CCMC CANADIAN CODE COMPLIANCE EVALUATION

CCMC EVALUATION

CCMC 12412-R

CCMC Canadian code compliance evaluation

CCMC number:	12412-R
Status:	Active
Issue date:	1992-07-17
Modified date:	2023-12-19
Evaluation holder:	**Pacific Woodtech Corporation** 1850 Park Lane Burlington WA 98233 United States Website: www.pacificwoodtech.com Telephone: 360-707-2200
Product names:	• LPI®18 • LPI®20Plus • LPI®32Plus • LPI®36 • LPI®42Plus • LPI®52Plus • LPI®530 • LPI®56 • PWI 18S • PWI 20S • PWI 32S • PWI 36L • PWI 42S • PWI 52S • PWI 53L • PWI 56L
Compliance:	NBC 2015, OBC

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 ...	Acceptable
9.10.8.10. Application to Houses	Alternative
9.23.4.2.(2) Spans for floor joists that are not sele ...	Alternative

Ontario Building Code

Ruling No. 05-08-132 (12412-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 2005-05-13 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

- LPI®18
- LPI®20Plus
- LPI®32Plus
- LPI®36
- LPI®42Plus
- LPI®52Plus
- LPI®530
- LPI®56
- PWI 18S
- PWI 20S
- PWI 32S
- PWI 36L
- PWI 42S
- PWI 52S
- PWI 53L
- PWI 56L

Product description

The products are prefabricated wood I-joists consisting of two continuous sawn lumber flanges or two structural composite lumber (SCL) flanges glued to one of the two thicknesses of an oriented strandboard (OSB) web (9.5 mm or 11.1 mm). The OSB web is manufactured specifically for Pacific Woodtech Corporation and conforms to CSA O325, “Construction Sheathing,” Product Standard PS 2. The dimensions of each product are listed in Table 1 below.

The web-flange connection is made by inserting a beveled OSB web into a machined groove in the centre of the flange. Web segments are end-jointed together to form a continuous web. The web-flange connection and the web segment end joints are glued with a phenol-resorcinol adhesive (see CCMC 13054-L and 13291-L). Fingerjoints are glued using either phenol-resorcinol adhesives (see CCMC 12917-L) or a water-based melamine resin (see CCMC 13307-L).

Table 1. Dimensions of the products

Product	Flange type	Flange size width × thickness, mm (in.)	Web thickness, mm (in.)	Range of joist depths, mm (in.)
PWI 18S or LPI® 18	Sawn lumber	63.5 × 38 (2½ × 1½)	9.5 (⅜)	200 to 406 (7⅞ to 16)
PWI 20S or LPI® 20Plus	Sawn lumber	63.5 × 38 (2½ × 1½)	9.5 (⅜)	200 to 406 (7⅞ to 16)
PWI 32S or LPI® 32Plus	Sawn lumber	63.5 × 38 (2½ × 1½)	9.5 (⅜)	200 to 406 (7⅞ to 16)

Product	Flange type	Flange size width × thickness, mm (in.)	Web thickness, mm (in.)	Range of joist depths, mm (in.)
PWI 42S or LPI® 42Plus	Sawn lumber	89 × 38 (3½ × 1½)	9.5 (⅜)	200 to 406 (7⅞ to 16)
PWI 42S or LPI® 42Plus	Sawn lumber	89 × 38 (3½ × 1½)	11.1 (7/16)	457 to 610 (18 to 24)
PWI 52S or LPI® 52Plus	Sawn lumber	89 × 38 (3½ × 1½)	11.1 (7/16)	235 to 610 (9¼ to 24)
PWI 36L or LPI® 36	LVL	57 × 38 (2¼ × 1½)	9.5 (⅜)	301 to 610 (11⅞ to 24)
PWI 56L or LPI® 56	LVL	89 × 38 (3½ × 1½)	11.1 (7/16)	301 to 610 (11⅞ to 24)
PWI 53L or LPI® 530	LVL	53 × 33 (2-1/16 × 1-5/16)	9.5 (⅜)	241 to 406 (9½ to 16)

Manufacturing plants

This evaluation is limited to products produced at the following plants:

Product names	Manufacturing plants		
	Larouche, QC, CA	Red Bluff, CA, US	St-Prime, QC, CA
LPI®18	✓	✓	✓
LPI®20Plus	✓	✓	✓
LPI®32Plus	✓	✓	✓
LPI®36	✓	✓	✓
LPI®42Plus	✓	✓	✓
LPI®52Plus	✓	✓	✓
LPI®530	✓	✓	✓
LPI®56	✓	✓	✓
PWI 18S	✓	✓	✓
PWI 20S	✓	✓	✓
PWI 32S	✓	✓	✓
PWI 36L	✓	✓	✓
PWI 42S	✓	✓	✓
PWI 52S	✓	✓	✓
PWI 53L	✓	✓	✓
PWI 56L	✓	✓	✓

✓ 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 pre-engineering tables in the literature listed below have 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).

(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 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.

Pacific Woodtech Corporation pre-engineered 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 the documents entitled:

1. "Pacific Woodtech™ I-Joists RESIDENTIAL CONSTRUCTION CANADIAN (LSD) TECHNICAL GUIDE PWI 18S, 20S, 32S, 36L, 42S, 52S, and 56L; LPI 18, 20Plus, 32Plus, 36, 42Plus, 52Plus and 56," December 2022; and
2. "Pacific Woodtech™ LIGHT-FRAME COMMERCIAL, MIDRISE, AND MULTIFAMILY CONSTRUCTION CANADIAN (LSD) TECHNICAL GUIDE PWI 20S, 32S, 36L, 42S, 52S, and 56L; LPI 20Plus, 32Plus, 36, 42Plus, 52Plus and 56," December 2022.

