

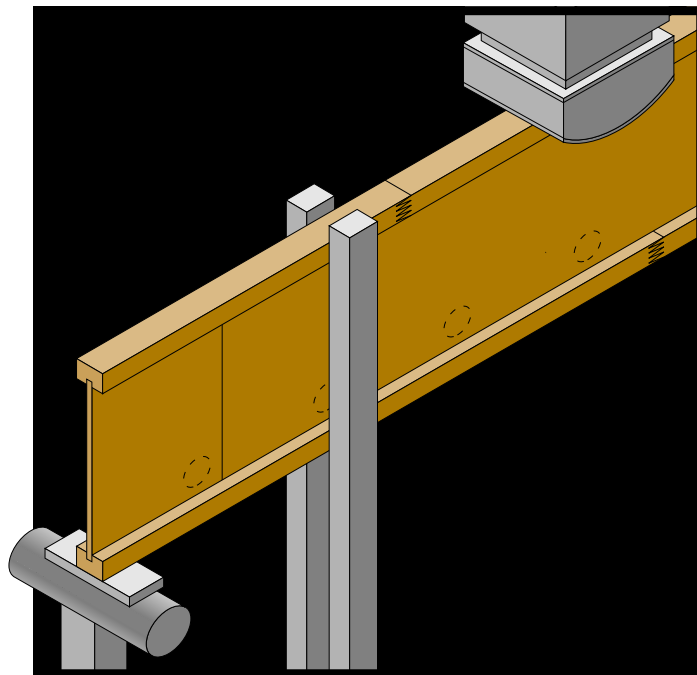
A P A E W S S T A N D A R D



PRI-400

PERFORMANCE STANDARD FOR APA EWS I-JOISTS (LIMIT STATES DESIGN)

Published by Engineered Wood Systems • April 2004



ENGINEERED WOOD SYSTEMS
APA EWS

WOOD

The Miracle Material™



Wood is the right choice for a host of construction applications. It is the earth’s natural, energy efficient and renewable building material.

Engineered wood is a better use of wood. The miracle in today’s wood products is that they make more efficient use of the wood fiber resource

to make stronger plywood, oriented strand board, I-joists, glued laminated timbers, and laminated veneer lumber. That’s good for the environment, and good for designers seeking strong, efficient, and striking building design.

A few facts about wood.

- **We’re not running out of trees.** One-third of the United States land base – 731 million acres – is covered by forests. About two-thirds of that 731 million acres is suitable for repeated planting and harvesting of timber. But only about half of the land suitable for growing timber is open to logging. Most of that harvestable acreage also is open to other uses, such as camping, hiking, and hunting. Forests fully cover one-half of Canada’s land mass. Of this forestland, nearly half is considered productive, or capable of producing timber on a sustained yield basis. Canada has the highest per capita accumulation of protected natural areas in the world – areas including national and provincial parks.



- **We’re growing more wood every day.** American landowners plant more than two billion trees every year. In addition, millions of trees seed naturally. The forest products industry, which comprises about 15 percent of forestland ownership, is responsible for 41 percent of replanted forest acreage. That works out to more than one billion trees a year, or about three million trees planted every day. This high rate of replanting accounts for the fact that each year, 27 percent more timber is grown than is harvested. Canada’s replanting record shows a fourfold increase in the number of trees planted between 1975 and 1990.

- **Manufacturing wood is energy efficient.** Wood products made up 47 percent of all industrial raw materials manufactured in the United States, yet consumed only 4 percent of the energy needed to manufacture all industrial raw materials, according to a 1987 study.

Material	Percent of Production	Percent of Energy Use
Wood	47	4
Steel	23	48
Aluminum	2	8

- **Good news for a healthy planet.** For every ton of wood grown, a young forest produces 1.07 tons of oxygen and absorbs 1.47 tons of carbon dioxide.



Wood, the miracle material for the environment, for design, and for strong, lasting construction.

