CCMC CANADIAN CODE COMPLIANCE EVALUATION

CCMC EVALUATION

CCMC 14146-R

CCMC Canadian code compliance evaluation

CCMC number:	14146-R
Status:	Active
Issue date:	2019-12-02
Modified date:	2024-01-24
Evaluation holder:	**IB EWP Inc.** 480 Rue Jocelyn-Bastille Pohénégamook QC G0L 1J0 Canada Website: www.ibewp.com Telephone: 418-893-1515 Email: sales@ibewp.com
Product names:	• IB400 • IB600 • IB700 • IB800 • IB900x
Compliance:	NBC 2015, NBC 2020, OBC
Criteria:	CCMC-TG-061733.01-15B "CCMC Technical Guide for Prefabricated Wood I-Joists" CCMC-TG-061733.01-20 "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 codes:

National Building Code of Canada 2015

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

National Building Code of Canada 2020

Code provision	Solution type
4.3.1.1.(1) Buildings and their structural members m ...	Acceptable
9.10.8.10. Application to Houses	Alternative
9.23.4.2.(2) Spans for floor joists that are not sele ...	Alternative
9.4.1. Structural Design Requirements and Application Limitations	Acceptable

Ontario Building Code

Ruling No. 04-01-105 (14146-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on 2004-02-13 (revised 2022-12-07) pursuant to s.29 of the Building Code Act, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

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

- IB400
- IB600
- IB700
- IB800
- IB900x

Product description

The products are prefabricated wood I-joists consisting of two finger-jointed lumber flanges. The flange sizes and grades are shown in Table 1 below. This evaluation covers all the I-joist series products described in this evaluation that are manufactured at the Pohénégamook plant.

The flanges are finger-jointed at the plant and glued to a 9.5-mm- or 11-mm-thick oriented strandboard (OSB) web, which is manufactured in conformance with CSA O325-16, “Construction Sheathing.”

The web–flange connection is made by inserting the profiled OSB web into an 18.8-mm-deep tapered groove in the centre of the wide face of the top and bottom flanges. Consecutive web segments are end-spliced with a V-shaped joint to form a continuous web.

For the products manufactured at the Pohénégamook plant, all the V-shaped edge web segments, the web-to-flange and the flange finger joints are bonded together using a polyurethane adhesive (see CCMC 13513-L).

APA – The Engineered Wood Association (APA EWS trademark) conducts regular audits of the manufacturing plant and the quality assurance program as part of the product certification.

Table 1. Joist flange sizes and grades

IB I-joist	Depth (mm)	Grade	Flange size (mm)	Web thickness (1) (mm)
IB400	200–406	Proprietary (2) S-P-F No. 2 and better, or enhanced (3) MSR 1650f-1.5E	38 × 63.5	9.5
IB600	200–508	Enhanced (3) MSR 2100f-1.8E	38 × 63.5	9.5
IB700	241–406	Enhanced (3) MSR 1650f-1.5E	38 × 89	9.5
IB800	200–508	Enhanced (3) MSR 2100f-1.8E	38 × 89	9.5
IB900x	200–610	Enhanced (3) MSR 2400f-2.0E	38 × 89	11.1

	Notes
1	Referenced dimensions are nominal. Tolerances are as specified in the manufacturing standard.

2	The visually graded lumber flange is regraded with a proprietary tension value that has been qualified. The flange is subject to proprietary grading rules and ongoing testing in accordance with the manufacturing standard.
3	The machine stress rated (MSR) lumber flange is enhanced with a proprietary tension value that has been qualified. The flange is subject to proprietary grading rules and ongoing testing in accordance with the manufacturing standard.

Manufacturing plant

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

Product names	Manufacturing plant
	Pohénégamook, QC, CA
IB400	✓
IB600	✓
IB700	✓
IB800	✓
IB900x	✓

✓ 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 or roof 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 and the NBC 2020 for acceptance by the local authority having jurisdiction (AHJ):

Manufacturer's pre-engineered design tables

When the products are used as floor joists in simple (single) span or continuous (multiple) span applications supporting uniform loads only, the installation must be in accordance with the floor span tables (including vibration criteria (2)) found in the documents below.

For IB400, IB600, IB700, IB800 and IB900x products:

1. *IB CND Sealed Reinforced Cantilever Table*, dated April 5th 2022;
2. *IB CND Roof Span Tables*, dated April 5th 2022;
3. *IB CND Web Hole Tables*, dated April 5th 2022;
4. *IB400 CND Sealed Floor Span Tables*, dated January 5th 2022;
5. *IB600 CND Sealed Floor Span Tables*, dated January 5th 2022;
6. *IB700 CND Sealed Floor Span Tables*, dated January 5th 2022;
7. *IB800 CND Sealed Commercial Floor Span Tables*, dated June 10th 2022;
8. *IB800 CND Sealed Floor Span Tables*, dated January 5th 2022;
9. *IB900x CND Sealed Commercial Floor Span Tables*, dated June 10th 2022;
10. *IB900x CND Sealed Residential Floor Span Tables*, dated June 10th 2022; and
11. *IB EWP Inc. MAX-CORE I-Joist Installation Guide – Canada – ENGLISH (JIE0823C)*, dated August 2023.

