

CCMC 14001-R

CCMC Canadian code compliance evaluation

CCMC number:	14001-R
Status:	Active
Issue date:	2014-10-03
Modified date:	2024-03-25
Evaluation holder:	<p>Pinkwood Ltd. 5929 6th Street NE Calgary AB T2K 5R5 Canada Website: www.pinkwood.ca Telephone: 403-279-3700 Email: info@pinkwood.ca</p>
Product names:	<ul style="list-style-type: none"> • Pinkwood PKI 10, I-Joists • Pinkwood PKI 20, I-Joists • Pinkwood PKI 23, I-Joists • Pinkwood PKI 35 Plus, I-Joists • Pinkwood PKI 40, I-Joists • Pinkwood PKI 50, I-Joists
Compliance:	NBC 2015
Criteria:	CCMC-TG-061733.01-15, "CCMC Technical Guide for Prefabricated Wood I-Joists"

In most jurisdictions this document is sufficient evidence for approval by Canadian authorities.

[Learn more about CCMC recognition](#) [Look for the trusted CCMC mark on products to verify compliance.](#)

Compliance opinion

It is the opinion of the Canadian Construction Materials Centre that the evaluated products, when used as joists in floor and roof applications in accordance with the conditions and limitations stated in this evaluation, comply with the following code:

National Building Code of Canada 2015

Code provision	Solution type
4.3.1.1.(1) Buildings and their structural members m ...	<u>Acceptable</u>
9.10.8.10. Application to Houses	<u>Alternative</u>
9.23.4.2.(2) Spans for floor joists that are not sele ...	<u>Alternative</u>

The above opinion(s) is/are based on the evaluation by the CCMC of technical evidence provided by the evaluation holder, and is bound by the stated conditions and limitations. For the benefit of the user, a summary of the technical information that forms the basis of this evaluation has been included.

Product information

Product names

- Pinkwood PKI 10, I-Joists
- Pinkwood PKI 20, I-Joists
- Pinkwood PKI 23, I-Joists
- Pinkwood PKI 35 Plus, I-Joists
- Pinkwood PKI 40, I-Joists
- Pinkwood PKI 50, I-Joists

Product description

The products are prefabricated wood I-joists consisting of six proprietary grade fingerjointed lumber flanges that are graded in accordance with the Pinkwood Quality Assurance Manual and glued flatwise to a 9.5-mm- or 11.1-mm-thick oriented strandboard (OSB) web. The I-joist series are available in depths ranging from 241 mm to 610 mm. [Table 1](#) provides a description of the products.

The OSB web material is installed with the wafer orientation parallel to the length of the joist. The web segments are bonded with a V-joint using a phenol-resorcinol adhesive (see CCMC 13054-L). The flange is bonded to the web using the same adhesive. The flange fingerjoints are bonded with a melamine formaldehyde adhesive (see CCMC 13252-L).

Table 1. Description of the Pinkwood I-joist series

Joist series	Joist type	Joist depth (mm)	Flange dimension (mm)	Flange grade	Web thickness (mm)
PKI 10	PKI 10-10	241	38 × 63.5	Ripped 2 × 6 enhanced No. 2 Spruce-Pine-Fir (S-P-F) and better S-P-F lumber	9.5
	PKI 10-12	302	38 × 63.5		9.5
	PKI 10-14	356	38 × 63.5		9.5
PKI 20	PKI 20-10	241	38 × 63.5	Proprietary enhanced machine stress rated (MSR) lumber	9.5
	PKI 20-12	302	38 × 63.5		9.5
	PKI 20-14	356	38 × 63.5		9.5
	PKI 20-16	406	38 × 63.5		9.5
PKI 23	PKI 23-10	241	38 × 63.5	Proprietary enhanced MSR lumber	9.5

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Joist series	Joist type	Joist depth (mm)	Flange dimension (mm)	Flange grade	Web thickness (mm)
	PKI 23-12	302	38 × 63.5		9.5
	PKI 23-14	356	38 × 63.5		9.5
	PKI 23-16	406	38 × 63.5		9.5
PKI 35 Plus	PKI 35 Plus-10	241	38 × 89	Ripped 2 × 8 enhanced No. 2 S-P-F and better S-P-F lumber or 2 × 4 enhanced Douglas Fir-Larch (north)	9.5
	PKI 35 Plus-12	302	38 × 89		9.5
	PKI 35 Plus-14	356	38 × 89		9.5
	PKI 35 Plus-16	406	38 × 89		9.5
PKI 40	PKI 40-10	241	38 × 89	Proprietary enhanced MSR lumber	9.5
	PKI 40-12	302	38 × 89		9.5
	PKI 40-14	356	38 × 89		9.5
	PKI 40-16	406	38 × 89		9.5
	PKI 40-18	457	38 × 89		11.1
	PKI 40-20	508	38 × 89		11.1
	PKI 40-22	559	38 × 89		11.1
	PKI 40-24	610	38 × 89		11.1
PKI 50	PKI 50-12	302	38 × 89	Proprietary enhanced MSR lumber	11.1
	PKI 50-14	356	38 × 89		11.1
	PKI 50-16	406	38 × 89		11.1

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Joist series	Joist type	Joist depth (mm)	Flange dimension (mm)	Flange grade	Web thickness (mm)
	PKI 50-18	457	38 × 89		11.1
	PKI 50-20	508	38 × 89		11.1
	PKI 50-22	559	38 × 89		11.1
	PKI 50-24	610	38 × 89		11.1

Manufacturing plant

This evaluation is valid only for products produced at the following plant:

Product names	Manufacturing plant
	Calgary, AB, CA
Pinkwood PKI 10, I-Joists	☑
Pinkwood PKI 20, I-Joists	☑
Pinkwood PKI 23, I-Joists	☑
Pinkwood PKI 35 Plus, I-Joists	☑
Pinkwood PKI 40, I-Joists	☑
Pinkwood PKI 50, I-Joists	☑

☑ Indicates that the product from this manufacturing facility has been evaluated by the CCMC

Conditions and limitations

The CCMC's compliance opinion is bound by this product being used in accordance with the conditions and limitations set out below.

- The products are intended for use in structural applications such as floor, ceiling, roof and rim joists, and are intended for dry service use ⁽¹⁾ applications only.
- The following pre-engineering information has been provided to the CCMC by the manufacturer to demonstrate compliance with Part 9, Housing and Small Buildings, of the NBC 2015 for acceptance by the local authority having jurisdiction (AHJ):

Manufacturer's pre-engineered design tables

When the products are used to support uniform loads only, the installation must be in accordance with the span tables (including vibration criteria ⁽²⁾) found in Pinkwood Ltd.'s "PKjoists Specifier Guide – Canada," December 2022.

The product must be installed in accordance with the manufacturer's installation guidelines noted in the above-mentioned documents for those applications falling within the scope of the documents. Applications outside the scope of the installation guidelines require engineering on a case-by-case basis.

Manufacturer's pre-engineered installation details

The manufacturer's pre-engineered details within "PKjoists Specifier Guide – Canada" are limited in scope to building designs where the anticipated loads on the following structural details are not exceeded:

- floor span tables, pages 3 and 4;
- blocking panels and floor installation details, pages 5 and 6;
- web stiffeners, page 6;
- cantilevers, page 6; and
- web hole details and table, pages 7 and 8.

Engineering required

When required by the AHJ, or for applications beyond the scope/limitations of those referenced in the Code compliance opinion section, the drawings or related documents must bear the seal of a professional engineer.

