, exposed, fire-resistance-rated steel suspension ceiling grid.	<ul style="list-style-type: none"> Install beneath the gypsum board ceiling membrane. Minimum distance between the suspended ceiling and the gypsum board ceiling membrane must be 12 inches. The grid system must be suspended with No. 12 SWG galvanized steel wire fastened to the stripping or joists using 3 inch long flathead hanger screws.

FIGURE 4D—ASSEMBLY D (One-hour Fire-resistance-rated Roof-ceiling or Floor-ceiling Assembly):



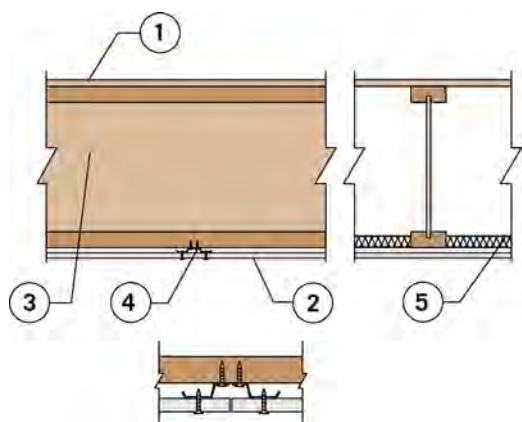
Assembly Component		Component Specifications	Installation
1	Sheathing	<ul style="list-style-type: none"> Single layer of 48/24 span-rated, tongue-and-groove, sheathing (Exposure 1). When used as a roof-ceiling assembly, a single layer of square-edged span-rated sheathing (Exposure 1), complying with the code, is permitted to be used for roof sheathing. 	All butt joints of the sheathing must be located over framing members.
2	TJI® Joist	Minimum flange depth of 1 ³ / ₈ inches.	Installed in accordance with this report, at a maximum spacing of 24 inches on-center.
3	Channels	No. 26 gauge galvanized steel furring channel.	<ul style="list-style-type: none"> Installed perpendicular to joists. Furring channels spaced 24 inches on-center. Furring channels spaced 1½ inches from, and on each side of, wallboard end joints, and 24 inches from end joints. Attached and suspended from the joists using No. 24 gage proprietary attachment clips designated "Simpson Strong-Tie CSC Support Clips." A CSC support clip must be located at each joist, to support the furring channel. At channel splices, adjacent pieces are overlapped a minimum of 6 inches, and are tied with double-strand No. 18 SWG galvanized steel wire at each end of the overlap.
4	Clips	Simpson Strong-Tie Co. Type CSC support clips.	<ul style="list-style-type: none"> Support furring channels at the intersection with each joist with clips. Support clips nailed to side of joist bottom flange with 1½ -inch-long No. 11 gauge nail.
(not shown)	Stabilizer Strap	¾-inch x 6-inch No. 24 gauge galvanized steel strap.	Used to prevent rotation of the support clips at wallboard end joints and along walls.
6	Mineral Wool Blankets	<ul style="list-style-type: none"> Single layer of 1-inch-thick, minimum 6 pcf Thermafiber Type CW 90 mineral-wool blanket, Fibrex-FBX 1280 Industrial Board, Fibrex-IF 1280 Flex Batt, IIG MinWool 1260 Industrial Board or IIG MinWool 1260 Flexible Batt. Alternatively, a layer of 2-inch-thick, Thermafiber mineral-wool blanket, having a density of 8 pcf, is permitted to be used. 	Installed below the bottom flanges of the joists and on top of the furring channels.
7	Gypsum Board	<ul style="list-style-type: none"> Single layer of ½-inch-thick, USG SHEETROCK® Brand FIRECODE® C gypsum board, or Single layer of ½-inch-thick, CertainTeed ProRoc® Type C gypsum board. 	Attached with screws to steel furring channels placed perpendicular to the joists.