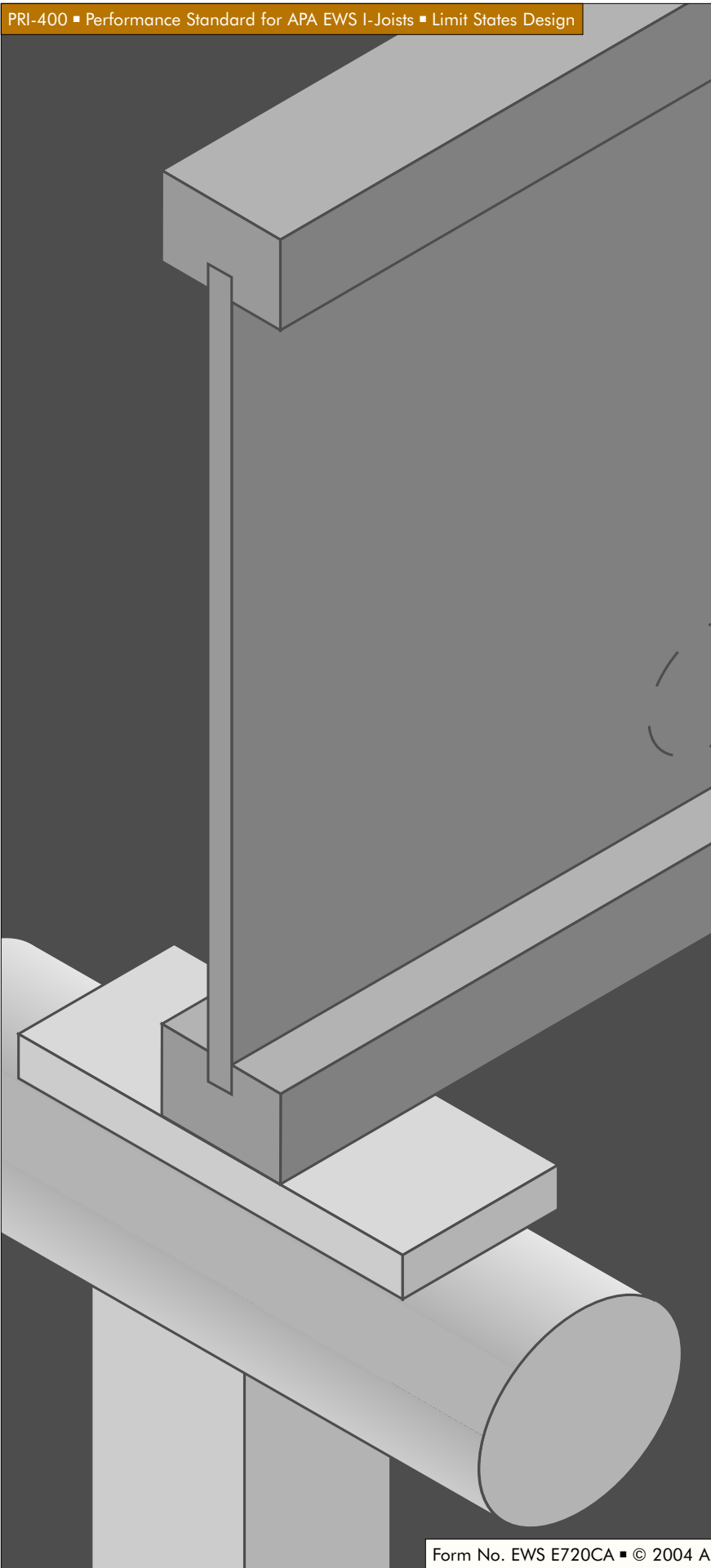
14" PRI™-40 LSD

SPACING
SIMPLE SPAN 12 16 19.2 24
MULTIPLE SPAN 19-1 17-9 17-2 17-0
21-0 19-6 18-9 18-6

APA EWS
Glue Laminated Floors
PLANET 0003 • PRI-400

NOTICE:

The technical data contained in this guide applies to I-joists that bear the APA Performance Rated I-Joist (PRI™) trademark. These trademarked products, manufactured by APA EWS member mills, adhere to our quality assurance program and conform to PRI-400, "Performance Standard for APA EWS I-Joists."



CONTENTS

1. SCOPE4

2. REFERENCED DOCUMENTS5

3. TERMINOLOGY6

4. PERFORMANCE CRITERIA AND REQUIREMENTS7

TABLE 1a8

TABLE 1b9

TABLE 210

TABLE 311

5. QUALIFICATION REQUIREMENTS12

6. QUALITY ASSURANCE13

7. TYPICAL INFORMATION SHOWN ON TRADEMARKS14

PRI-400 PERFORMANCE STANDARD FOR APA EWS I-JOISTS USED IN RESIDENTIAL FLOORS (LIMIT STATES DESIGN)