Installations beyond the scope/limitations of the Manufacturer's pre-engineered design tables and the Manufacturer's pre-engineered installation details imply, but are not limited to, the following:

- higher loads/longer spans than the manufacturer's pre-engineered details;
- roof joists or rafters;
- concentrated loads;
- offset bearing walls;
- areas of high wind and/or high seismicity;
- stair openings;
- design of supporting wall studs/beams when the total load exceeds the NBC 2015 pre-engineered floor/roof joist tables;
- design of supporting foundation footings when the total load exceeds the NBC 2015 pre-engineered floor/roof joist tables; and

- fire resistance (see applicable fire-resistance assembly listings for special joist and adhesive used).

The factored resistance and engineering properties for the products must not exceed the values set forth in [Table 2](#) and [Table 3](#).

Engineering support provided by the manufacturer

Pinkwood Ltd. provides engineering support and must be consulted on the use of the product. Pinkwood Ltd. technical services may be reached at: 403-279-3700.

- These products must be identified with the phrase "CCMC 14001-R" along the side of the product. This CCMC number is only valid when it appears in conjunction with the Intertek Testing Services certification mark.
- Damaged or defective joists must not be used, unless repaired in accordance with written instructions from the manufacturer.

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- 1 All lumber, wood-based panels and proprietary engineered wood products are intended for dry service conditions. "Dry service" is defined as the in-service environment under which the average equilibrium moisture content (MC) of lumber is 15% or less over a year and does not exceed 19% at any time. Wood contained within the interior of dry, heated or unheated buildings has generally been found to have a MC between 6% and 14% according to season and location. During construction, all wood-based products should be protected from the weather to ensure that the 19% MC is not exceeded in accordance with Article 9.3.2.5., Moisture Content, of Division B of the NBC 2015.
 - 2 In cases where concrete topping is applied or bridging/blocking is used and joists are installed at the maximum spans, the current vibration criteria may not address all occupant performance expectations. Therefore, Pinkwood Ltd. should be consulted for span adjustments, if necessary, in these types of installations.
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Technical information

This evaluation is based on demonstrated conformance with the following criteria:

Criteria number	Criteria name
CCMC-TG-061733.01-15	CCMC Technical Guide for Prefabricated Wood I-Joists

General

The evaluation holder has submitted technical documentation for the CCMC's evaluation. Testing was conducted at laboratories recognized by the CCMC. The corresponding technical evidence for this product is summarized below. Additional engineering data and load/span tables are available from the manufacturer as outlined in the [Conditions and limitations](#) section.

Design requirements

Table 2. Factored resistance specifications for the products ⁽¹⁾ ⁽²⁾ ⁽³⁾

Joist type	Depth (mm)	Factored moment resistance (N·m)	Factored shear resistance (N)	$EI \times 10^6$ (kN·mm ²)	$K \times 10^6$ (N)
PKI 10-10	241	5 098	8 852	482	21.97
PKI 10-12	302	6 033	10 431	819	27.47
PKI 10-14	356	8 386	11 788	1 205	32.38
PKI 20-10	241	6 338	8 852	554	21.97
PKI 20-12	302	8 474	10 431	938	27.49
PKI 20-14	356	9 931	11 788	1 375	32.38
PKI 20-16	406	11 402	13 122	1 871	37.01
PKI 23-10	241	7 254	8 852	649	21.97
PKI 23-12	302	9 409	10 431	1 091	27.47
PKI 23-14	356	11 328	11 788	1 593	32.38
PKI 23-16	406	13 131	13 122	2 158	37.01
PKI 35 Plus-10	241	7 565	8 852	671	21.97
PKI 35 Plus-12	302	9 796	10 431	1 137	27.49
PKI 35 Plus-14	356	11 748	11 788	1 664	32.38
PKI 35 Plus-16	406	13 355	13 122	2 259	37.01
PKI 40-10	241	12 148	9 408	941	21.97

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Joist type	Depth (mm)	Factored moment resistance (N·m)	Factored shear resistance (N)	EI × 10 ⁶ (kN·mm ²)	K × 10 ⁶ (N)
PKI 40-12	302	15 714	11 410	1 587	27.49
PKI 40-14	356	18 927	13 167	2 316	32.38
PKI 40-16	406	21 937	14 857	3 134	37.01
PKI 40-18	457	24 811	17 793	4 079	41.64
PKI 40-20	508	27 455	18 816	5 163	46.26
PKI 40-22	559	30 065	19 772	6 383	50.89
PKI 40-24	610	32 648	20 684	7 744	55.51
PKI 50-12	302	17 937	14 991	1 745	27.49
PKI 50-14	356	20 744	16 014	2 523	32.38
PKI 50-16	406	24 025	16 948	3 392	37.01
PKI 50-18	457	28 798	17 793	4 417	41.64
PKI 50-20	508	31 963	18 816	5 276	46.26
PKI 50-22	559	32 899	19 772	6 523	50.89
PKI 50-24	610	35 726	20 684	7 912	55.51

Notes:

- 1 Design values were developed in accordance with CSA O86-14.
- 2 All factored resistance values include the resistance factor and the reliability normalization factor (K_r).
- 3 Additional engineering data and load/span tables are available from the manufacturer.

Table 3. Bearing factored resistance specifications for the products ⁽¹⁾ ⁽²⁾ ⁽³⁾

Joist type	Depth (mm)	End reaction (N)				Intermediate reaction (N)			
		38 mm or 64 mm bearing ⁽⁴⁾		102 mm bearing ⁽⁵⁾		89 mm bearing		140 mm bearing	
		Bearing stiffeners		Bearing stiffeners		Bearing stiffeners		Bearing stiffeners	
		No	Yes	No	Yes	No	Yes	No	Yes
PKI 10-10	241	6 316	8 007	7 784	8 852	15 413	16 014	17 192	17 682
PKI 10-12	302	6 316	8 941	8 140	10 431	15 413	17 437	17 726	19 728
PKI 10-14	356	6 316	9 786	8 429	11 788	15 413	18 705	18 149	20 782

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Joist type	Depth (mm)	End reaction (N)				Intermediate reaction (N)			
		38 mm or 64 mm bearing ⁽⁴⁾		102 mm bearing ⁽⁵⁾		89 mm bearing		140 mm bearing	
		Bearing stiffeners		Bearing stiffeners		Bearing stiffeners		Bearing stiffeners	
		No	Yes	No	Yes	No	Yes	No	Yes
PKI 20-10	241	6 806	8 007	7 784	8 852	15 413	16 681	17 192	18 505
PKI 20-12	302	6 806	8 941	8 140	10 431	16 369	17 726	18 215	19 861
PKI 20-14	356	6 806	9 786	8 429	11 788	17 237	18 705	19 127	21 107
PKI 20-16	406	6 806	10 609	8 696	13 122	18 038	19 617	20 017	22 286
PKI 23-10	241	6 806	8 007	7 784	8 852	15 413	16 681	17 192	18 505
PKI 23-12	302	6 806	8 941	8 140	10 431	16 369	17 726	18 215	19 861
PKI 23-14	356	6 806	9 786	8 429	11 788	17 237	18 705	19 127	21 107
PKI 23-16	406	6 806	10 609	8 696	13 122	18 038	19 617	20 017	22 286
PKI 35 Plus-10	241	6 316	8 007	7 784	8 852	15 413	16 014	17 192	17 682
PKI 35 Plus-12	302	6 316	8 941	8 140	10 431	15 413	17 437	17 726	19 728
PKI 35 Plus-14	356	6 316	9 786	8 429	11 788	15 413	18 705	18 149	20 782
PKI 35 Plus-16	406	6 316	10 609	8 585	13 100	15 413	20 217	18 571	21 796
PKI 40-10	241	8 318	9 408	9 163	9 408	20 351	21 730	20 640	22 441
PKI 40-12	302	8 741	10 609	11 210	11 410	21 240	23 442	21 907	24 688
PKI 40-14	356	8 985	11 654	11 210	13 167	21 641	25 021	23 020	26 712
PKI 40-16	406	9 074	12 633	11 210	14 857	22 063	26 511	24 109	28 647
PKI 40-18	457	9 186	14 457	11 788	17 904	19 995	30 092	24 109	34 896
PKI 40-20	508	9 186	15 324	11 788	18 527	19 995	30 960	24 109	34 896
PKI 40-22	559	9 186	16 214	11 788	19 194	19 995	31 805	24 109	34 896
PKI 40-24	610	9 186	17 126	11 788	19 861	19 995	32 583	24 109	34 896
PKI 50-12	302	8 741	10 609	11 210	11 410	21 240	23 442	21 907	24 688
PKI 50-14	356	8 985	11 654	11 210	13 167	21 641	25 021	23 020	26 712
PKI 50-16	406	9 074	12 633	11 210	14 857	22 063	26 511	24 109	28 647
PKI 50-18	457	9 186	14 457	11 788	17 904	19 995	30 092	24 109	34 896
PKI 50-20	508	9 186	15 324	11 788	18 527	19 995	30 960	24 109	34 896
PKI 50-22	559	9 186	16 214	11 788	19 194	19 995	31 805	24 109	34 896
PKI 50-24	610	9 186	17 126	11 788	19 861	19 995	32 583	24 109	34 896