The product must be installed in accordance with the manufacturer's installation guidelines noted in the two documents listed above 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.

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

Pacific Woodtech Corporation pre-engineered installation details

The manufacturer's pre-engineered details within documents (1) and (2) outlined in the Pacific Woodtech Corporation pre-engineered tables section are limited in scope to building designs where the anticipated loads on the following structural details are not exceeded:

- web stiffener requirements, page 5 of (1) and page 22 of (2)
- floor span tables, pages 6 to 9 of (1) and pages 6 to 15 of (2);
- roof span tables, pages 14 to 17 of (1) and pages 16 to 19 of (2);
- uniform floor load tables, pages 10 to 11 of (1);
- uniform roof load tables, pages 12 to 13 of (1);

- loadbearing cantilever tables, page 18 of (1);
- brick ledge cantilever, pages 18 to 19 of (1); and
- web hole tables, pages 20 to 21 of (1) and pages 20 to 21 of (2).

Engineering required

For structural applications beyond the scope/limitations of the above-referenced publications or when required by the AHJ, the drawings or related documents must bear the authorized seal of a professional engineer skilled in wood design and licensed to practise under the appropriate provincial or territorial legislation. Installations beyond the scope/limitations of the Pacific Woodtech Corporation pre-engineered tables and Pacific Woodtech Corporation pre-engineered installation details sections imply, but are not limited to, the following:

- higher loads/longer spans than the manufacturer's pre-engineered details;
- concentrated loads;
- offset bearing walls;
- areas of high wind and seismicity;
- stair openings;
- design of supporting wall studs/beams when total load exceeds the NBC 2015 pre-engineered floor/roof joist tables;
- design of supporting foundation footings when total load exceeds the NBC 2015 pre-engineered floor/roof joist tables; and
- fire resistance (see applicable fire-resistance assembly listings for specific joist and adhesives used).

The engineer must design in accordance with CAN/CSA-O86, and may use the "Engineering Guide for Wood-Frame Construction," published by the Canadian Wood Council, as a guide.

The factored resistance and engineering properties for the products must not exceed the values set forth in the Design requirements section.

The ends of all I-joist members used as joists, rafters, and beams must be restrained to prevent rollover. This is normally achieved by attaching a diaphragm sheathing to the top or to the compression edge, and to an end wall or shear transfer panel capable of transferring a minimum unfactored uniform load of 730 N/m or the required shear forces due to wind or seismic conditions. Blocking or cross-bracing with equivalent strength may be used.

The compression edges of all the products' members used as joists and rafters must be laterally supported at least every 610 mm, except where design is done in accordance with CAN/CSA-O86.

Nailing of the products must be in accordance with the manufacturer's engineering details provided on a case-by-case basis.

Engineering support provided by manufacturer

Pacific Woodtech Corporation provides engineering support through either their local distributor or a professional engineer skilled in wood design and licensed to practise under the appropriate provincial or territorial legislation. Pacific Woodtech Corporation may also be consulted in the use of the product.

- Pacific Woodtech Corporation (technical support): 800-515-7570; e-mail: design@pacificwoodtech.com.

Damaged or defective products must not be used, unless repaired in accordance with written instructions from the manufacturer.

This product must be identified with the phrase “CCMC 12412-R” along the side of the product. This CCMC number is only valid when it appears in conjunction with the certification mark of APA-EWS.

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. Engineering properties of sawn lumber flanges PWI 18S or LPI® 18

Joist depth (1)	Factored resistance		EI × 10^6	K × 10^6
	Moment (2)	Shear		
mm (in.)	N-m (lb-ft.)	N (lb)	kN-mm^2 (lb-$in.^2$)	N (lb-ft./in.)
200 (7⅞)	4 305 (3 175)	6 605 (1 485)	198 (69)	16.12 (0.302)
225 (8⅞)	4 867 (3 590)	7 406 (1 665)	264 (92)	17.83 (0.334)
235 (9¼)	5 003 (3 690)	7 717 (1 735)	327 (114)	18.52 (0.347)
241 (9½)	5 098 (3 760)	7 940 (1 785)	407 (142)	18.95 (0.355)
286 (11¼)	5 762 (4 250)	8 985 (2 020)	654 (228)	22.10 (0.414)
302 (11⅞)	6 033 (4 450)	9 363 (2 105)	712 (248)	23.22 (0.435)
356 (14)	8 385 (6 185)	10 608 (2 385)	1 065 (371)	27.12 (0.508)
406 (16)	9 538 (7 035)	11 698 (2 630)	1 475 (514)	30.80 (0.577)

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 The factored moment resistances listed in the table above must not be increased by any Code-allowed repetitive member system factor.

Table 3. Engineering properties of sawn lumber flanges PWI 20S or LPI® 20Plus

Joist depth (1)	Factored resistance		EI × 10^6	K × 10^6
	Moment (2)	Shear		
mm (in.)	N-m (lb-ft.)	N (lb)	kN-mm^2 (lb-$in.^2$)	N (lb-ft./in.)
200 (7⅞)	5 037 (3 715)	7 339 (1 650)	336 (117)	16.28 (0.305)
225 (8⅞)	5 816 (4 290)	8 251 (1 855)	451 (157)	17.99 (0.337)
235 (9¼)	6 108 (4 505)	8 607 (1 935)	496 (173)	18.68 (0.35)
241 (9½)	6 331 (4 670)	8 852 (1 990)	531 (185)	19.11 (0.358)
286 (11¼)	7 687 (5 670)	10 008 (2 250)	804 (280)	22.26 (0.417)
302 (11⅞)	8 473 (6 250)	10 431 (2 345)	913 (318)	23.38 (0.438)
356 (14)	9 924 (7 320)	11 787 (2 650)	1 360 (474)	27.33 (0.512)
406 (16)	11 388 (8 400)	13 122 (2 950)	1 871 (652)	31.06 (0.582)

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 The factored moment resistances listed in the table above must not be increased by any Code-allowed repetitive member system factor.