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 these installation guidelines require engineering on a case-by-case basis.

Manufacturer's pre-engineered installation details

The products must be installed in accordance with the applicable manufacturer's installation documents outlined above. Installation of the products is limited in scope to building designs where the anticipated loads on the following structural details are not exceeded (references are to documents 1 through 11 above):

- cantilever design table (1);
- roof span tables (2);
- floor span tables (4 through 10);
- rim joist, rimboard and blocking resistance (floor framing details of 11);
- squash blocks (floor framing details of 11);
- backer block (floor framing details of 11);
- web stiffener requirements (11);

- filler block for double I-joists (11); and
- web hole tables (3 and 11).

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 above imply, but are not limited to, the following:

- higher loads/longer spans than the manufacturer's pre-engineered details;
- concentrated loads;
- offset bearing walls;
- design of cantilevers, when the cantilever conditions exceed the limitations of the NBC 2020 pre-engineered tables;
- roof span, when the design loads exceed the limitations of the NBC 2020 pre-engineered roof span tables;
- high wind and seismic areas;
- stair openings;
- design of supporting wall studs / beams when the total load exceeds the NBC 2020 pre-engineered floor/ roof joist tables; and
- design of supporting foundation footings when the total load exceeds the NBC 2020 pre-engineered floor/roof joist tables.

Engineering support provided by the manufacturer

- IB EWP Inc. provides engineering and product support and can be contacted through the following:
  Telephone: 418-893-1515
  Email: sales@ibewp.com

- These products must be identified with the phrase "CCMC 14146-R" along the side of the flange. This CCMC number is only valid when it appears in conjunction with the APA EWS 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 conditions" is defined as the in-service environment in 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 an MC of 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 and the NBC 2020.

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. The manufacturer should therefore be consulted for span adjustments, if necessary, in these types of installations.

Technical information

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

Criteria number	Criteria name
CCMC-TG-061733.01-15B	CCMC Technical Guide for Prefabricated Wood I-Joists
CCMC-TG-061733.01-20	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. Engineering properties (1) (limit states design (2))

Series	Joist depth (mm)	Factored moment resistance (3) M_r (N·m)	Factored shear resistance (4) V_r (N)	EI ($\times 10^6$) (kN·mm^2)	Shear deflection factor "K" ($\times 10^6$) (N)	Factored vertical load resistance (5) (kN/m)
			With stiffeners			
IB400	200	5 040	8 109	353	18.24	42.3
	219	5 626	8 109	439	19.97	42.3
	235	6 122	8 109	531	21.40	42.3
	241	6 314	8 320	568	21.97	42.3
	286	7 689	9 864	849	26.02	42.3
	302	8 185	10 391	964	27.49	42.3
	356	9 854	12 286	1 418	32.38	42.3
	406	11 421	14 042	1 931	37.01	42.3
IB600	200	6 945	8 109	416	18.24	42.3
	219	7 757	8 109	519	19.97	42.3
	235	8 433	9 478	631	21.40	42.3
	241	8 704	9 619	674	21.97	42.3
	286	10 598	10 637	1 022	26.02	42.3
	302	11 274	11 023	1 145	27.49	42.3
	356	13 574	12 286	1 679	32.38	42.3
	406	15 739	14 042	2 293	37.01	42.3

Series	Joist depth (mm)	Factored moment resistance [3] M_r (N·m)	Factored shear resistance [4] V_r (N)	EI ($\times 10^6$) (kN·mm^2)	Shear deflection factor "K" ($\times 10^6$) (N)	Factored vertical load resistance [5] (kN/m)
			With stiffeners			
	457	17 802	15 797	3 002	41.63	37.0
	508	19 696	17 552	3 742	46.26	31.7
IB700	241	8 941	9 829	775	21.97	42.3
	302	11 590	11 374	1 311	27.49	42.3
	356	13 958	12 743	1 917	32.38	42.3
	406	16 179	14 042	2 600	37.01	42.3
IB800	200	9 831	8 109	585	18.24	42.3
	219	10 981	8 109	729	19.97	42.3
	235	11 940	9 759	881	21.40	42.3
	241	12 323	9 864	936	21.97	42.3
	286	15 006	10 812	1 415	26.02	42.3
	302	15 965	11 163	1 584	27.49	42.3
	356	19 234	12 883	2 316	32.38	42.3
	406	22 301	14 533	3 139	37.01	42.3
	457	25 108	16 148	4 147	41.63	38.3
	508	27 915	18 254	5 163	46.26	34.4
IB900x	200	12 097	9 548	620	22.42	42.3
	219	13 507	10 285	775	24.55	42.3
	241	15 164	11 163	976	27.04	42.3
	302	19 651	13 515	1 644	33.80	42.3
	356	23 654	14 919	2 399	39.85	42.3
	406	27 431	16 358	3 246	45.55	42.3
	457	31 016	17 622	4 227	51.24	38.3
	508	34 331	18 921	5 349	56.93	34.4
	559	37 611	20 185	6 612	62.63	26.5
	610	40 847	21 484	8 018	68.32	26.5