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Notes:

- 1 Design values were developed in accordance with CSA O86-14.
 - 2 All factored resistance values include the resistance factor and the reliability normalization factor (Kr).
 - 3 Additional engineering data and load/span tables are available from the manufacturer.
 - 4 For I-joists with a depth equal to or less than 406 mm, the end reaction is based on a 38 mm bearing length. For I-joists with a depth equal to or greater than 457 mm, the end reaction is based on a 64 mm bearing length.
 - 5 For PKI 23 Series I-joists, the bearing length is 89 mm.
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Additional test information for the products

The characteristic values obtained from testing to ASTM D5055-13e1, “Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists,” as specified in CSA O86-14, are summarized below. The manufacturer’s published pre-engineered joist spans were designed in accordance with CSA O86-19.

Table 4. Additional test information for the products

Property	Test information
Moment capacity	The moment capacity qualification was carried out using the analytical method based on the characteristics of the flange material, and with confirmatory testing done in accordance with ASTM D5055. Data from confirmatory tests were used to establish the applicable coefficient of variation, CV_w . The reliability normalization factor from Table 16.2.3.2 of CSA O86-14 was used to determine the specified strength.
Shear capacity	The shear capacity was established for each depth separately in accordance with ASTM D5055. Qualification tests have been used to establish the applicable coefficient of variation, CV_w . The reliability normalization factor from Table 16.2.3.2 of CSA O86-14 was used to determine the specified strength.
Stiffness	An appropriate test program was used to confirm the stiffness capacity. The following formula was used to predict mid-span deflection: $\Delta_{\text{deflection}} = \frac{5wL^4}{384EI} + \frac{wL^2}{K}$ where: w = load (kN/m) L = span (mm) EI and K from Table 2 .
End joints	Flange tension tests were conducted in accordance with Section 6.4.1.3. of ASTM D5055. The tensile capacity was determined in accordance with Section 6.4.1.4. of ASTM D5055. Tests have been used to establish the applicable coefficient of variation, CV_w . The reliability normalization factor from Table 16.2.3.2 of CSA O86-14 was used to determine the specified strength.

Property	Test information
Creep	Specimens were tested for creep performance in accordance with Section 6.6.3. of ASTM D5055. The specimens recovered more than 90% of the basic dead load deflection.
Bearing length	Qualification tests were conducted to qualify minimum bearing lengths. The I-joist design properties on end reaction and intermediate reaction were analyzed using ASTM D5055. Qualification tests for the reaction values were used to establish the applicable coefficient of variation, CV_w . The reliability normalization factor from Table 16.2.3.2 of CSA O86-14 was used to determine the specified strength.
Adhesive qualification	The web-to-web adhesive and the web-to-flange adhesive comply with CSA O112.7-M1977, "Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing)" (see CCMC 13054-L). The flange fingerjoint adhesive complies with CSA O112.9-04, "Evaluation of Adhesives for Structural Wood Products (Exterior Exposure)" (see CCMC 13252-L).
Web stock	The web stock meets the requirements of CSA O325, "Construction Sheathing," and is certified by APA, a third-party certification agency.

Fire-protection options

The performance of the below fire-protection options are presented as additional information for authorities having jurisdiction. This section is beyond the scope of the CCMC's Code compliance opinion related to the evaluation of structural performance.

Fire performance of innovative structural products

The CCMC Registry of Product Assessments contains opinions on the suitability-for-use of products intended as structural elements in houses. Although historically there has been no need to regulate the structural fire performance of houses, an inherent intent of the National Building Code of Canada (NBC) is that occupants have sufficient time to escape from a building in the event of a fire. There are many factors that may determine whether that intent is achieved. The fire endurance of structural elements may be one. However, its importance may be minimized by other factors such as combustible content load, early warning devices, smoke movement and toxicity, and fire department response time; all contributing to the overall system performance. Research is underway within the NRC Construction Research Centre to determine the critical factors that affect occupant escape from houses.

Some innovative structural products have been used in the marketplace for several years and have gained the confidence of design professionals, code authorities and users with respect to their performance under typical fire scenarios in today's house system. Some newer products have not been in service long enough to have gained that confidence and may present a more obvious concern.

The minimum fire performance of innovative structural materials, or alternative solutions, as compared to that of the NBC-specified conventional wood-frame construction, or acceptable solution, has been the subject of analysis and discussion for several years among fire officials, provincial and territorial regulators, and AHJs. In fire tests conducted between 2002 and 2008 at the NRC, the innovative structural joist systems tested, and currently in the marketplace (i.e., I-joists, C-channel steel joists, metal-plated wood trusses and metal-web trusses), had a time-to-collapse below the performance of exposed 38 mm × 235 mm (2 × 10) lumber joists.

The CCMC provides this floor fire performance information to the local AHJs across Canada to aid their decision-making on whether the fire performance of floors (i.e., the time to evacuate before failure occurs) for alternative joist

systems performs “as well as” the inherent fire performance of exposed 38 mm × 235 mm (2 × 10) lumber joists. As is the case for all innovative products, designers and authorities should exercise judgment in considering the use of innovative structural products for houses. Unless otherwise stated, innovative structural products for houses have not been evaluated in the context of the NBC intent noted above.

The CCMC has reviewed the fire-protection options below in comparison to the fire performance of an unprotected, exposed 38 mm × 235 mm (2 × 10) floor joist system. The presented fire-protection options perform “as well as” exposed 38 mm × 235 mm (2 × 10) lumber joists. It should be noted that the NBC 2015 exempts single-family houses constructed using conventional wood-frame construction, in accordance with Part 9, from requiring a fire-resistance rating (see Article 9.10.8.10. of Division B of the NBC 2015). The fire-protection options below for alternative floor joists are not to be considered in sprinklered single-family houses or where fire-resistance-rated assemblies are required.

The following fire-protection assemblies are applicable for the evaluated products as provided in [Table 5](#).

Table 5. Applicable Pinkwood I-joist series based on flange size

Product	Flange size (thickness × width) (mm)	Fire protection assembly
PKI 10	38 × 63.5	FP-01, WEBshield®
PKI 20	38 × 63.5	FP-01, WEBshield®
PKI 23	38 × 63.5	FP-01, WEBshield®
PKI 35 Plus	38 × 89	FP-01, WEBshield®
PKI 40	38 × 39	FP-01, WEBshield®
PKI 50	38 × 89	FP-01, WEBshield®

Industry-based fire-protection options

Fire-protection options

The details of the following industry-based fire-protection floor assemblies ⁽¹⁾ are outlined in the figures below.