Table 4. Engineering properties of sawn lumber flanges PWI 32S or LPI® 32Plus

Joist depth (1)	Factored resistance		EI × 10^6	K × 10^6
	Moment (2)	Shear		
mm (in.)	N-m (lb-ft.)	N (lb)	kN-mm^2 (lb-$in.^2$)	N (lb-ft./in.)
200 (7⅞)	6 026 (4 445)	7 339 (1 650)	405 (141)	16.28 (0.305)
225 (8⅞)	6 962 (5 135)	8 251 (1 855)	531 (185)	17.99 (0.337)
235 (9¼)	7 314 (5 395)	8 607 (1 935)	594 (207)	18.68 (0.35)
241 (9½)	7 552 (5 570)	8 852 (1 990)	634 (221)	19.11 (0.358)
286 (11¼)	9 192 (6 780)	10 008 (2 250)	950 (331)	22.26 (0.417)
302 (11⅞)	9 775 (7 210)	10 431 (2 345)	1 076 (375)	23.38 (0.438)
356 (14)	11 768 (8 680)	11 787 (2 650)	1 575 (549)	27.33 (0.512)

Joist depth (1)	Factored resistance		EI × 10^6	K × 10^6
	Moment (2)	Shear		
mm (in.)	N-m (lb-ft.)	N (lb)	kN-mm^2 (lb-$in.^2$)	N (lb-ft./in.)
406 (16)	13 646 (10 065)	13 122 (2 950)	2 132 (743)	31.06 (0.582)

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 The factored moment resistances listed in the table above must not be increased by any Code-allowed repetitive member system factor.

Table 5. Engineering properties of sawn lumber flanges PWI 42S or LPI® 42Plus

Joist depth (1)	Factored resistance		EI × 10^6	K × 10^6
	Moment (2)	Shear		
mm (in.)	N-m (lb-ft.)	N (lb)	kN-mm^2 (lb-$in.^2$)	N (lb-ft./in.)
200 (7⅞)	9 667 (7 130)	8 029 (1 805)	585 (204)	18.20 (0.341)
225 (8⅞)	11 151 (8 225)	8 874 (1 995)	781 (272)	20.55 (0.385)
235 (9¼)	11 741 (8 660)	9 207 (2 070)	864 (301)	21.40 (0.401)
241 (9½)	12 120 (8 940)	9 408 (2 115)	921 (321)	21.99 (0.412)
286 (11¼)	14 764 (10 890)	10 875 (2 445)	1 377 (480)	26.05 (0.488)
302 (11⅞)	15 706 (11 585)	11 409 (2 565)	1 570 (547)	27.49 (0.515)
356 (14)	18 913 (13 950)	13 166 (2 960)	2 301 (802)	32.40 (0.607)
406 (16)	21 936 (16 180)	14 856 (3 340)	3 134 (1 092)	36.99 (0.693)
457 (18)	24 797 (18 290)	17 948 (4 035)	3 825 (1 333)	51.24 (0.96)
508 (20)	27 447 (20 245)	19 616 (4 410)	4 844 (1 688)	56.95 (1.067)
559 (22)	30 064 (22 175)	21 284 (4 785)	5 992 (2 088)	62.61 (1.173)
610 (24)	32 646 (24 080)	22 952 (5 160)	7 272 (2 534)	68.32 (1.28)

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 The factored moment resistances listed in the table above must not be increased by any Code-allowed repetitive member system factor.

Table 6. Engineering properties of sawn lumber flanges PWI 52S or LPI® 52Plus

Joist depth (1)	Factored resistance		EI × 10^6	K × 10^6
	Moment (2)	Shear		
mm (in.)	N-m (lb-ft.)	N (lb)	kN-mm^2 (lb-$in.^2$)	N (lb-ft./in.)
235 (9¼)	14 303 (10 550)	12 032 (2 705)	958 (334)	26.31 (0.493)
241 (9½)	14 764 (10 890)	12 254 (2 755)	1 022 (356)	27.06 (0.507)
286 (11¼)	17 950 (13 240)	13 856 (3 115)	1 518 (529)	32.03 (0.6)
302 (11⅞)	19 096 (14 085)	14 434 (3 245)	1 722 (600)	33.79 (0.633)
356 (14)	22 994 (16 960)	16 369 (3 680)	2 508 (874)	39.87 (0.747)
406 (16)	26 668 (19 670)	18 148 (4 080)	3 395 (1 183)	45.53 (0.853)
457 (18)	30 145 (22 235)	19 972 (4 490)	4 419 (1 540)	51.24 (0.96)
508 (20)	33 372 (24 615)	21 795 (4 900)	5 590 (1 948)	56.95 (1.067)
559 (22)	36 551 (26 960)	23 597 (5 305)	6 910 (2 408)	62.61 (1.173)
610 (24)	39 696 (29 280)	25 420 (5 715)	8 377 (2 919)	68.32 (1.28)

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 The factored moment resistances listed in the table above must not be increased by any Code-allowed repetitive member system factor.