FIGURE 4E—ASSEMBLY E (One-hour Fire-resistance-rated Roof-ceiling or Floor-ceiling Assembly):



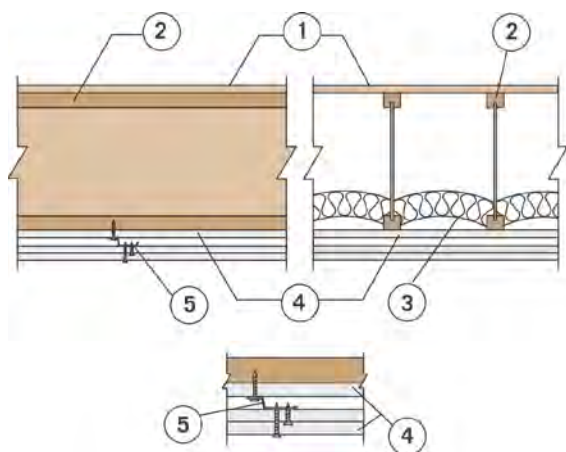
Assembly Component		Component Specifications	Installation
1	Double Wood Floor	<ul style="list-style-type: none"> Subfloor of nominal 1-inch-thick, tongue-and-groove sheathing or 32/16 span-rated sheathing (Exposure 1) and a second layer of nominal 1-inch-thick, tongue-and-groove finish flooring or 40/20 span-rated sheathing (Exposure 1), or Type-1 Grade-1 particleboard not less than $\frac{5}{8}$-inch thick. Alternatively, a single layer of 48/24 span-rated, tongue-and-groove sheathing (Exposure 1) may be used. When used as a roof-ceiling assembly, a single layer of square-edged span-rated sheathing (Exposure 1), complying with the code, is permitted to be used for roof sheathing. 	<ul style="list-style-type: none"> When a single-layer floor is used, a construction adhesive conforming to ASTM D3498 must be applied to the top of the joists prior to placing sheathing. All butt joints of the sheathing must be located over framing members.
2	TJI® Joist	TJI® joist.	<ul style="list-style-type: none"> Installed in accordance with this report. Maximum spacing of 24 inches on-center for floor-ceiling assemblies, and a maximum spacing of 48 inches on-center for roof-ceiling assemblies. When the flooring consists of a double wood floor, the joists may be spaced a maximum of 48 inches on-center.
(not shown)	Channels	Resilient channels.	<ul style="list-style-type: none"> Installed at 24 inches on-center when joist spacing is more than 24 inches on-center.
(not shown)	Stripping	Minimum of nominal 2-by-4, construction-grade Douglas fir lumber for spans up to 5 feet. Stripping materials of equivalent strength and attachment are permitted when specifically approved by the code official.	<ul style="list-style-type: none"> Stripping attached to the joist bottom flange using a minimum of two 10d box nails. Attachment of the ceiling membrane to the stripping must be similar to the attachment of the ceiling membrane to the TJI joists.
3	Ceiling System	<ul style="list-style-type: none"> Any approved ceiling membrane that provides a minimum 40-minute finish rating must be used. An example of an approved ceiling having a 40-minute finish rating is one that consists of two layers of $\frac{1}{2}$ inch-thick, Type X gypsum board complying with ASTM C1396, a minimum of 4 feet wide, installed perpendicular to the TJI joists, as described in Figure 4B of this report (Assembly B). 	<ul style="list-style-type: none"> Substantiating data, including a report of the fire-endurance testing conducted in accordance with ASTM E119, must be furnished to the local code official, and must verify that a particular ceiling system meets the 40-minute finish rating requirements. When the finish rating is to be determined, temperature performance of protective membranes must be in accordance with Section 47 of ASTM E119. The finish rating is defined in Section 48 of ASTM E119.

FIGURE 4F—ASSEMBLY F (One-hour Fire-resistance-rated Roof-ceiling or Floor-ceiling Assembly):