1. FP-01 - 12.5 mm (1/2 in.) Gypsum Board Attached to Bottom of Flange
2. FP-02 - 12.5 mm (1/2 in.) Gypsum Board Attached Directly to Web
3. FP-03 - 12.5 mm (1/2 in.) Gypsum Board Attached Directly to Sides of Flange
4. FP-04 - Mineral Wool Insulation
5. FP-06 - 12.5 mm (1/2 in.) Gypsum Board Installed on Top of the Bottom Flange
6. FP-07 - 15.8 mm (5/8 in.) Gypsum Board Installed on Top of the Bottom Flange
7. FP-09 - Rockwool SAFE'n'Sound® Mineral Wool Insulation

Note:

- 1 These floor assemblies and supporting fire test data have been provided to the CCMC by the I-joist industry in collaboration with the APA – Engineered Wood Association. The floor assemblies contained herein reviewed by the CCMC provide equivalent fire performance to exposed 38 mm × 235 mm (2 × 10) lumber joists, and are a subset of those published in APA System Report SR-405G, dated April 2019.

Fire protection assembly details

The following floor assembly design (FP-01) is the default alternative solution for all cases and where the manufacturer has not undertaken any specific testing to show equivalency to exposed 38 x 235 mm (2×10) lumber with proprietary joist fire-protection options.

Fire protection of floors FP-01

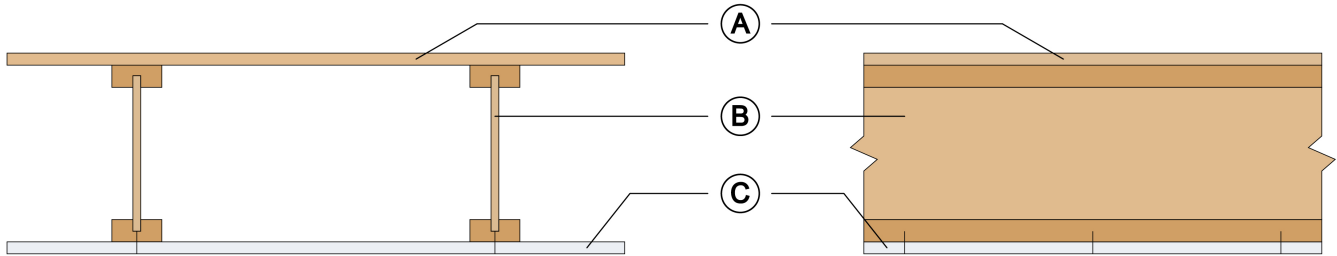


Figure 1. Fire protection of floors FP-01 - fire protection: 12.5 mm (1/2-in.) gypsum board attached to bottom of flange

- A. Floor sheathing: materials and installation in accordance with the NBC 2015.
- B. I-joist: installation in accordance with Section 3 of this Report. Maximum 24 in. on centre (o.c.) spacing. Applicable to all flange sizes. Minimum web thickness of 9.5 mm (3/8 in.).
- C. 12.5 mm (1/2 in.) gypsum board: materials and installation in accordance with the NBC 2015. 1 × 3 (nominal) wood furring strips are permitted to be installed perpendicular to the bottom flange of the I-joists at 400 mm (16 in.) o.c. provided that the gypsum boards are directly attached to the furring strips using 32 mm (1-1/4 in.) Type W drywall screws at 300 mm (12 in.) o.c. Gypsum board not required to be finished with tape and joint compound.

The remaining fire-resistance designs, FP-02 to FP-09, provide fire performance as good as to 38 mm × 235 mm (2 × 10) dimensional lumber exposed floor joists.

Fire protection of floors FP-02

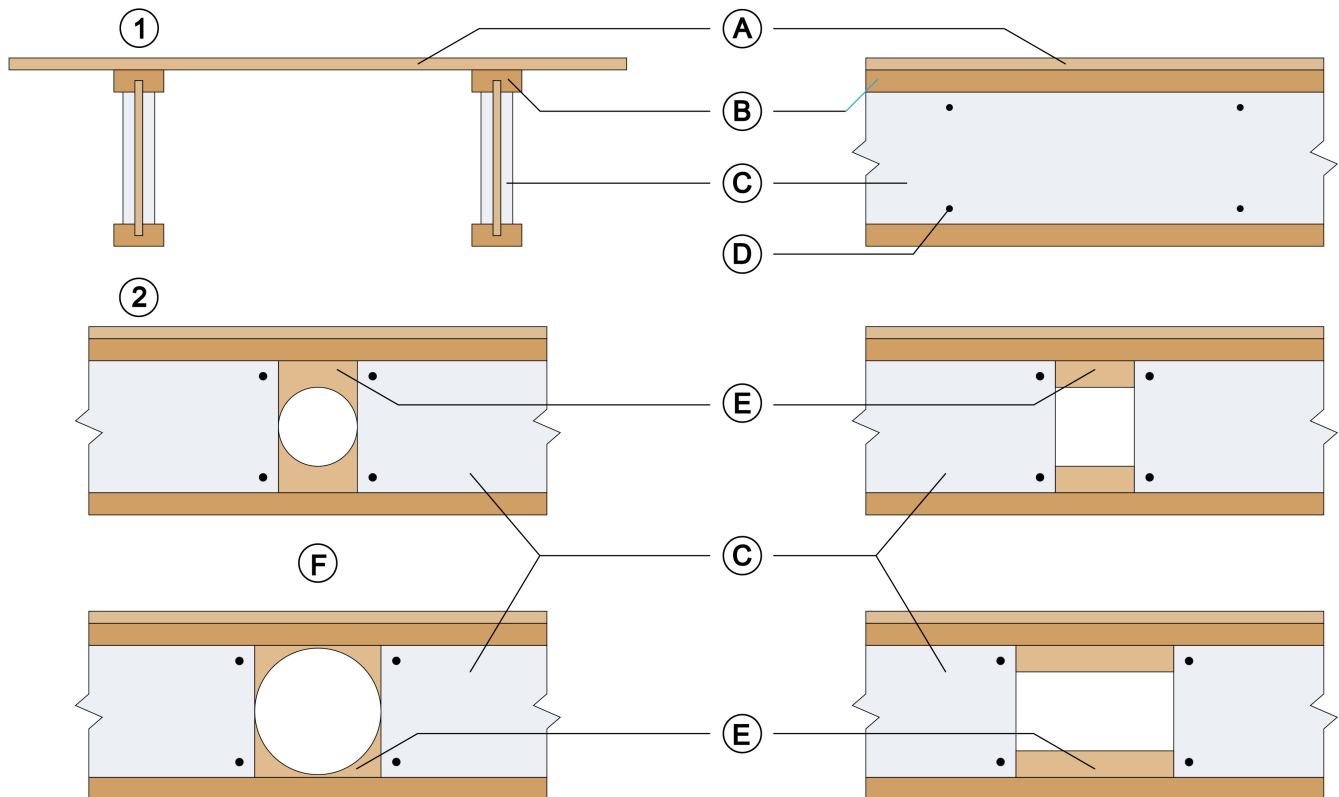


Figure 2. Fire protection of floors FP-02 - fire protection: 12.5 mm (1/2 in.) gypsum board attached directly to web

1. 12.5 mm (1/2 in.) gypsum board attached to web
2. installation requirements at web holes

- A. Floor sheathing: materials and installation in accordance with the NBC 2015.
- B. I-joist: installation in accordance with Section 3 of this Report. Maximum 24 in. on centre (o.c.) spacing. Minimum flange size of 38 mm (1-1/2 in.) thick × 50 mm (2 in.) wide. Minimum web thickness of 9.5 mm (3/8 in.). At hole location, fasteners shall be installed 25 mm (1 in.) from the edge and end of the gypsum board.
- C. 12.5 mm (1/2 in.) gypsum board: materials (over entire length of I-joist) not required to be finished with tape and joint compound. Fasteners: minimum 25 mm (1 in.) screws (Type W or Type S) or nails installed 25 mm (1 in.) from edges and ends and 400 mm (16 in.) o.c., top and bottom. Fasteners may be staggered from top to bottom.
- D. Fastener
- E. I-joist web
- F. Or