Notes

1 Additional engineering data and load/span tables are available from the manufacturer.

2 Design values were developed in accordance with CAN/CSA O86, "Engineering Design in Wood," for standard term load duration (K_d = 1). All values, except EI and K, are permitted to be adjusted for other load durations as permitted by CSA O86.

3 Factored moment resistance (M_r) must not be increased by any code-allowed system factor.

4 Factored shear resistance (V_r) of the I-joist with a minimum end bearing of 102 mm. Stiffeners must be designed in accordance with specifications.

5 Factored vertical uniform load resistance of the I-joist when used as blocking (i.e., squash blocks).

Table 3. Additional engineering properties (limit states design) (1)

Series	Depth (mm)	Factored end reactions (2) (N)									
		38-mm bearing		44-mm bearing		70-mm bearing		89-mm bearing		102-mm bearing	
		No stiffeners	With stiffeners (3)	No stiffeners	With stiffeners (3)	No stiffeners	With stiffeners (3)	No stiffeners	With stiffeners (3)	No stiffeners	With stiffeners (3)
IB400	200	6 705	7 407	6 845	7 477	7 407	7 758	7 828	7 969	8 109	8 109
	219	7 477	7 793	7 547	7 828	7 793	7 934	7 969	8 039	8 109	8 109
	235	7 793	8 109	7 828	8 109	8 109	8 109	8 109	8 109	8 109	8 109
	241	7 863	8 320	7 934	8 320	8 320	8 320	8 320	8 320	8 320	8 320
	286	8 249	9 513	8 460	9 548	9 408	9 864	9 864	9 864	9 864	9 864
	302	8 425	9 970	8 636	10 040	9 619	10 391	10 285	10 391	10 391	10 391
	356	8 846	11 444	9 092	11 549	10 215	12 286	10 882	12 286	10 882	12 286
	406	9 303	12 813	9 513	12 953	10 215	14 042	10 882	14 042	10 882	14 042
IB600	200	6 705	7 407	6 845	7 477	7 407	7 758	7 828	7 969	8 109	8 109
	219	7 477	7 793	7 547	7 828	7 793	7 934	7 969	8 039	8 109	8 109
	235	7 793	8 109	7 934	9 478	8 109	9 478	8 109	9 478	8 109	9 478
	241	7 863	8 320	8 004	9 619	8 320	9 619	8 320	9 619	8 320	9 619
	286	8 249	9 513	8 530	10 637	9 408	10 637	9 864	10 637	9 864	10 637
	302	8 425	9 970	8 706	11 023	9 619	11 023	10 285	11 023	10 391	11 023
	356	8 846	11 444	9 373	12 286	10 250	12 286	10 882	12 286	10 882	12 286
	406	9 303	12 813	9 970	13 515	10 496	13 831	10 882	14 042	10 882	14 042
	457	n/a	n/a	10 566	14 709	10 742	15 340	10 882	15 797	10 882	15 797
	508	n/a	n/a	10 882	15 867	10 882	16 815	10 882	17 552	10 882	17 552