April, 2004

1. Scope

- 1.1** The APA EWS performance-rated I-joist is an “I”-shaped structural member prefabricated using sawn or structural composite lumber flanges and structural-use panel webs, bonded together with exterior adhesives.
- 1.2** To be classified as an APA EWS performance-rated I-joist, the joist shall meet an L/480 live load deflection criterion and the intent of the floor vibration provisions given in the National Building Code of Canada for residential floor applications, in addition to meeting all other requirements of this standard.
- 1.3** APA EWS performance-rated I-joists are intended for use as joists in residential floor construction. Products carrying the APA EWS performance-rated I-joist trademark are to be installed in accordance with recommendations published by APA – *The Engineered Wood Association*.
- 1.4** APA EWS performance-rated I-joists can be used for applications other than residential floor construction provided that appropriate design properties of the I-joists are used in design.
- 1.5** APA EWS performance-rated I-joists are intended for use in dry-service conditions where the average moisture content is less than 16%.
- 1.6** This standard provides a span rating system for a series of APA EWS performance-rated I-joists used in residential floor construction. To qualify for trademarking as an APA EWS performance-rated I-joist, the I-joist shall demonstrate conformance to the performance requirements for the span rating as well as the design properties set forth in this standard.

2. Referenced Documents

2.1 ASTM Standards:

- D 9 Terminology Relating to Wood
- D 198 Methods of Static Tests of Lumber in Structural Sizes
- D 245 Practice for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber
- D 1037 Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
- D 2555 Test Methods for Establishing Clear Wood Strength Values
- D 2559 Specification for Adhesives for Structural Laminated Wood Products for Use under Exterior (Wet-Use) Exposure Conditions
- D 3498 Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems
- D 5055 Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists
- D 5456 Specification for Evaluation of Structural Composite Lumber Products

2.2 Other Standards:

- ANSI A190.1 Structural Glued Laminated Timber
- CSA O86 Engineering Design in Wood
- CSA O112.6 Phenol and Phenol-Resorcinol Adhesives for Wood (High-Temperature Curing)
- CSA O112.7 Phenol and Phenol-Resorcinol Adhesives for Wood (Room- and Intermediate-Temperature Curing)
- CSA O121 Douglas Fir Plywood
- CAN/CSA O122 Structural Glued Laminated Timber
- CSA O151 Canadian Softwood Plywood
- CAN/CSA O325.0 Construction Sheathing
- CSA O437.0 OSB and Waferboard
- National Building Code of Canada
- Voluntary Product Standard PS 1 Construction and Industrial Plywood
- Voluntary Product Standard PS 2 Performance Standard for Wood-Based Structural-Use Panels

2.3 APA Publications:

- APA PRP-108 Performance Standards and Qualification Policies Policy for Structural-Use Panels
- APA Quality Assurance Policies for Structural-Use Panels Qualified to PRP-108
- Quality Assurance Policy for APA EWS Performance-Rated I-Joists
- APA Specification AFG-01 Adhesives for Field-Gluing Plywood to Wood Framing

3. Terminology

3.1 Definitions – See the referenced documents for definitions of terms used in this standard.

3.2 Description of terms specific to this standard:

Bending EI: A measure of flexural stiffness without the influence of shear deflection.

Characteristic value: A value determined from test data for derivation of a design property. For the mechanical properties referenced in this standard, the characteristic values represent the 5th percentile estimates with 75% confidence, except for the stiffness (EI), which is based on the mean value. In addition, the coefficient of shear deflection (K) is determined based on theoretical calculations.

Clear span: The distance between the faces of two adjacent supports, which is the basis for the span ratings given in this standard.

Design span (test span): The distance between the centerlines of two adjacent supports, which is typically referenced in full-scale beam tests or used in a structural design.

Prefabricated wood I-joist: A structural member manufactured using sawn lumber or structural composite lumber flanges and structural panel webs, bonded together with exterior exposure adhesives, forming an “I” cross-sectional shape.

4. Performance Criteria and Requirements

This section provides performance criteria and requirements for APA EWS performance-rated I-joists. APA EWS performance-rated I-joists shall be qualified in accordance with Section 5 by demonstrating conformance to the performance requirements given in this section.

4.1 Sizes and Tolerances

4.1.1 Flanges – APA EWS performance-rated I-joists are produced using either structural composite lumber or sawn lumber as flange materials.

4.1.2 Webs – APA EWS performance-rated I-joists are produced using structural-use panels, including plywood and oriented strand board (OSB) meeting PS 1, PS 2, CSA O121, CSA O151, CSA O325, CSA O437, or APA PRP-108, as web materials.

4.1.3 Depth – APA EWS performance-rated I-joists shall have a net depth of 241 mm (9-1/2 inches), 302 mm (11-7/8 inches), 356 mm (14 inches), and 406 mm (16 inches).