Fire protection of floors FP-03

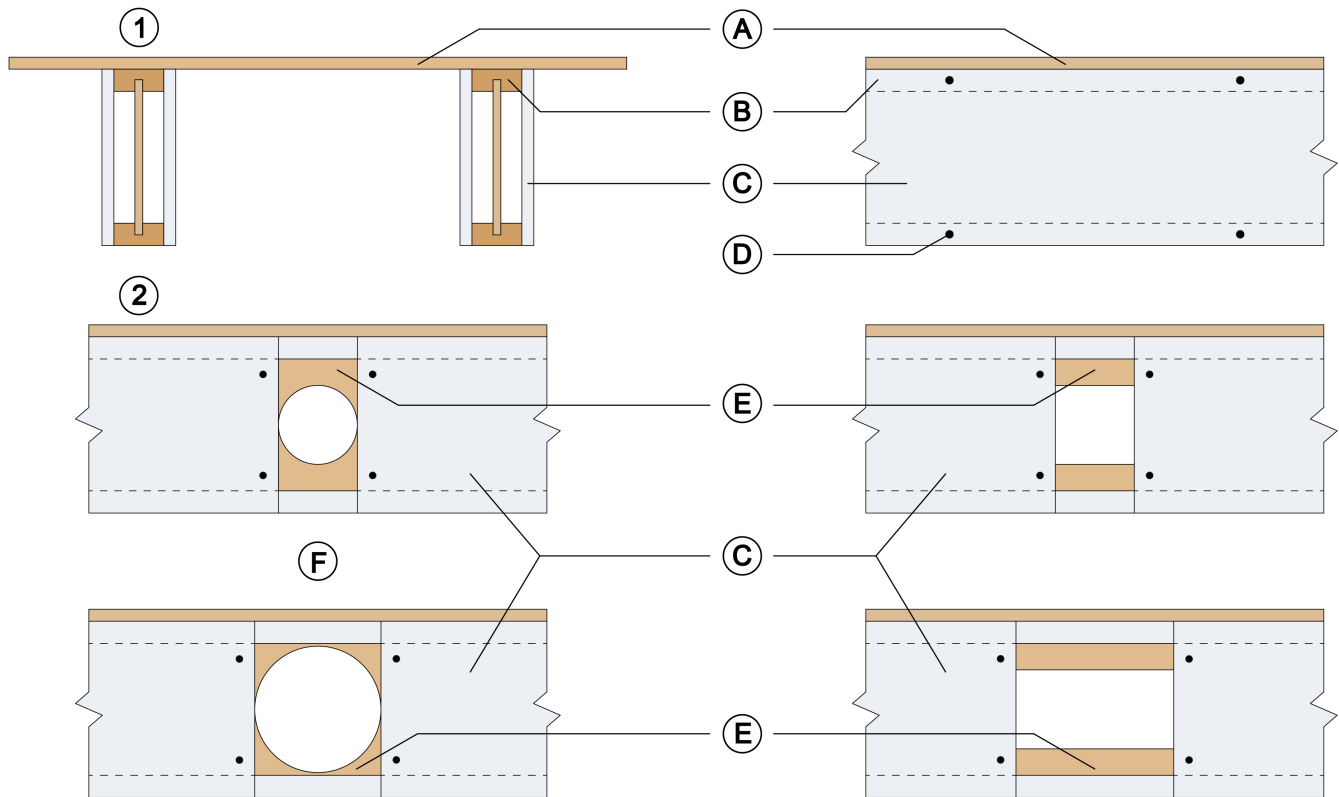


Figure 3. Fire protection of floors FP-03 - fire protection: 12.5 mm (1/2 in.) gypsum board attached directly to sides of flange

1. 12.5 mm (1/2 in.) gypsum board attached to sides of flange
2. installation requirements at web holes
 - A. Floor sheathing: materials and installation in accordance with the NBC 2015.
 - B. I-joist: installation in accordance with Section 3 of this Report. Maximum 600 mm (24 in.) on centre (o.c.) spacing. Minimum flange size of 28.5 mm (1-1/8 in.) thick × 44.5 mm (1-3/4 in.) wide. Minimum web thickness of 9.5 mm (3/8 in.). At hole location, fasteners shall be installed 12.5 mm (1/2 in.) from the edge and 1 in. from the end of the gypsum board. Maximum fastener spacing shall be no more than 8 in. on gypsum board above and below the hole.
 - C. 12.5 mm (1/2 in.) gypsum board: materials (over entire length of I-joist) not required to be finished with tape and joint compound. Fasteners: minimum 25 mm (1 in.) screws (Type W or Type S) or nails installed 12.5 mm (1/2 in.) from edges and 1 in. from ends, and 400 mm (16 in.) o.c., top and bottom. Fasteners may be staggered from top to bottom.
 - D. Fastener
 - E. I-Joist web
 - F. Or

Fire protection of floors FP-04

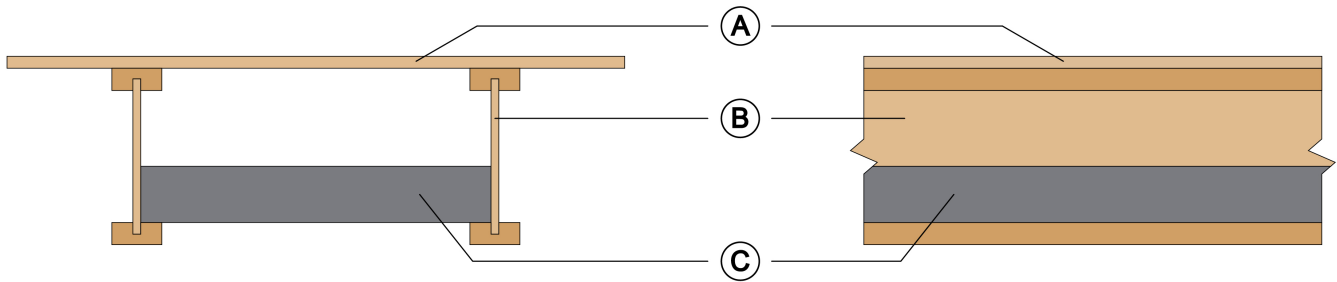


Figure 4. Fire protection of floors FP-04 - fire protection: mineral wool insulation

- A. Floor sheathing: materials and installation in accordance with the NBC 2015.
- B. I-joist: installation in accordance with the "Conditions and limitations" section of this evaluation. Maximum 487 mm (19.2 in.) on centre (o.c.) spacing. Minimum flange size of 28.5 mm (1 1/8 in.) thick × 44.5 mm (1 3/4 in.) wide. Minimum web thickness of 9.5 mm (3/8 in.).
- C. Mineral wool insulation: minimum 46.5 kg/m³ (2.9 lb/ft³) (nominal) and 50 mm (2 in.) thick mineral wool insulation made of rock slag, complying with CAN/ULC-S702 and with CCMC Listing, installed without gaps between individual batts as shown with stay wire insulation supports, spaced no more than 600 mm (24 in.) apart and no more than 100 mm (4 in.) from ends of batts. Minimum 40 kg/m³ (2.5 lb/ft³) (nominal) and 50 mm (2 in.) thick mineral wool insulation shall be permitted if the I-joists are spaced no more than 400 mm (16 in.) o.c. Use minimum 387 mm (15.25 in.) and 470 mm (18.5 in.) wide batts when I-joist spacing is 400 mm (16 in.) and 487 mm (19.2 in.) o.c., respectively.