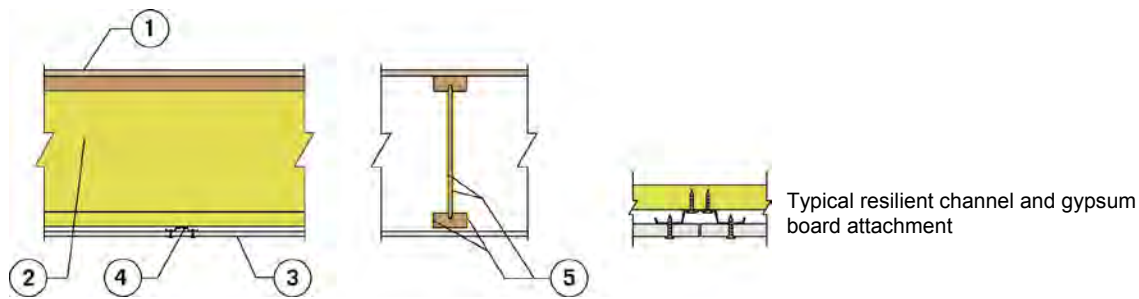
Assembly Component		Component Specifications	Installation
1	Sheathing	<ul style="list-style-type: none"> Single layer of 48/24 span-rated, tongue-and-groove, sheathing (Exposure 1). When used as a roof-ceiling assembly, a single layer of square-edged span-rated sheathing (Exposure 1), complying with the code, is permitted to be used for roof sheathing. 	<ul style="list-style-type: none"> Attached to the TJI® joist top flange with construction adhesive that meets ASTM D3498, and nailed using 8d common nails spaced a maximum of 6 inches on-center along the boundary and edges, and 12 inches on-center in the field. All butt joints of the sheathing must be located over framing members.
2	Gypsum Board	<ul style="list-style-type: none"> Single layer of 5/8-inch-thick, USG SHEETROCK® Brand FIRECODE® C gypsum board, or Single layer of 5/8-inch-thick, CertainTeed ProRoc® Type C gypsum board. 	Fastened to the resilient channels with 1-inch-long, Type S screws spaced 12 inches on-center in the field and 8 inches on-center at the butt joints.
3	TJI® Joist	Nominal 2 x 4 or larger flanges.	<ul style="list-style-type: none"> Installed in accordance with this report. When used in a floor-ceiling assembly, joist spacing must not exceed 24 inches on-center. When used in a roof-ceiling assembly, joist spacing is permitted to exceed 24 inches on-center.
4	Channels	RC-1 resilient channels.	<ul style="list-style-type: none"> Installed perpendicular to joists. Spaced at 16 inches on-center. Attached to the joists with 1 5/8-inch-long, Type S screws at each joist. Two channels must be provided at each gypsum-board butt joint, and extend to the next joist beyond the longitudinal joints.
(not shown)	Stripping	Minimum of nominal 2-by-4, construction-grade Douglas fir lumber for spans up to 5 feet. Stripping materials of equivalent strength and attachment are permitted when specifically approved by the code official.	<ul style="list-style-type: none"> In roof-ceiling assemblies in which TJI® joists are spaced more than 24 inches on-center, the ceiling, including the resilient channels, must be attached to stripping spaced 24 inches on-center. The attachment of the ceiling membrane to the stripping members is similar to the attachment of the ceiling membrane to the joists. Stripping must be attached to the bottom flanges of the joists using a minimum of two 10d box nails.
5	Mineral Wool Blankets	Single layer of 1 1/2-inch-thick, minimum 2 1/2 pcf, Thermafiber Sound Attenuation Fire Blankets, Fibrex-SAFB (Sound Attenuation Fire Batts), or IIG MinWool 1200 Sound Attenuation Fire Batts.	<ul style="list-style-type: none"> Installed between the bottom flanges of the joists and on top of the resilient channels. Friction-fitted into place and supported by the resilient channels.

FIGURE 4G—ASSEMBLY G (Two-hour Fire-resistance-rated Roof-ceiling or Floor-ceiling Assembly):