Series	Depth (mm)	Factored end reactions [2] (N)									
		38-mm bearing		44-mm bearing		70-mm bearing		89-mm bearing		102-mm bearing	
		No stiffeners	With stiffeners [3]	No stiffeners	With stiffeners [3]	No stiffeners	With stiffeners [3]	No stiffeners	With stiffeners [3]	No stiffeners	With stiffeners [3]
IB700	241	8 074	9 583	8 249	9 619	8 952	9 724	9 478	9 794	9 829	9 829
	302	8 671	10 988	8 881	11 058	9 654	11 198	10 285	11 304	10 672	11 374
	356	9 232	12 251	9 443	12 322	10 250	12 532	10 952	12 673	11 409	12 743
	406	9 724	13 445	9 970	13 515	10 917	14 042	11 619	14 042	12 111	14 042
IB800	200	6 705	7 407	6 845	7 477	7 407	7 758	7 828	7 969	8 109	8 109
	219	7 477	7 793	7 547	7 828	7 793	7 934	7 969	8 039	8 109	8 109
	235	7 793	8 109	7 934	9 689	8 109	9 689	8 109	9 689	8 109	9 759
	241	7 863	8 320	8 004	9 864	8 320	9 864	8 320	9 684	8 320	9 864
	286	8 249	9 513	8 530	10 812	9 408	10 812	9 864	10 812	9 864	10 812
	302	8 846	11 163	9 057	11 163	9 864	11 163	10 461	11 163	10 882	11 163
	356	9 373	12 602	9 583	12 637	10 321	12 743	10 882	12 848	11 233	12 883
	406	9 899	13 971	10 075	14 042	10 742	14 252	10 882	14 428	11 233	14 533
	457	n/a	n/a	10 566	15 937	10 742	16 043	10 882	16 148	11 233	16 148
	508	n/a	n/a	10 882	17 271	10 882	17 833	10 882	18 254	11 584	18 254
IB900x	200	8 811	8 952	8 881	9 022	9 197	9 267	9 408	9 443	9 548	9 548
	219	9 022	9 373	9 162	9 478	9 654	9 864	10 005	10 110	10 250	10 285
	241	9 267	9 864	9 443	10 005	10 180	10 531	10 707	10 917	11 058	11 163
	302	9 829	11 233	9 829	11 479	11 444	12 392	12 567	13 059	13 234	13 515
	356	9 829	12 637	9 829	12 637	11 444	13 129	12 673	13 761	13 234	14 919
	406	9 970	13 971	10 075	14 042	11 514	15 376	12 673	16 358	13 234	16 358
	457	n/a	n/a	10 566	15 937	11 233	16 885	11 760	17 622	13 234	17 622
	508	n/a	n/a	10 672	17 341	11 233	18 184	11 760	18 816	13 234	18 921
	559	n/a	n/a	10 321	18 219	11 128	19 132	11 760	19 799	13 094	20 185
	610	n/a	n/a	10 321	20 220	11 128	20 536	11 760	20 782	12 778	21 484

Notes

1 Design values were developed in accordance with CSA O86 for standard term load duration (K_d = 1). All values, except EI and K, are permitted to be adjusted for other load durations as permitted by CSA O86.

2 Interpolation of the tabulated values of the factored end reaction resistances is permitted. For factored reactions for bearings 102 mm or longer, it is permitted to use the factored shear resistance in Table 2.

3 Stiffeners must be designed in accordance with specifications.

Table 4. Additional engineering properties (limit states design) (1)

Series	Depth (mm)	Factored interior reactions (2) (N)			
		89-mm bearing		140-mm bearing	
		No stiffeners	With stiffeners (3)	No stiffeners	With stiffeners (3)
IB400	200	15 165	15 481	16 218	16 499
	219	15 165	16 043	16 218	16 639
	235	15 165	16 534	16 218	16 639
	241	15 165	16 639	16 639	16 639
	286	17 552	19 623	19 728	19 728
	302	17 552	19 658	19 728	20 782
	356	17 552	19 833	21 765	24 257
	406	17 552	20 009	21 765	25 626
IB600	200	15 165	15 481	16 218	16 499
	219	15 165	16 043	16 218	17 517
	235	15 165	18 956	16 218	18 965
	241	15 165	19 237	16 639	19 237
	286	17 552	21 273	19 728	21 273
	302	17 552	21 589	19 728	22 045
	356	17 552	22 572	21 765	24 257
	406	17 552	23 520	21 765	25 626
	457	17 552	24 046	21 765	26 223
	508	17 552	24 222	21 765	26 820
IB700	241	17 552	19 658	17 552	19 658
	302	17 552	22 747	20 431	22 747
	356	17 552	25 486	21 765	25 486
	406	17 552	28 083	21 765	28 083
IB800	200	15 235	15 481	16 218	16 499

Series	Depth (mm)	Factored interior reactions [2] (N)			
		89-mm bearing		140-mm bearing	
		No stiffeners	With stiffeners [3]	No stiffeners	With stiffeners [3]
	219	15 270	16 043	16 218	17 517
	235	16 218	18 956	16 218	18 956
	241	17 341	19 237	17 341	19 237
	286	19 728	21 273	19 728	21 273
	302	19 764	22 326	22 045	22 326
	356	21 765	25 275	23 239	25 731
	406	21 765	28 083	23 450	28 785
	457	21 765	29 663	21 765	29 663
	508	21 765	30 541	21 765	30 541
IB900x	200	19 904	21 765	20 044	22 116
	219	20 606	22 116	20 711	22 396
	241	21 378	22 502	21 484	22 712
	302	23 555	23 555	23 555	23 555
	356	23 555	25 275	23 555	25 731
	406	23 555	28 083	23 555	28 785
	457	23 555	29 979	23 555	32 577
	508	23 555	32 296	23 555	33 770
	559	23 555	34 086	23 555	34 191
	610	23 555	34 577	23 555	34 577

Notes

1 Design values were developed in accordance with CSA O86 for standard term load duration (K_d = 1). All values, except EI and K, are permitted to be adjusted for other load durations as permitted by CSA O86.