Note: As per NBC 2015, Sentence 9.25.2.3.(7), any insulation that may be subjected to mechanical damage is to be protected by a covering such as gypsum board, plywood, particleboard, OSB or hardboard.

For assemblies where mineral-fibre insulation is installed to provide joist protection in a fire, as per NBC 2015, Sentence 9.25.2.3.(7), any insulation that may be subjected to mechanical damage is to be protected by a covering such as gypsum board, plywood, particleboard, oriented strandboard (OSB) or hardboard

Fire protection of floors FP-06

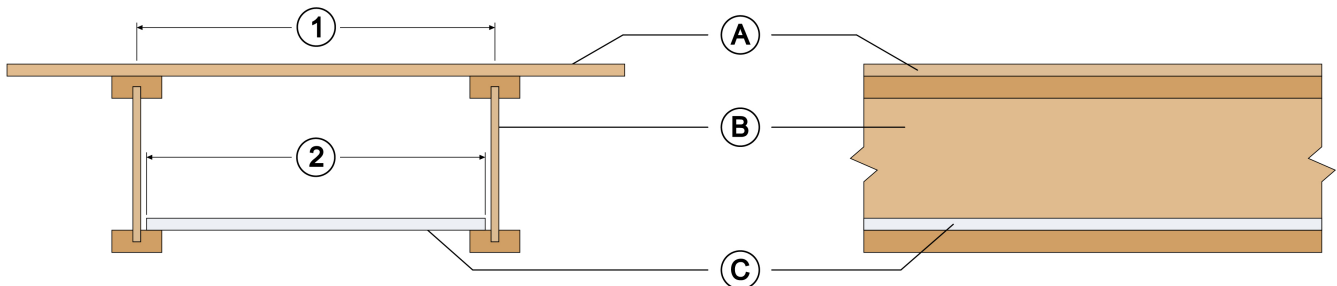


Figure 5. Fire protection of floors FP-06 - fire protection: 12.5 mm (1/2-in.) gypsum board installed on top of the bottom flange

- A. Floor sheathing: materials and installation in accordance with NBC 2015.
- B. I-joist: installation in accordance with Section 3 of this Report. Maximum 487 mm (19.2 in.) on centre spacing. Minimum flange size of 28.5 mm (1-1/8 in.) thick × 50 mm (2 in.) wide. Minimum web thickness of 9.5 mm (3/8 in.).
- C. One layer of 12.5 mm (1/2 in.) lightweight or normal weight (nominal 7.3 kg/m² (1.5 psf) minimum) gypsum wall board meeting ASTM C 1396, installed on the top of the bottom flange. Mechanical fastener or adhesive attachment to the top of the bottom flange is not required.

1. 19.2 inches maximum
2. Gypsum board length (see table below)

Table 6. Table for FP-06 ⁽³⁾

Joist spacing	Required length for gypsum boards
300 mm (12 in.)	282.5 mm (11-1/8 in.) ± 3.2 mm (1/8 in.)
400 mm (16 in.)	384.2 mm (15-1/8 in.) ± 3.2 mm (1/8 in.)
487 mm (19.2 in.)	467 mm (18-3/8 in.) ± 3.2 mm (1/8 in.)

Note:

³ Gypsum board lengths shown above provide at least a 6 mm (1/4 in.) bearing on the top of the bottom flange in each I-joist as installed. For other joist spacings, the required gypsum board lengths shall be adjusted so that the required gypsum board lengths are determined based on a full bearing on the flange at one end of the joist spacing, while maintaining at least a 6 mm (1/4 in.) bearing at the other end. If double joists are used, the required gypsum board lengths shall be reduced from the table above by a length equal to the flange width.

Fire protection of floors FP-07

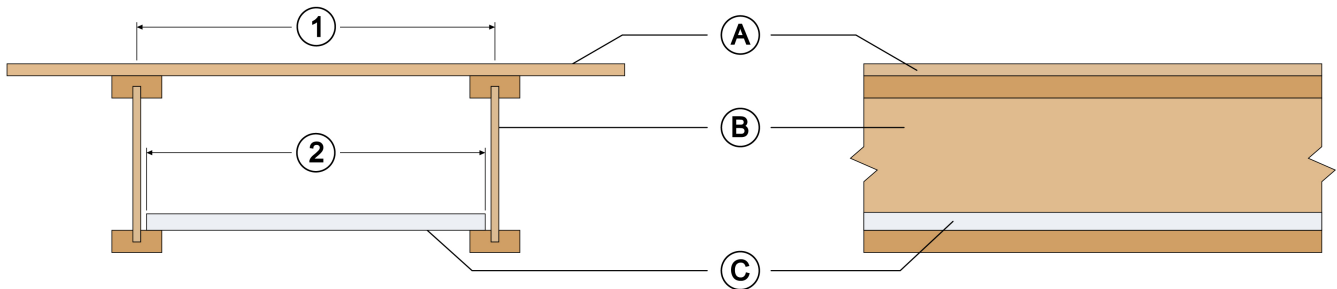


Figure 6. Fire protection of floors FP-07 - fire protection: 15.8 mm (5/8-inch) gypsum board installed on top of the bottom flange

- A. Floor sheathing: materials and installation in accordance with the NBC 2015.
 - B. I-joist: installation in accordance with Section 3 of this Report. Maximum 600 mm (24 in.) on centre spacing. Minimum flange size of 28.5 mm (1-1/8 in.) thick × 50 mm (2 in.) wide. Minimum web thickness of 9.5 mm (3/8 in.).
 - C. One layer of 15.8 mm (5/8 in.) lightweight or normal weight (nominal 9.3 kg/m² (1.9 psf) minimum) gypsum wall board meeting ASTM C 1396, installed on the top of the bottom flange. Mechanical fastener or adhesive attachment to the top of the bottom flange is not required.
1. 24 inches maximum
 2. Gypsum board length (see table below)

Table 7. Gypsum board length for FP-07 ⁽⁴⁾

Joist spacing	Required length for gypsum boards
300 mm (12 in.)	282.5 mm (11-1/8 in.) ± 3.2 mm (1/8 in.)
400 mm (16 in.)	384.2 mm (15-1/8 in.) ± 3.2 mm (1/8 in.)
487 mm (19.2 in.)	467 mm (18-3/8 in.) ± 3.2 mm (1/8 in.)
600 mm (24 in.)	587 mm (23-1/8 in.) ± 3.2 mm (1/8 in.)

Note:

- 4 Gypsum board lengths shown above provide at least a 6 mm (1/4 in.) bearing on the top of the bottom flange in each I-joint as installed. For other joist spacings, the required gypsum board lengths shall be adjusted so that the required gypsum board lengths are determined based on a full bearing on the flange at one end of the joist spacing, while maintaining at least a 6 mm (1/4 in.) bearing at the other end. If double joists are used, the required gypsum board lengths shall be reduced from the table above by a length equal to the flange width.