Table 7. Engineering properties of LVL flanges PWI 36L or LPI® 36

Joist depth (1)	Factored resistance		EI × 10^6	K × 10^6
	Moment (2)	Shear		
mm (in.)	N-m (lb-ft.)	N (lb)	kN-mm^2 (lb-$in.^2$)	N (lb-ft./in.)
302 (11⅞)	14 527 (10 715)	11 342 (2 550)	1 231 (429)	24.98 (0.468)
356 (14)	17 489 (12 900)	12 855 (2 890)	1 785 (622)	29.36 (0.55)
406 (16)	20 282 (14 960)	14 189 (3 190)	2 399 (836)	33.36 (0.625)
457 (18)	22 858 (16 860)	15 346 (3 450)	3 105 (1 082)	37.36 (0.7)
508 (20)	25 407 (18 740)	16 280 (3 660)	3 903 (1 360)	41.31 (0.774)
559 (22)	27 942 (20 610)	17 103 (3 845)	4 789 (1 669)	45.37 (0.85)
610 (24)	30 450 (22 460)	17 725 (3 985)	5 768 (2 010)	49.21 (0.922)

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 The factored moment resistances listed in the table above must not be increased by any Code-allowed repetitive member system factor.

Table 8. Engineering properties of LVL flanges PWI 56L or LPI® 56

Joist depth (1)	Factored resistance		EI × 10^6	K × 10^6
	Moment (2)	Shear		
mm (in.)	N-m (lb-ft.)	N (lb)	kN-mm^2 (lb-$in.^2$)	N (lb-ft/in.)
302 (11⅞)	22 939 (16 920)	14 434 (3 245)	1 917 (668)	29.30 (0.549)
356 (14)	27 617 (20 370)	16 369 (3 680)	2 778 (968)	34.21 (0.641)
406 (16)	32 030 (23 625)	18 148 (4 080)	3 733 (1 301)	38.91 (0.729)
457 (18)	36 104 (26 630)	19 972 (4 490)	4 833 (1 684)	43.61 (0.817)
508 (20)	40 144 (29 610)	21 795 (4 900)	6 069 (2 115)	48.31 (0.905)
559 (22)	44 143 (32 560)	23 597 (5 305)	7 453 (2 597)	53.00 (0.993)
610 (24)	48 116 (35 490)	25 420 (5 715)	8 973 (3 127)	57.70 (1.081)

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 The factored moment resistances listed in the table above must not be increased by any Code-allowed repetitive member system factor.

Table 9. Engineering properties of LVL flanges PWI 53L or LPI® 530

Joist depth (1)	Factored resistance		EI × 10^6	K × 10^6
	Moment (2)	Shear		
mm (in.)	N-m (lb-ft.)	N (lb)	kN-mm^2 (lb-$in.^2$)	N (lb-ft./in.)
241 (9½)	9 023 (6 655)	9 408 (2 115)	574 (200)	25.5 (5.74)
302 (11⅞)	11 613 (8 565)	10 987 (2 470)	967 (337)	31.5 (7.09)
356 (14)	13 775 (10 160)	12 388 (2 785)	1 412 (492)	37.0 (8.32)
406 (16)	15 761 (11 625)	13 723 (3 085)	1 911 (666)	42.1 (9.47)

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 The factored moment resistances listed in the table above must not be increased by any Code-allowed repetitive member system factor.

Table 10. Additional engineering properties of sawn lumber flanges PWI 18S or LPI® 18

Joist depth (1)	Factored end reaction				Factored intermediate reaction				Factored flange bearing (3)
	N (lb)				N (lb)				
	38 mm (1½ in.) bearing length		102 mm (4 in.) bearing length		89 mm (3½ in.) bearing length		140 mm (5½ in.) bearing length		
mm (in.)	w/o WS (2)	WS	w/o WS	WS	w/o WS	WS	w/o WS	WS	N/mm (lb/in.)
200 (7⅞)	6 116 (1 375)	6 605 (1 485)	6 605 (1 485)	6 605 (1 485)	13 277 (2 985)	14 278 (3 210)	14 856 (3 340)	15 790 (3 550)	242 (1 380)

Joist depth (1)	Factored end reaction				Factored intermediate reaction				Factored flange bearing (3)
	N (lb)				N (lb)				
	38 mm (1½ in.) bearing length		102 mm (4 in.) bearing length		89 mm (3½ in.) bearing length		140 mm (5½ in.) bearing length		
mm (in.)	w/o WS (2)	WS	w/o WS	WS	w/o WS	WS	w/o WS	WS	N/mm (lb/in.)
225 (8⅞)	6 116 (1 375)	6 961 (1 565)	6 850 (1 540)	7 406 (1 665)	13 611 (3 060)	14 701 (3 305)	15 190 (3 415)	16 280 (3 660)	
235 (9¼)	6 116 (1 375)	7 095 (1 595)	6 961 (1 565)	7 717 (1 735)	13 767 (3 095)	14 856 (3 340)	15 368 (3 455)	16 502 (3 710)	
241 (9½)	6 116 (1 375)	7 206 (1 620)	6 983 (1 570)	7 940 (1 785)	13 856 (3 115)	14 990 (3 370)	15 479 (3 480)	16 636 (3 740)	
286 (11¼)	6 116 (1 375)	7 784 (1 750)	7 228 (1 625)	8 985 (2 020)	14 500 (3 260)	15 701 (3 530)	16 146 (3 630)	17 547 (3 945)	
302 (11⅞)	6 116 (1 375)	8 029 (1 805)	7 295 (1 640)	9 363 (2 105)	14 701 (3 305)	15 946 (3 585)	16 391 (3 685)	17 859 (4 015)	
356 (14)	6 116 (1 375)	8 807 (1 980)	7 584 (1 705)	10 608 (2 385)	15 479 (3 480)	16 813 (3 780)	17 192 (3 865)	18 948 (4 260)	
406 (16)	6 116 (1 375)	9 519 (2 140)	7 828 (1 760)	11 698 (2 630)	16 213 (3 645)	17 659 (3 970)	18 014 (4 050)	20 038 (4 505)	

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 WS: web stiffeners; w/o WS: without web stiffeners.