2 Interpolation of the factored interior reaction resistances between tabulated values is permitted.

3 Stiffeners must be designed in accordance with specifications.

Additional test information for the products

The design values were obtained from testing to ASTM D5055-19, "Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists," and previous editions as specified in CSA O86-19, "Engineering Design in Wood," and in previous editions as summarized below. The manufacturer's published pre-engineered joist spans were designed in accordance with CSA O86-19.

Table 5. Additional test information for the products

Property	Test information
Shear capacity	The shear capacity of the specimens was established by combining data in accordance with ASTM D5055. Data from quality control (QC) tests were used to establish the applicable coefficient of variation, CV_w, and the reliability normalization factor from Table 16.1 of CSA O86 was used to determine the specified strength.
Moment capacity	The moment capacity qualification was carried out using the analytical method based on the characteristics of the flange material, with confirmatory testing in accordance with ASTM D5055. Data from QC tests were used to establish the applicable coefficient of variation, CV_w, and the reliability normalization factor from Table 16.1 of CSA O86 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: deflection = $(5wL^4)/(384EI) + (wL^2)/K$ where: deflection (in mm); w = unfactored uniform load (kN/m); L = design span (mm); EI = flexural rigidity ($kN \cdot mm^2$); and K = shear deflection factor (kN). Note: EI and K are taken from the technical information.
End joints	End joints were qualified as part of the flange tension qualification. The flanges are finger-joined at the plant, and regular tension testing is conducted.
Creep	Specimens were tested for creep performance in accordance with ASTM D5055. The specimens recovered more than 90% of the basic dead load deflection.
Bearing length	Tests were conducted to qualify, with and without web stiffeners, minimum end-bearing lengths of 38 mm, 44 mm, 89 mm and 102 mm, as well as interior bearing lengths of 89 mm and 140 mm. Qualification tests were used to establish the applicable coefficient of variation, CV_w, and the reliability normalization factor from Table 16.1 of CSA O86 was used to determine the specified strength.
Adhesive qualification	For the products manufactured at the Pohénégamook plant, all joints are bonded together using a polyurethane adhesive, UX-160/WD3-A322 (CCMC 13513-L).
Web stock	The web stock complies with CAN/CSA O325.0-16, "Construction Sheathing."

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 below fire-protection options in comparison to the fire performance of an unprotected exposed 38 mm × 235 mm (2 x 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 reference in the compliance opinion of this evaluation exempts single-family houses constructed using conventional wood-frame construction, in accordance with Part 9 of the NBC, from requiring a fire-resistance rating (see Article 9.10.8.10. of Division B of the NBC 2015 and the NBC 2020). The below fire-protection options for alternative floor joists are not to be considered in sprinklered single-family houses or where fire-resistance-rated assemblies are required.

The fire-protection assemblies are applicable for the evaluated products as provided in Table 6 below.

Table 6. Applicable IB MAX-CORE® Series I-Joists for fire-protection assemblies based on flange size

Product	Flange size (thickness × width) (mm)	Fire-protection assembly
IB400	38 × 63.5	FP-01, FP-02, FP-03, FP-04, FP-06, FP-07, FP-09
IB600	38 × 63.5	FP-01, FP-02, FP-03, FP-04, FP-06, FP-07, FP-09
IB700	38 × 89	FP-01, FP-02, FP-03, FP-04, FP-06, FP-07, FP-09
IB800	38 × 89	FP-01, FP-02, FP-03, FP-04, FP-06, FP-07, FP-09
IB900x	38 × 89	FP-01, FP-02, FP-03, FP-04, FP-06, FP-07, FP-09

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

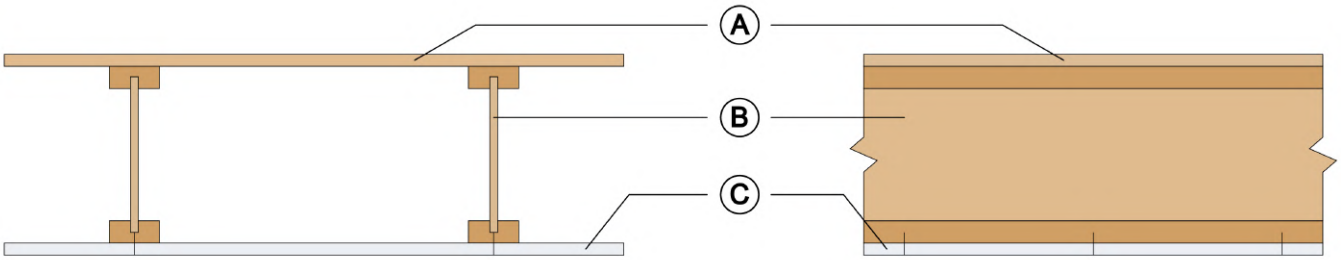

Figure 1. Fire protection of floors FP-01 - fire protection: 12.5 mm (1/2-in.) gypsum board attached to bottom of flange