Fire protection of floors FP-09

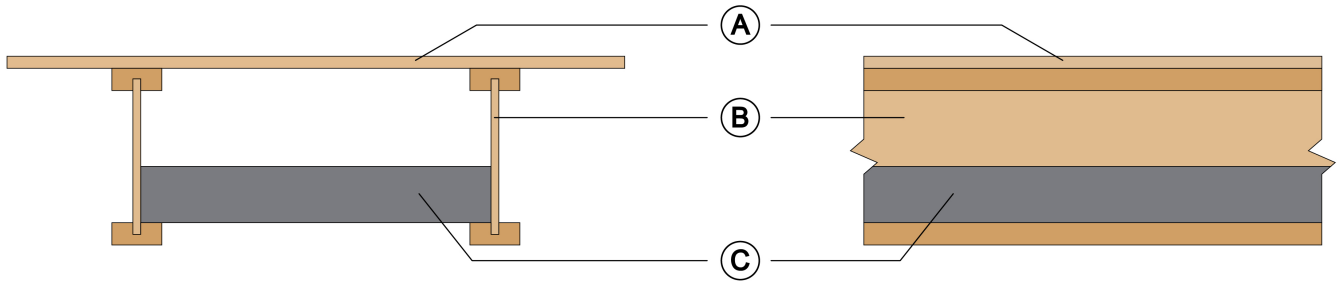


Figure 7. Fire protection of floors FP-09 - fire protection: Rockwool SAFE'n'Sound® mineral wool insulation

- A. floor sheathing: materials and installation in accordance with the NBC 2015.
- B. I-joist: installation in accordance with the "Conditions and limitations" section of this evaluation. Maximum 600 mm (24 in.) on centre (o.c.) spacing. Minimum flange size of 28.5 mm (1 1/8 in.) thick × 50 mm (2 in.) wide. Minimum web thickness of 9.5 mm (3/8 in.).
- C. mineral wool insulation: Rockwool SAFE'n'SOUND® minimum 40 kg/m³ (2.5 lb/ft³) (nominal) and 75 mm (3 in.) thick mineral wool batt insulation made of rock or furnace slag (ASTM C 665 Type 1-compliant) installed as shown with insulation stay wire supports, spaced no more than 600 mm (24 in.) apart and no more than 100 mm (4 in.) from ends of batts. Use minimum 387 mm (15.25 in.), 470 mm (18.5 in.) and 584 mm (23 in.) wide batts when I-joist spacing is 400 mm (16 in.), 487 mm (19.2 in.) and 600 mm (24 in.) o.c., respectively.

Note: As per NBC 2015, Sentence 9.25.2.3.(7), any insulation that may be subjected to mechanical damage is to be protected by a covering such as gypsum board, plywood, particleboard, OSB or hardboard.

For assemblies where mineral-fibre insulation is installed to provide joist protection in a fire, as per NBC 2015, Sentence 9.25.2.3.(7), any insulation that may be subjected to mechanical damage is to be protected by a covering such as gypsum board, plywood, particleboard, oriented strandboard (OSB) or hardboard

Manufacturer-proprietary fire protection options

The following fire-resistance floor assembly design provided by the manufacturer ⁽¹⁾ provides fire performance as good as to 38 mm × 235 mm (2 × 10) dimensional lumber exposed floor joists.

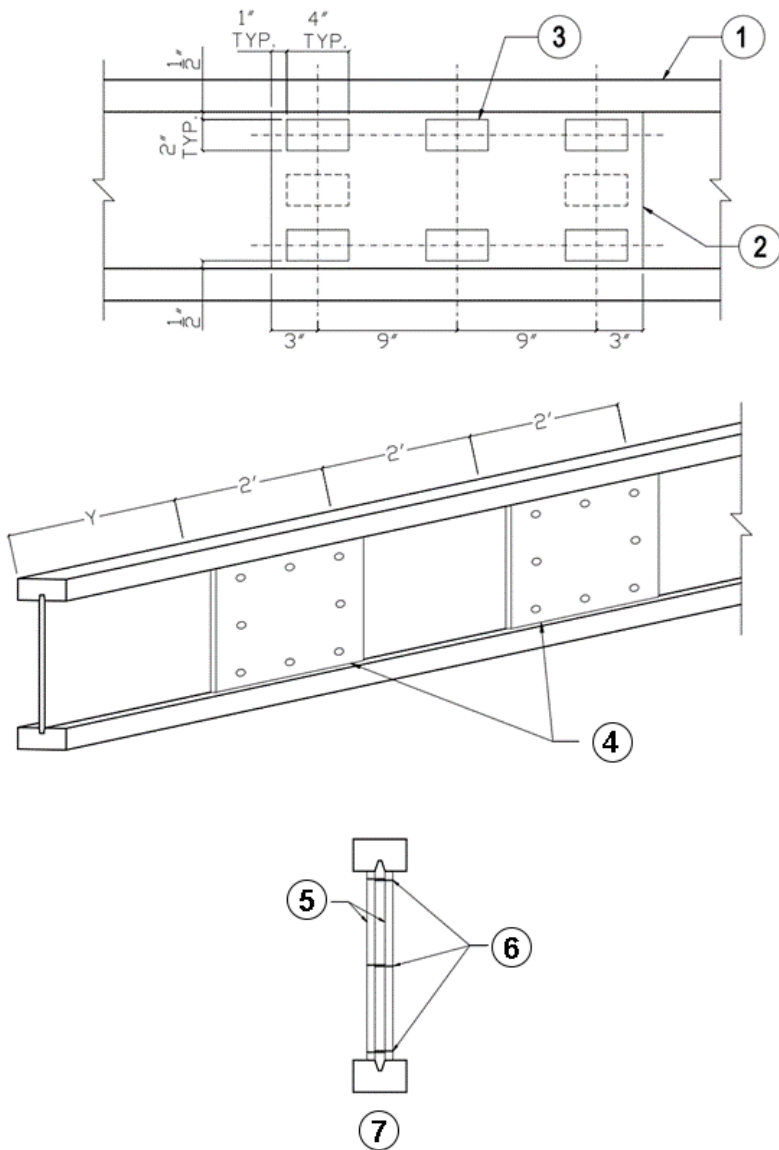


Figure 8. WEBshield® installation details

1. Wood I-joist per plan
2. WEBshield® panels
3. Fastener zones - one fastener to be installed in each of the eight zones
4. WEBshield® panels: see Table 7
5. WEBshield® panels
6. Fasteners in WEBshield® panels on opposite sides of the web must be staggered to avoid interference
7. Section view

- WEBshield® panels must be installed tightly against the I-joist web at prescribed intervals, back-to-back on each side, to protect the web against exposure to flame. Fasten each panel using 16-gauge 3/4-in.-long × 7/16-in. crown staples, or equivalent, according to the following specifications:
 - Installation details: Use (8) 3/4-in.-long staples, minimum, to attach WEBshield® panels as shown. WEBshield® panels must be installed at 4-ft.-on-centre spacing intervals with a 0.5 in. spacing tolerance. End panels must begin within 2 ft. from the ends of the I-joist (dimension y).

- The 3/4-in.-long fasteners must be installed at 90 degrees to the panel surface for adequate penetration to hold the panel against the I-joist web.

Pinkwood FRI Assembly - WEBshield®

Pinkwood I-joists protected with Pinkwood WEBshield® panels, a patented fire-protective assembly called Pinkwood FRI Assembly, offers fire protection to perform as well as unprotected 38 mm × 235 mm (2 × 10) lumber floors. WEBshield® panels are OSB panels, nominal 15/32-in. thick (11.91 mm), 24 in. (610 mm) long, and manufactured to fit between the top and bottom flanges to protect the webs of the Pinkwood I-Joists in FRI Assembly. The application of FRI Assembly is subject to the following conditions:

1. **Installation of WEBshield® panels:** The WEBshield® Panels are installed in-plant in accordance with [Figure 8](#). Pinkwood joists with WEBshield® panels installed are certified by Intertek Testing Services.
2. **I-joists used in FRI Assembly:** Pinkwood I-joists used in FRI Assembly must be limited to 9 1/2-in. (241 mm) through 14-in. (356 mm) depths with OSB webs, and must meet the minimum size and strength property requirements specified in [Table 6](#).
3. **Design:** The Pinkwood FRI Assembly must be used for applications having a maximum live load of 40 psf (1 915 N/m²) and a maximum dead load of 20 psf (958 N/m²). For use in FRI Assembly, the published moment resistance of Pinkwood I-joists must be reduced to 82% for minimum WEBshield® coverage as specified in [Table 7](#) of this evaluation.