3 The factored compression perpendicular to the grain of the flange per mm (in.) of bearing length.

Table 11. Additional engineering properties of sawn lumber flanges PWI 20S or LPI® 20Plus

Joist depth [1]	Factored end reaction				Factored intermediate reaction				Factored flange bearing [3]
	N (lb)				N (lb)				
	38 mm (1½ in.) bearing length		102 mm (4 in.) bearing length		89 mm (3½ in.) bearing length		140 mm (5½ in.) bearing length		
mm (in.)	w/o WS [2]	WS	w/o WS	WS	w/o WS	WS	w/o WS	WS	N/mm (lb/in.)
200 (7⅞)	6 805 (1 530)	7 339 (1 650)	7 339 (1 650)	7 339 (1 650)	14 745 (3 315)	15 902 (3 575)	16 502 (3 710)	17 547 (3 945)	242 (1 380)
225 (8⅞)	6 805 (1 530)	7 717 (1 735)	7 628 (1 715)	8 251 (1 855)	15 168 (3 410)	16 369 (3 680)	16 925 (3 805)	18 103 (4 070)	
235 (9¼)	6 805 (1 530)	7 895 (1 775)	7 717 (1 735)	8 607 (1 935)	15 301 (3 440)	16 524 (3 715)	17 103 (3 845)	18 370 (4 130)	
241 (9½)	6 805 (1 530)	8 006 (1 800)	7 784 (1 750)	8 852 (1 990)	15 412 (3 465)	16 680 (3 750)	17 192 (3 865)	18 504 (4 160)	
286 (11¼)	6 805 (1 530)	8 674 (1 950)	8 029 (1 805)	10 008 (2 250)	16 102 (3 620)	17 436 (3 920)	17 970 (4 040)	19 527 (4 390)	
302 (11⅞)	6 805 (1 530)	8 940 (2 010)	8 140 (1 830)	10 431 (2 345)	16 369 (3 680)	17 725 (3 985)	18 215 (4 095)	19 860 (4 465)	
356 (14)	6 805 (1 530)	9 786 (2 200)	8 429 (1 895)	11 787 (2 650)	17 236 (3 875)	18 704 (4 205)	19 126 (4 300)	21 106 (4 745)	
406 (16)	6 805 (1 530)	10 608 (2 385)	8 696 (1 955)	13 122 (2 950)	18 037 (4 055)	19 616 (4 410)	20 016 (4 500)	22 284 (5 010)	

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 WS: web stiffeners; w/o WS: without web stiffeners.

3 The factored compression perpendicular to the grain of the flange per mm (in.) of bearing length.

Table 12. Additional engineering properties of sawn lumber flanges PWI 32S or LPI® 32Plus

Joist depth [1]	Factored end reaction				Factored intermediate reaction				Factored flange bearing [3]
	N (lb)				N (lb)				
	38 mm (1½ in.) bearing length		102 mm (4 in.) bearing length		89 mm (3½ in.) bearing length		140 mm (5½ in.) bearing length		
mm (in.)	w/o WS [2]	WS	w/o WS	WS	w/o WS	WS	w/o WS	WS	N/mm (lb/in.)
200 (7⅞)	6 805 (1 530)	7 339 (1 650)	7 339 (1 650)	7 339 (1 650)	14 745 (3 315)	15 902 (3 575)	16 502 (3 710)	17 547 (3 945)	297 (1 695)
225 (8⅞)	6 805 (1 530)	7 717 (1 735)	7 628 (1 715)	8 251 (1 855)	15 168 (3 410)	16 369 (3 680)	16 925 (3 805)	18 103 (4 070)	
235 (9¼)	6 805 (1 530)	7 895 (1 775)	7 717 (1 735)	8 607 (1 935)	15 301 (3 440)	16 524 (3 715)	17 103 (3 845)	18 370 (4 130)	
241 (9½)	6 805 (1 530)	8 006 (1 800)	7 784 (1 750)	8 852 (1 990)	15 412 (3 465)	16 680 (3 750)	17 192 (3 865)	18 504 (4 160)	
286 (11¼)	6 805 (1 530)	8 674 (1 950)	8 029 (1 805)	10 008 (2 250)	16 102 (3 620)	17 436 (3 920)	17 970 (4 040)	19 527 (4 390)	
302 (11⅞)	6 805 (1 530)	8 940 (2 010)	8 140 (1 830)	10 431 (2 345)	16 369 (3 680)	17 725 (3 985)	18 215 (4 095)	19 860 (4 465)	
356 (14)	6 805 (1 530)	9 786 (2 200)	8 429 (1 895)	11 787 (2 650)	17 236 (3 875)	18 704 (4 205)	19 126 (4 300)	21 106 (4 745)	
406 (16)	6 805 (1 530)	10 608 (2 385)	8 696 (1 955)	13 122 (2 950)	18 037 (4 055)	19 616 (4 410)	20 016 (4 500)	22 284 (5 010)	

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 WS: web stiffeners; w/o WS: without web stiffeners.

3 The factored compression perpendicular to the grain of the flange per mm (in.) of bearing length.

Table 13. Additional engineering properties of sawn lumber flanges PWI 42S or LPI® 42Plus