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

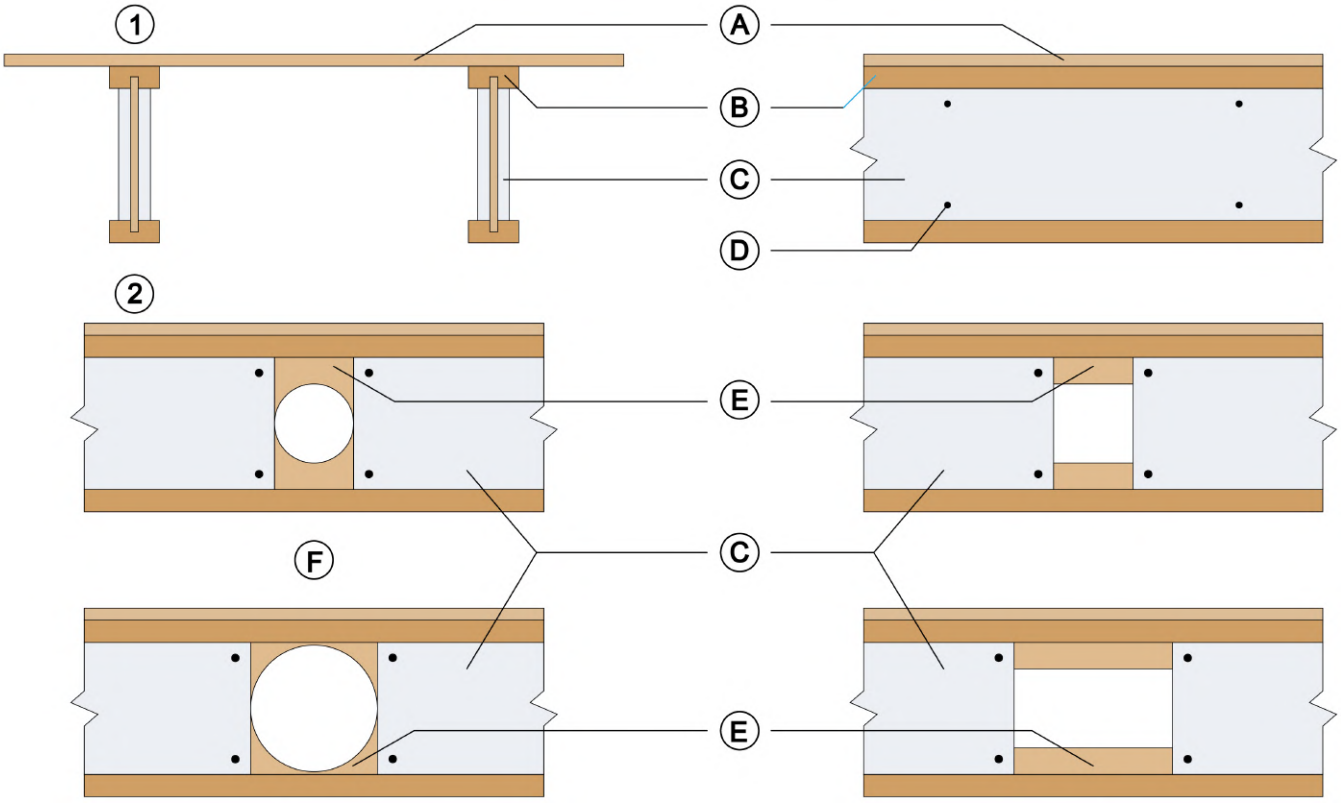

Figure 2. Fire protection of floors FP-02 - fire protection: 12.5 mm (1/2 in.) gypsum board attached directly to web