Assembly Component		Component Specifications	Installation
1	Sheathing	<ul style="list-style-type: none"> Single layer of 48/24 span-rated, tongue-and-groove, sheathing (Exposure 1). When used as a roof-ceiling assembly, a single layer of square-edged span-rated sheathing (Exposure 1), complying with the code, is permitted to be used for roof sheathing. 	<ul style="list-style-type: none"> All butt joints of the sheathing must be located over framing members. Flooring is permitted to be omitted where unusable attic space occurs above the system, provided the requirements of Section 4.5 are met.
2	TJI® Joist	Minimum joist depth of 9 ¹ / ₄ inches.	Installed in accordance with this report, at a maximum spacing of 24 inches on-center.
3	Optional Insulation	Glass-fiber insulation with unfaced batts that are 24 inches wide by 48 inches long by 3 ¹ / ₂ inches thick.	Installed in the plenum and supported by stay wires spaced at 12 inches along the joist bottom flange.
4	Gypsum Board	Three layers of ⁵ / ₈ -inch-thick NGC Gold Bond® Fire-Shield C gypsum board.	<ul style="list-style-type: none"> Base layer installed perpendicular to joists with end joints staggered, and attached directly to the bottom flange using 1⁵/₈-inch-long Type S screws spaced 12 inches on-center along each joist. Resilient channels attached per 5 below. Middle layer of gypsum board installed perpendicular to the resilient channels, with end joints staggered, and attached to the resilient channels with 1-inch-long, Type S screws spaced 12 inches on-center. Finish layer of gypsum board installed with edges and end joints staggered from the middle layer, and must be fastened to the resilient channels using 1⁵/₈-inch-long, Type S screws spaced 8 inches on-center. Joints of the finish layer of gypsum board must be covered with joint compound and paper tape, and exposed screw heads must be covered with joint compound. Ceiling membrane may be omitted when used as a floor-ceiling assembly over unusable crawl spaces.
5	Channels	Minimum No. 28 gauge (0.016 inch) resilient channels.	<ul style="list-style-type: none"> Installed perpendicular to joists, under the first layer of gypsum board. Spaced a maximum of 16 inches on-center. Attached to the bottom flange of each joist with 1⁵/₈-inch-long, Type S screws.

FIGURE 4H—ASSEMBLY H (One-hour Fire-resistance-rated Roof-ceiling or Floor-ceiling Assembly)**:



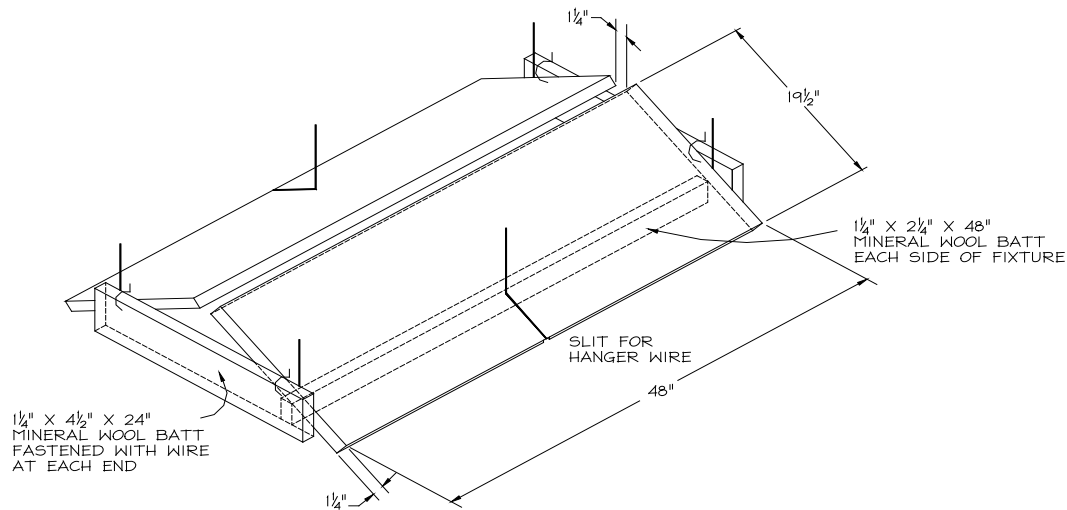
Assembly Component		Component Specifications	Installation
1	Floor Sheathing	<ul style="list-style-type: none"> Single layer 48/24 span-rated, tongue-and-groove sheathing (Exposure 1). When used as a roof-ceiling assembly, the decking is permitted to be any wood deck recognized in the code. 	<ul style="list-style-type: none"> Construction adhesive conforming to ASTM D3498 must be applied to the top of the joists prior to placing sheathing. All butt joints of the sheathing must be located over framing members. The floor sheathing shall be installed in accordance with the applicable code.
2	Flak Jacket™-Protected TJI® Joists	<ul style="list-style-type: none"> TJI® 210, 230, 360 and 560 joists with Flak Jacket™ protection. Minimum flange depth is 1 3/8 inches. Minimum joist depth is 9 1/2 inches. 	<p>Installed in accordance with Weyerhaeuser recommendations, with a maximum spacing of 16 inches on-center. For TJI® 230, 360 and 560 joists with a depth of 11-7/8 inches or deeper the maximum spacing is 24 inches on-center.</p>
3	Gypsum Board	One layer of 5/8-inch-thick, Pabco® Flame Curb® Super "C" gypsum board.	<ul style="list-style-type: none"> Attach to resilient channels with 1 1/8-inch Type S drywall screws spaced at 6 inches on center. Tape and joint compound must be applied to all fastener heads and gypsum wallboard joints on exposed surfaces.
4	Resilient Channels	RC-1 type resilient channels.	<ul style="list-style-type: none"> Spaced at 16 inches on-center, installed perpendicular to the TJI® joists and attached with 1 5/8-inch-long, Type W screws at each joist. Two channels must be provided at each gypsum-board butt joint, and extend to the next joist beyond the longitudinal joints. Where splices are necessary, the resilient channels must overlap 6-inches and be fastened together with two screws.
5	Flak Jacket™ Protection	Flak Jacket™ coating.	Flak Jacket™ protection is applied to both sides of the web and the vertical sides of the bottom flange, in accordance with the TJI® Joist With Flak Jacket™ Protection Manufacturing Standard and quality control program.
(not shown)	Optional Insulation	Glass fiber insulation, minimum 3 1/2 inch thick.	Placed in I-joist cavity, between the I-joists and above the bottom flange.
**Load Limitation		For design with this assembly, use 90% of published TJI® 210, 230, 360 and 560 bending moment capacity found in Table 3 of this report.	