Joist depth (1)	Factored end reaction				Factored intermediate reaction				Factored flange bearing (3)
	N (lb)				N (lb)				
	38 mm (1½ in.) bearing length		102 mm (4 in.) bearing length		89 mm (3½ in.) bearing length		140 mm (5½ in.) bearing length		
mm (in.)	w/o WS (2)	WS	w/o WS	WS	w/o WS	WS	w/o WS	WS	N/mm (lb/in.)
200 (7⅞)	8 029 (1 805)	8 029 (1 805)	8 029 (1 805)	8 029 (1 805)	19 771 (4 445)	20 483 (4 605)	19 771 (4 445)	20 861 (4 690)	429 (2 450)
225 (8⅞)	8 207 (1 845)	8 874 (1 995)	8 696 (1 955)	8 874 (1 995)	20 149 (4 530)	21 217 (4 770)	20 283 (4 560)	21 795 (4 900)	
235 (9¼)	8 296 (1 865)	9 207 (2 070)	8 985 (2 020)	9 207 (2 070)	20 283 (4 560)	21 506 (4 835)	20 505 (4 610)	22 196 (4 990)	
241 (9½)	8 318 (1 870)	9 408 (2 115)	9 163 (2 060)	9 408 (2 115)	20 350 (4 575)	21 728 (4 885)	20 639 (4 640)	22 440 (5 045)	
286 (11¼)	8 629 (1 940)	10 275 (2 310)	10 631 (2 390)	10 875 (2 445)	21 017 (4 725)	22 952 (5 160)	21 595 (4 855)	24 086 (5 415)	
302 (11⅞)	8 740 (1 965)	10 608 (2 385)	11 209 (2 520)	11 409 (2 565)	21 239 (4 775)	23 441 (5 270)	21 906 (4 925)	24 686 (5 550)	
356 (14)	9 118 (2 050)	11 654 (2 620)	11 209 (2 520)	13 166 (2 960)	22 040 (4 955)	25 020 (5 625)	23 018 (5 175)	26 710 (6 005)	
406 (16)	9 474 (2 130)	12 632 (2 840)	11 209 (2 520)	14 856 (3 340)	22 774 (5 120)	26 510 (5 960)	24 108 (5 420)	28 645 (6 440)	
457 (18)	10 542 (2 370) (4)	16 191 (3 640) (4)	11 876 (2 670)	17 948 (4 035)	24 219 (5 445)	30 091 (6 765)	27 022 (6 075)	32 470 (7 300)	
508 (20)	10 542 (2 370) (4)	17 192 (3 865) (4)	11 876 (2 670)	19 616 (4 410)	24 219 (5 445)	30 958 (6 960)	27 022 (6 075)	33 938 (7 630)	
559 (22)	10 542 (2 370) (4)	18 215 (4 095) (4)	11 876 (2 670)	21 284 (4 785)	24 219 (5 445)	31 803 (7 150)	27 022 (6 075)	35 317 (7 940)	
610 (24)	10 542 (2 370) (4)	18 993 (4 270) (4)	11 876 (2 670)	22 952 (5 160)	24 219 (5 445)	32 582 (7 325)	27 022 (6 075)	36 585 (8 225)	

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 WS: web stiffeners; w/o WS: without web stiffeners.

3 The factored compression perpendicular to the grain of the flange per mm (in.) of bearing length.

4 Factored end reaction for 64 mm (2½ in.) bearing length.

Table 14. Additional engineering properties of sawn lumber flanges PWI 52S or LPI® 52Plus

Joist depth (1)	Factored end reaction				Factored intermediate reaction				Factored flange bearing (3)
	N (lb)				N (lb)				
	38 mm (1½ in.) bearing length		102 mm (4 in.) bearing length		89 mm (3½ in.) bearing length		140 mm (5½ in.) bearing length		
mm (in.)	w/o WS (2)	WS	w/o WS	WS	w/o WS	WS	w/o WS	WS	N/mm (lb/in.)
235 (9¼)	9 341 (2 100)	11 454 (2 575)	11 164 (2 510)	12 032 (2 705)	23 864 (5 365)	25 843 (5 810)	24 575 (5 525)	26 688 (6 000)	429 (2 450)
241 (9½)	9 363 (2 105)	11 587 (2 605)	11 231 (2 525)	12 254 (2 755)	23 864 (5 365)	26 043 (5 855)	24 686 (5 550)	26 955 (6 060)	
286 (11¼)	9 541 (2 145)	12 454 (2 800)	11 698 (2 630)	13 856 (3 115)	23 975 (5 390)	27 555 (6 195)	25 309 (5 690)	28 845 (6 485)	
302 (11⅞)	9 608 (2 160)	12 788 (2 875)	11 876 (2 670)	14 434 (3 245)	24 019 (5 400)	28 089 (6 315)	25 532 (5 740)	29 557 (6 645)	
356 (14)	9 719 (2 185)	13 833 (3 110)	12 944 (2 910)	16 369 (3 680)	24 108 (5 420)	29 913 (6 725)	26 288 (5 910)	31 870 (7 165)	
406 (16)	9 830 (2 210)	14 812 (3 330)	13 944 (3 135)	18 148 (4 080)	24 219 (5 445)	31 625 (7 110)	27 022 (6 075)	34 094 (7 665)	
457 (18)	11 943 (2 685) (4)	17 481 (3 930) (4)	14 945 (3 360)	19 972 (4 490)	24 219 (5 445)	33 338 (7 495)	27 022 (6 075)	36 273 (8 155)	
508 (20)	11 943 (2 685) (4)	18 771 (4 220) (4)	14 945 (3 360)	21 795 (4 900)	24 219 (5 445)	35 028 (7 875)	27 022 (6 075)	38 431 (8 640)	
559 (22)	11 943 (2 685) (4)	20 105 (4 520) (4)	14 945 (3 360)	23 597 (5 305)	24 219 (5 445)	36 763 (8 265)	27 022 (6 075)	40 655 (9 140)	
610 (24)	11 943 (2 685) (4)	21 439 (4 820) (4)	14 945 (3 360)	25 420 (5 715)	24 219 (5 445)	38 164 (8 580)	27 022 (6 075)	42 834 (9 630)	

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 WS: web stiffeners; w/o WS: without web stiffeners.