Table 8. Requirements for I-joists used in FRI assembly

Flange		Web stock		Minimum design properties ⁽¹⁾	
Min. specific gravity	Min. size (mm)		Min. thickness (mm)	Factored moment resistance (N·m)	Bending stiffness EI (×10 ⁵ kN·mm ²)
	Depth	Width			
0.42	38	63.5	9.5	5 098	482

Note:

- ¹ Minimum design properties refer to the design properties of the I-joists for limit states design published in the CCMC evaluation. For the factored moment resistance, it is the published design value before the reduction factor 0.82 is applied.

Table 9. Minimum quantity of WEBshield® panels

Joist span ≤	Minimum quantity	
	WEBshield® length 24 in.	WEBshield® length 12 in.
26 ft.	12	
25 ft.	12	
24 ft.	12	
23 ft.	10	2

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Joist span ≤	Minimum quantity	
	WEBshield® length 24 in.	WEBshield® length 12 in.
22 ft.	10	
21 ft.	10	
20 ft.	10	
19 ft.	8	2
18 ft.	8	
17 ft.	8	
16 ft.	8	
15 ft.	6	2
14 ft.	6	
13 ft.	6	
12 ft.	6	
11 ft.	4	2
10 ft.	4	
9 ft.	4	
8 ft.	4	
7 ft.	2	2
6 ft.	2	
5 ft.	2	
4 ft.	2	
3 ft.		2

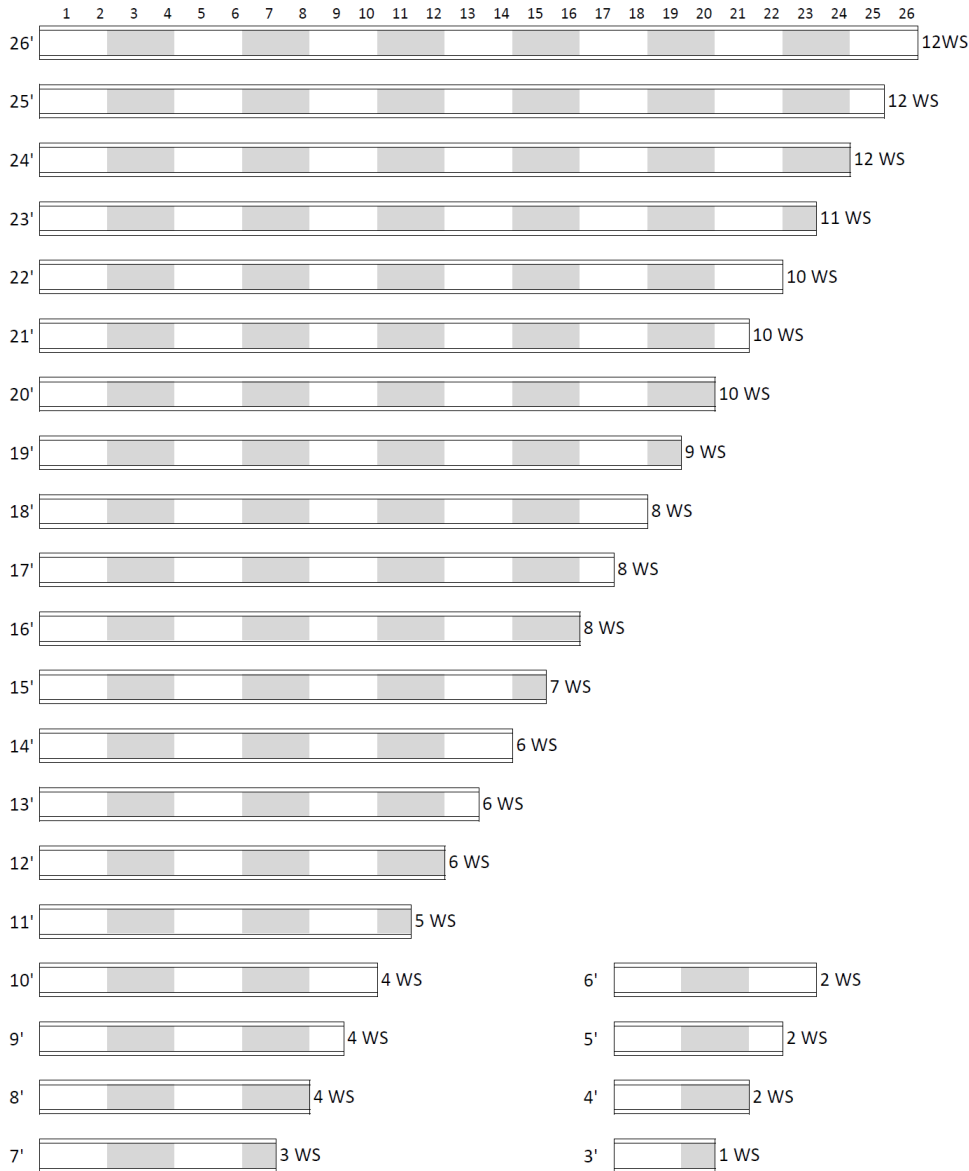


Figure 9. FRI Assemblies - 15/32 in. WEBshield®

- 2 ft. gap with 2 ft. panel length and 2 ft. end start section. Field trimmable.

Note:

- 1 These floor assemblies and supported fire test data have been provided to the CCMC by the I-joist industry in collaboration with the APA-Engineered Wood Association. The floor assemblies contained in this evaluation reviewed by the CCMC provide equivalent fire performance to exposed 38 mm × 235 mm (2 × 10) lumber joists, and are a subset of those published in the APA System Report SR-405G, dated April 2019.

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Code compliance as an acceptable solution

Code Compliance via Acceptable Solutions

If a building design (e.g. material, component, assembly or system) can be shown to meet all provisions of the applicable **acceptable solutions** in Division B (e.g. it complies with the applicable provisions of a referenced standard), it is deemed to have satisfied the objectives and functional statements linked to those provisions and thus to have complied with that part of the Code.

— National Building Code of Canada, Sentence A-1.2.1.1.(1)(a)

The CCMC has determined that compliance with this provision of the Code has been demonstrated as an **Acceptable Solution**. The evaluation report provides a summary of the basis of CCMC's compliance opinion.

CCMC's code compliance opinions

All CCMC evaluation reports are opinions of code compliance established in accordance with the National Building Code of Canada, Subsection 1.2.1. "Compliance with this Code," which requires compliance to be achieved by:

- complying with the applicable acceptable solutions in Division B, or
- using an alternative solution that will achieve at least the minimum level of performance required by Division B in the areas defined by the objective and functional statements attributed to the applicable acceptable solutions.

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Code compliance as an alternative solution

Code Compliance via Alternative Solutions

Where a design differs from the acceptable solutions in Division B, then it should be treated as an **"alternative solution."** A proponent of an alternative solution must demonstrate that the alternative solution addresses the same issues as the applicable acceptable solutions in Division B and their attributed objectives and functional statements. However, because the objectives and functional statements are entirely qualitative, demonstrating compliance with them in isolation is not possible. Therefore, Clause 1.2.1.1.(1)(b) identifies the principle that Division B establishes the quantitative performance targets that alternative solutions must meet. In many cases, these targets are not defined very precisely by the acceptable solutions [...] Nevertheless, Clause 1.2.1.1.(1)(b) makes it clear that an effort must be made to demonstrate that an alternative solution will perform as well as a design that would satisfy the applicable acceptable solutions in Division B—not “well enough” but “as well as.”

— National Building Code of Canada, Sentence A-1.2.1.1.(1)(b)

The CCMC has determined that compliance with this provision of the Code has been demonstrated as an **Alternative Solution**. The evaluation report provides a summary of the basis of CCMC's compliance opinion.

CCMC's code compliance opinions

All CCMC evaluation reports are opinions of code compliance established in accordance with the National Building Code of Canada, Subsection 1.2.1. "Compliance with this Code," which requires compliance to be achieved by:

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