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

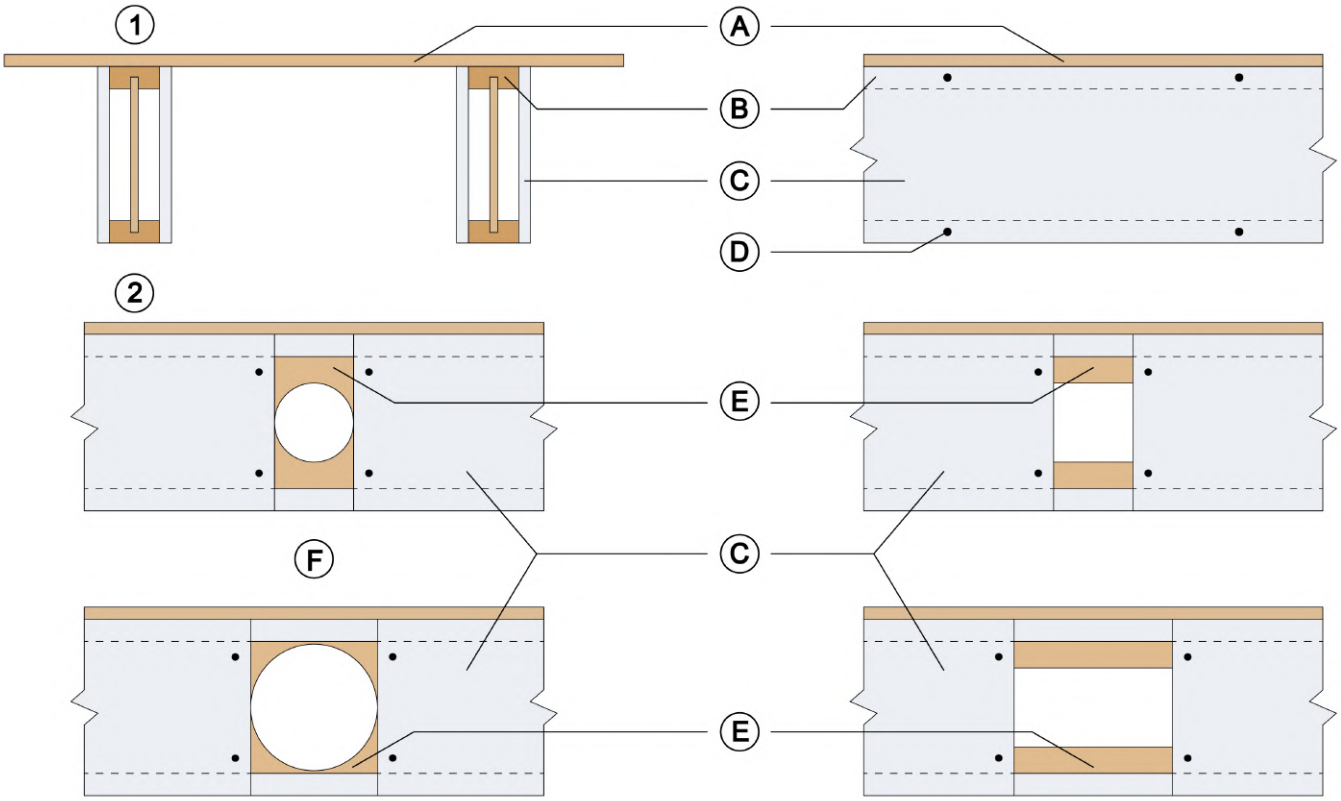

Figure 3. Fire protection of floors FP-03 - fire protection: 12.5 mm (1/2 in.) gypsum board attached directly to sides of flange

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

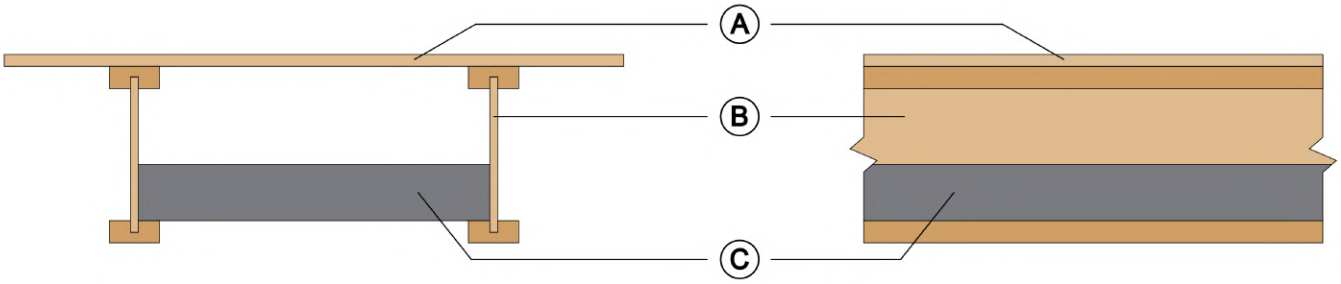

Figure 4. Fire protection of floors FP-04 - fire protection: mineral wool insulation

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/m^3 (2.9 lb/ft^3) (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/m^3 (2.5 lb/ft^3) (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