3 The factored compression perpendicular to the grain of the flange per mm (in.) of bearing length.

4 Factored end reaction for 64 mm (2½ in.) bearing length.

Table 15. Additional engineering properties of LVL flanges PWI 36L or LPI® 36

Joist depth (1)	Factored end reaction				Factored intermediate reaction				Factored flange bearing (3)
	N (lb)				N (lb)				
	38 mm (1½ in.) bearing length		102 mm (4 in.) bearing length		89 mm (3½ in.) bearing length		140 mm (5½ in.) bearing length		
mm (in.)	w/o WS (2)	WS	w/o WS	WS	w/o WS	WS	w/o WS	WS	N/mm (lb/in.)
302 (11⅞)	7 205 (1 620)	10 540 (2 370)	9 030 (2 030)	11 345 (2 550)	17 525 (3 940)	21 795 (4 900)	19 905 (4 475)	24 355 (5 475)	301 (1 720)
356 (14)	7 205 (1 620)	10 630 (2 390)	9 295 (2 090)	12 855 (2 890)	17 525 (3 940)	22 510 (5 060)	19 905 (4 475)	25 020 (5 625)	
406 (16)	7 205 (1 620)	10 700 (2 405)	9 540 (2 145)	14 190 (3 190)	17 525 (3 940)	23 195 (5 215)	19 905 (4 475)	25 665 (5 770)	
457 (18)	8 250 (1 855) (4)	12 635 (2 840) (4)	9 785 (2 200)	15 345 (3 450)	17 525 (3 940)	23 910 (5 375)	19 905 (4 475)	26 335 (5 920)	
508 (20)	8 320 (1 870) (4)	13 055 (2 935) (4)	10 030 (2 255)	16 280 (3 660)	17 525 (3 940)	24 575 (5 525)	19 905 (4 475)	26 955 (6 060)	
559 (22)	8 430 (1 895) (4)	13 455 (3 025) (4)	10 275 (2 310)	17 105 (3 845)	17 525 (3 940)	25 265 (5 680)	19 905 (4 475)	27 600 (6 205)	
610 (24)	8 540 (1 920) (4)	13 765 (3 095) (4)	10 540 (2 370)	17 725 (3 985)	17 525 (3 940)	25 975 (5 840)	19 905 (4 475)	28 270 (6 355)	

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 WS: web stiffeners; w/o WS: without web stiffeners.

3 The factored compression perpendicular to the grain of the flange per mm (in.) of bearing length.

4 Factored end reaction for 64 mm (2½ in.) bearing length.

Table 16. Additional engineering properties of LVL flanges PWI 56L or LPI® 56

Joist depth [1]	Factored end reaction				Factored intermediate reaction				Factored flange bearing [3]
	N (lb)				N (lb)				
	38 mm (1½ in.) bearing length		102 mm (4 in.) bearing length		89 mm (3½ in.) bearing length		140 mm (5½ in.) bearing length		
mm (in.)	w/o WS [2]	WS	w/o WS	WS	w/o WS	WS	w/o WS	WS	N/mm (lb/in.)
302 (11⅞)	8 030 (1 805)	11 655 (2 620)	10 630 (2 390)	14 435 (3 245)	21 975 (4 940)	27 090 (6 090)	25 775 (5 795)	28 515 (6 410)	476 (2 720)
356 (14)	8 030 (1 805)	12 320 (2 770)	10 785 (2 425)	16 370 (3 680)	21 975 (4 940)	28 470 (6 400)	25 775 (5 795)	30 180 (6 785)	
406 (16)	8 030 (1 805)	12 945 (2 910)	10 920 (2 455)	18 150 (4 080)	21 975 (4 940)	29 805 (6 700)	25 775 (5 795)	31 760 (7 140)	
457 (18)	9 230 (2 075) [4]	16 145 (3 630) [4]	11 055 (2 485)	19 970 (4 490)	21 975 (4 940)	31 135 (7 000)	25 775 (5 795)	33 340 (7 495)	
508 (20)	9 295 (2 090) [4]	17 235 (3 875) [4]	11 210 (2 520)	21 795 (4 900)	21 975 (4 940)	32 425 (7 290)	25 775 (5 795)	34 940 (7 855)	
559 (22)	9 365 (2 105) [4]	18 325 (4 120) [4]	11 345 (2 550)	23 600 (5 305)	21 975 (4 940)	33 760 (7 590)	25 775 (5 795)	36 520 (8 210)	
610 (24)	9 410 (2 115) [4]	19 440 (4 370) [4]	11 475 (2 580)	25 420 (5 715)	21 975 (4 940)	35 095 (7 890)	25 775 (5 795)	38 120 (8 570)	

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 WS: web stiffeners; w/o WS: without web stiffeners.

3 The factored compression perpendicular to the grain of the flange per mm (in.) of bearing length.

4 Factored end reaction for 64 mm (2½ in.) bearing length.

Table 17. Additional engineering properties of LVL flanges PWI 53L or LPI® 530

Joist depth (1)	Factored end reaction				Factored intermediate reaction				Factored flange bearing (3)
	N (lb)				N (lb)				
	38 mm (1½ in.) bearing length		102 mm (4 in.) bearing length		89 mm (3½ in.) bearing length		140 mm (5½ in.) bearing length		
mm (in.)	w/o WS (2)	WS	w/o WS	WS	w/o WS	WS	w/o WS	WS	N/mm (lb/in.)
241 (9½)	6 183 (1 390)	7 896 (1 775)	7 695 (1 730)	9 408 (2 115)	14 501 (3 260)	16 147 (3 630)	15 902 (3 575)	17 548 (3 945)	275 (1 572)
302 (11⅞)	6 183 (1 390)	8 741 (1 965)	7 873 (1 770)	10 987 (2 470)	14 879 (3 345)	17 437 (3 920)	16 859 (3 790)	19 194 (4 315)	
356 (14)	6 183 (1 390)	9 475 (2 130)	8 029 (1 805)	12 388 (2 785)	15 191 (3 415)	18 638 (4 190)	17 726 (3 985)	20 684 (4 650)	
406 (16)	6 183 (1 390)	10 186 (2 290)	8 185 (1 840)	13 723 (3 085)	15 524 (3 490)	19 728 (4 435)	18 527 (4 165)	22 041 (4 955)	

Notes

1 For all depths of 241 mm (9½ in.) and greater, the factored intermediate reaction with a minimum bearing length of 76 mm (3 in.) shall be permitted to be determined by prorating based on the intermediate reaction values with a bearing length of 89 mm (3½ in.) and 140 mm (5½ in.).