TABLE 5—ALTERNATE FLOOR OR ROOF SYSTEMS

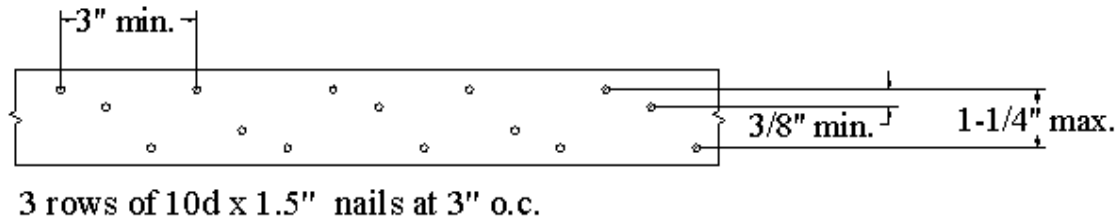
Applicable Assembly	Assembly Description Location	Maximum TJI® Joist Spacing	Sheathing Required	Floor or Roof Topping Required
One-Hour (A, B, C, D, E, F, H) and Two-Hour (G)	Figures 4A through 4H	24 inches on-center	Minimum 48/24 span-rated sheathing (Exposure 1).	<ul style="list-style-type: none"> 1½-inch-thick lightweight concrete or ¾-inch-thick gypsum concrete over the sheathing. Gypsum concrete must be recognized in a current ICC-ES evaluation report, and the report must include an evaluation for fire resistance that permits the replacement of the floor systems with the sheathing and gypsum concrete system.
		20 inches on-center	Minimum 40/20 span-rated sheathing (Exposure 1).	