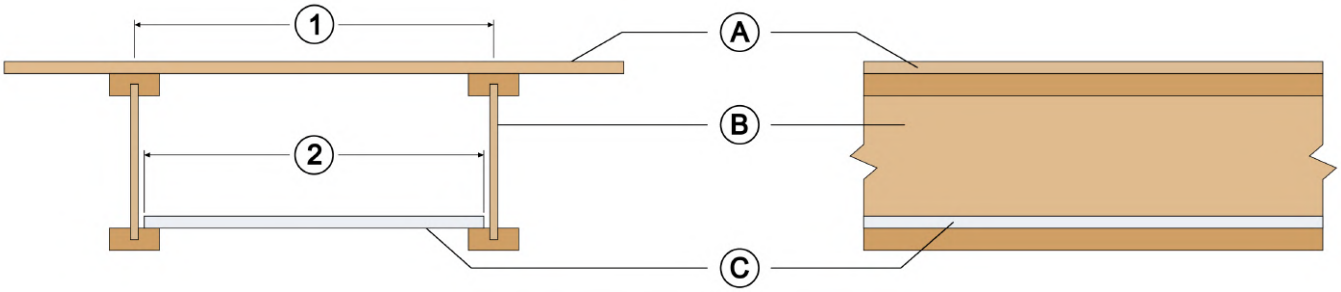

Figure 5. Fire protection of floors FP-06 - fire protection: 12.5 mm (1/2-in.) gypsum board installed on top of the bottom flange

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/m^2 (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 7. 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

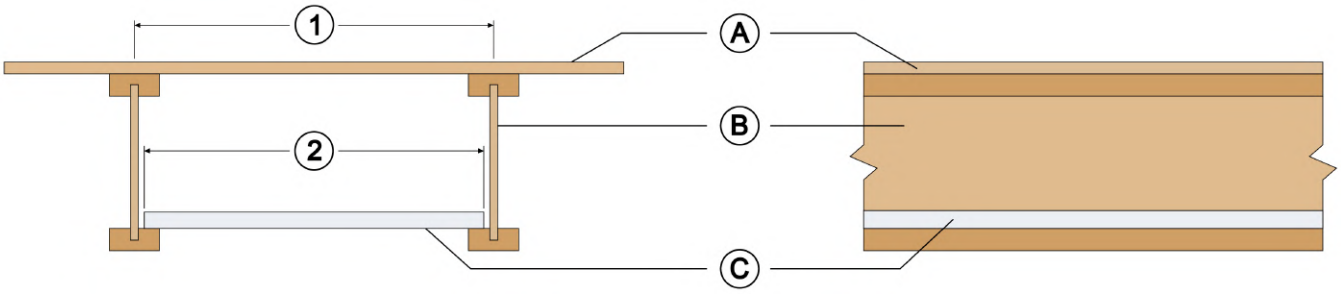

Figure 6. Fire protection of floors FP-07 - fire protection: 15.8 mm (5/8-inch) gypsum board installed on top of the bottom flange

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 8. 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-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-09

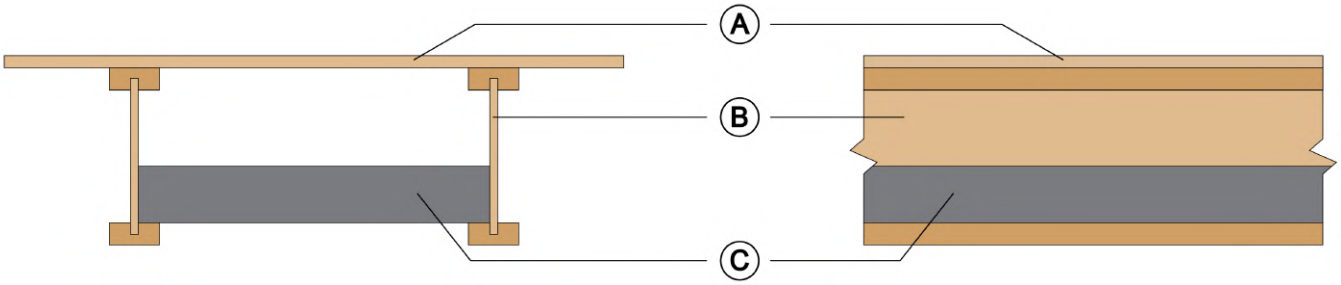

Figure 7. Fire protection of floors FP-09 - fire protection: Rockwool SAFE'n'Sound® mineral wool insulation

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/m^3 (2.5 lb/ft^3) (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

Administrative information

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This assessment must be read in the context of the entire CCMC Registry of Product Assessments, any applicable building code or by-law requirements, and/or any other regulatory requirements (for example, the Canada Consumer Product Safety Act, the Canadian Environmental Protection Act, etc.).

It is the responsibility of the user to confirm that the assessment they are using is current and has not been withdrawn or superseded by a later version on the CCMC Registry of Product Assessments.

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Alberta Building Officials Association (ABOA)	(Alberta Building Officials Associations (ABOA))
Saskatchewan Building Officials Association (SBOA)	(Saskatchewan Building Officials Association (SBOA))
Manitoba Building Officials Association (MBOA)	(Manitoba Building Officials Association (MBOA))
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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.

The CCMC assesses compliance with Canadian building, energy and safety codes, and is trusted by over 6,000 regulators across Canada.

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:

- 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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