2 WS: web stiffeners; w/o WS: without web stiffeners.

3 The factored compression perpendicular to the grain of the flange per mm (in.) of bearing length.

Additional test information for the products

The design values obtained from testing to ASTM D5055-08a, “Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists,” as specified in CAN/CSA-O86-09, “Engineering Design in Wood,” and in previous editions is summarized below. The manufacturer’s published pre-engineered joist spans were designed in accordance with CAN/CSA-O86-09

Table 18. Additional test information for the products

Product	Test information
Shear capacity	The shear capacity was established for each depth separately, as per ASTM D5055-04. Data from quality control (QC) tests have been used to establish the applicable coefficient of variation, CV_w, and the reliability normalization factor from Table 13.2.3.2 of CAN/CSA-O86-01 was used to determine the specified strength. The shear capacity was revised to meet the requirements of ASTM D5055-08 and CAN/CSA-O86-01.

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 D5055-04. Data from QC tests have been used to establish the applicable coefficient of variation, CVw, and the reliability normalization factor from Table 13.2.3.2 of CAN/CSA-O86-01 was used to determine the specified strength. Moment capacities for LPI® 18, 20Plus, 32Plus, 42Plus and 52Plus were revised to meet the requirements of ASTM D5055-08a and CAN/CSA-O86-09.
Stiffness	An appropriate test program was used to confirm the stiffness capacity. The following formula was used to predict mid-span deflection: deflection = (5wL4)/(384EI) + (wL2)/K where: w = load (kN/m), L = span (mm), EI and K are taken from the Technical information section
End joints	Flange tension tests were conducted in accordance with ASTM D5055-04, Section 6.3.1.3. The tensile capacity was determined in accordance with ASTM D5055-04, Section 6.3.1.4.
Creep	Specimens were tested for creep performance in accordance with ASTM D5055-04. 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 for LPI® 18, 20Plus, 32Plus, 42Plus and 52Plus were analyzed using ASTM D5055-08, whereby design values were based on linear interpolation within the tested bounds of depth and bearing length (4-corner method). Qualification tests for the reaction values were used to establish the applicable coefficient of variation, CV_w, and the reliability normalization factor from Table 13.2.3.2 of CAN/CSA-O86-01 was used to determine the specified strength. Extrapolation of reaction properties in the tables in the Design requirements section is not allowed. LPI® 36 and LPI® 56 reaction properties shown in the tables in the Design requirements section are specific to the bearing lengths shown and are based on a rational bearing analysis methodology. Data submitted confirm satisfactory performance to the rational methodology. Qualification test data for the reaction values were used to establish the applicable coefficient of variation, CV_w, and the reliability normalization factor from Table 14.2.3.2 of CSA O86-09 was used to determine the specified strength.
Adhesive qualification	The adhesive used complies with CSA O112.7-M1977, "Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing)" (see CCMC 12917-L, 13054-L and 13291-L). An alternate water-based melamine adhesive for flange fingerjoints complies with CSA O112.9-04, "Evaluation of Adhesives for Structural Wood Products (Exterior Exposure)" (see CCMC 13307-L).
Web stock	The web stock complies with CSA O325.0-92 (R2003), "Construction Sheathing."

Fire-protection options

This section is beyond the scope of the CCMC's Code compliance opinion related to the evaluation of structural performance. The performance of the fire-protection options have been reviewed by the CCMC and are presented as additional information for AHJs.

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 × 10) floor joist system. The presented fire-protection options performs “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 below fire-protection options for alternative floor joists is 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 19

Table 19. Applicable I-joists for fire protection assemblies based on flange size

Product	Flange size (thickness × width) (mm)	Fire protection assembly
PWI 18S or LPI® 18	38 × 63.5	FP-01, FP-02, FP-03, FP-04, FP-06, FP-07, FP-09
PWI 20S or LPI® 20Plus	38 × 63.5	FP-01, FP-02, FP-03, FP-04, FP-06, FP-07, FP-09
PWI 32S or LPI® 32Plus	38 × 63.5	FP-01, FP-02, FP-03, FP-04, FP-06, FP-07, FP-09
PWI 42S or LPI® 42Plus	38 × 89	FP-01, FP-02, FP-03, FP-04, FP-06, FP-07, FP-09
PWI 36L or LPI® 36	38 × 57	FP-01, FP-02, FP-03, FP-04, FP-06, FP-07, FP-09
PWI 56L or LPI® 56	38 × 89	FP-01, FP-02, FP-03, FP-04, FP-06, FP-07, FP-09
PWI 53L or LPI® 530	33 × 53	FP-01, 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

Above and side projection section drawings for 1/2 inch gypsum board attached to bottom flange.

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

Above and side projection section drawings for 1/2 inch gypsum board attached to web.

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

Above and side projection for 1/2 inch gypsum board

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

Above and side projection for mineral wood insulation

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

Above projection and side projection for mineral wood insulation

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 20. 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

Above projection and side projection for 5/8 inch gypsum board.

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 21. 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.)

Joist spacing	Required length for gypsum boards
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

Above projection and side projection for Rockwool Safe'n'Sound

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

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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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