TABLE 6—SOUND RATINGS

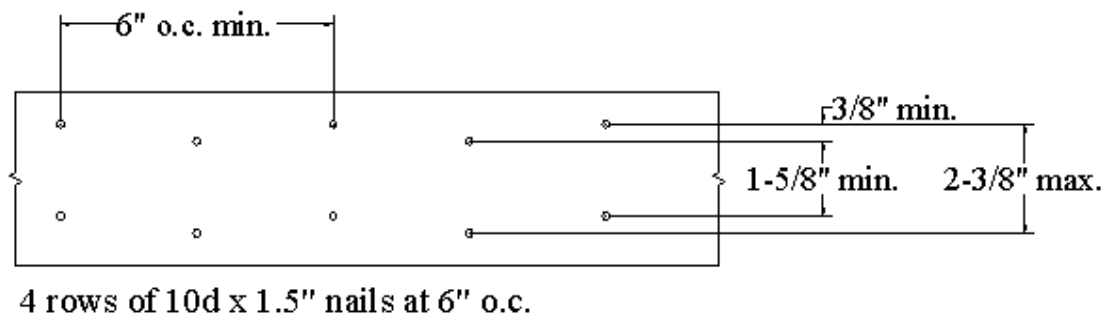
Assembly	Assembly Figure	STC Rating	Assembly Components Required	IIC Rating	Floor Covering Required
Assembly B Option 1	Figure 4B	50, minimum	Assembly B constructed with resilient channels spaced at 16 inches on-center to separate the ceiling membrane from the structural framing.	60	The floor covering must include a 40-ounce-per-square-yard pad and a 56-ounce-per-square-yard carpet.
				51	<ul style="list-style-type: none"> Floor covering must consist of Tarkett Acoustiflor sheet vinyl, Ceiling must consist of two layers of ⅝-inch-thick, Type X gypsum board, and the Bottom of the floor cavity must contain 3½-inch-thick glass-fiber insulation.
				45	The floor covering must include a 43.2-ounce-per-square-yard, minimum 0.123-inch-thick cushioned vinyl.
Assembly B Option 2	Figure 4B	58, minimum	<ul style="list-style-type: none"> Assembly B constructed with resilient channels spaced at 16 inches on-center to separate the ceiling membrane from the structural framing. ¾-inch-thick floor topping of gypsum concrete recognized in a current ICC-ES evaluation report. 	54	The floor covering must include a 40-ounce-per-square-yard pad and a 56-ounce-per-square-yard carpet.
				54	<ul style="list-style-type: none"> Floor covering must consist of Tarkett Acoustiflor sheet vinyl, Ceiling must consist of two layers of ⅝-inch-thick, Type X gypsum board, and the Bottom of the floor cavity must contain 3½-inch-thick glass-fiber insulation.
				50	<ul style="list-style-type: none"> Floor covering must be either Armstrong VIOS or Armstrong Cambray sheet vinyl, Ceiling must consist of two layers of ⅝-inch-thick Type X gypsum board, and Bottom of the floor cavity must contain 3½-inch-thick glass fiber insulation.
Assembly D Option 1	Figure 4D	47	Assembly D	54	Floor covering must include a 40-ounce-per-square-yard pad and a 56-ounce-per-square-yard carpet.
Assembly D Option 2	Figure 4D	59	Assembly D constructed with a ¾-inch-thick topping of gypsum concrete recognized in a current ICC-ES evaluation report.	54	Floor covering must include a 40-ounce-per-square-yard pad and a 56-ounce-per-square-yard carpet.
Assembly G	Figure 4G	50	Assembly G, constructed with 3½-inch-thick unfaced glass fiber insulation.	64	The floor covering must include a 69-ounce-per-square-yard, ⅜-inch-thick pad and 80-ounce-per-square-yard carpet.

**FIGURE 5—LIGHT FIXTURE PROTECTION**

(See Figure 4A, Items 4 and 7 for detailed description of mineral wool batts.)
For SI: 1 inch = 25.4 mm.

Detail A:

Detail A is applicable to all TJI Joists with structural composite lumber flange widths of 2.3 inches or greater. Simpson Strong-Tie Co. MSTI or PAI straps, or other straps of the same minimum gauge, dimensions, grade of steel and nail patterns and recognized in a current ICC-ES Report or ICC-ES Legacy Report may be used.

Detail B:

Detail B is applicable to all TJI Joists with structural composite lumber flange widths of 3.5 inches or greater. Simpson Strong-Tie Co. LSTI or LTTI straps, or other straps of the same minimum gauge, dimensions, grade of steel and nail patterns and recognized in a current ICC-ES Report or ICC-ES Legacy Report may be used.

General Notes:

Connection capacity limited to a lateral nail design value of 112 lbs/nail with the following conditions.

1. All nails must be 10d short nails, 0.148 inches x 1.5 inches.
2. Minimum steel thickness must be 18 gauge (0.049 inches).
3. Total connection capacity must not exceed the code approved strap or tension-tie design value.
4. The connection capacity is permitted to be increased for duration of load in accordance with the code.
5. No additional reductions are necessary due to penetration.
6. The minimum required end distance must be 3 inches.

FIGURE 6—METAL STRAP AND TENSION-TIE CONNECTION CAPACITIES AND DETAILS FOR TJI JOISTS

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