4.1.4 Flange dimension – The net flange width for APA EWS performance-rated I-joists depends on the flange materials used, but shall have a minimum net width of 38 mm (1-1/2 inches) and minimum net thickness of 33 mm (1-5/16 inches).

4.1.5 Tolerances – The tolerances permitted at the time of manufacture shall be as follows:

Flange Width – Plus or minus 0.8 mm (1/32 inch)

Flange Thickness – Minus 1.6 mm (1/16 inch)

I-Joist Depth – Plus 0 or minus 3.2 mm (1/8 inch)

4.2 Maximum Span

4.2.1 The maximum spans, as shown in Tables 1a and 1b, indicate the maximum clear span for various joist spacings under typical residential floor loads of 0.48 kPa (10 psf) dead load and 1.92 kPa (40 psf) live load.

4.3 Design Properties

4.3.1 APA EWS performance-rated I-joists shall be designed based on the tabulated values provided in Table 2.

4.4 Characteristic Test Values

4.4.1 APA EWS performance-rated I-joists shall have characteristic test values that are equal to or greater than the values given in Table 3.

TABLE 1a

MAXIMUM CLEAR SPANS FOR APA EWS PERFORMANCE-RATED I-JOISTS – SIMPLE SPAN ONLY^(a,b,c,d)

Depth	Joist Series	Simple Spans			
		On Center Spacing			
		305 mm (12 in.)	406 mm (16 in.)	488 mm (19.2 in.)	610 mm (24 in.)
241 mm (9-1/2 in.)	PRI-20	4.50 m (14 ft 9 in.)	4.24 m (13 ft 11 in.)	4.11 m (13 ft 6 in.)	4.06 m (13 ft 4 in.)
	PRI-30	4.57 m (15 ft 0 in.)	4.32 m (14 ft 2 in.)	4.19 m (13 ft 9 in.)	4.14 m (13 ft 7 in.)
	PRI-40	4.70 m (15 ft 5 in.)	4.45 m (14 ft 7 in.)	4.32 m (14 ft 2 in.)	4.27 m (14 ft 0 in.)
	PRI-50	4.67 m (15 ft 4 in.)	4.42 m (14 ft 6 in.)	4.29 m (14 ft 1 in.)	4.24 m (13 ft 11 in.)
	PRI-60	4.85 m (15 ft 11 in.)	4.57 m (15 ft 0 in.)	4.42 m (14 ft 6 in.)	4.39 m (14 ft 5 in.)
302 mm (11-7/8 in.)	PRI-20	5.05 m (16 ft 7 in.)	4.78 m (15 ft 8 in.)	4.62 m (15 ft 2 in.)	4.57 m (15 ft 0 in.)
	PRI-30	5.13 m (16 ft 10 in.)	4.85 m (15 ft 11 in.)	4.70 m (15 ft 5 in.)	4.65 m (15 ft 3 in.)
	PRI-40	5.28 m (17 ft 4 in.)	4.98 m (16 ft 4 in.)	4.83 m (15 ft 10 in.)	4.78 m (15 ft 8 in.)
	PRI-50	5.26 m (17 ft 3 in.)	4.98 m (16 ft 4 in.)	4.80 m (15 ft 9 in.)	4.78 m (15 ft 8 in.)
	PRI-60	5.44 m (17 ft 10 in.)	5.13 m (16 ft 10 in.)	4.98 m (16 ft 4 in.)	4.93 m (16 ft 2 in.)
	PRI-70	5.51 m (18 ft 1 in.)	5.18 m (17 ft 0 in.)	5.03 m (16 ft 6 in.)	4.98 m (16 ft 4 in.)
	PRI-80	5.84 m (19 ft 2 in.)	5.41 m (17 ft 9 in.)	5.23 m (17 ft 2 in.)	5.18 m (17 ft 0 in.)
	PRI-90	5.97 m (19 ft 7 in.)	5.54 m (18 ft 2 in.)	5.33 m (17 ft 6 in.)	5.26 m (17 ft 3 in.)
356 mm (14 in.)	PRI-40	5.82 m (19 ft 1 in.)	5.41 m (17 ft 9 in.)	5.23 m (17 ft 2 in.)	5.18 m (17 ft 0 in.)
	PRI-50	5.82 m (19 ft 1 in.)	5.41 m (17 ft 9 in.)	5.23 m (17 ft 2 in.)	5.18 m (17 ft 0 in.)
	PRI-60	6.05 m (19 ft 10 in.)	5.61 m (18 ft 5 in.)	5.41 m (17 ft 9 in.)	5.36 m (17 ft 7 in.)
	PRI-70	6.12 m (20 ft 1 in.)	5.69 m (18 ft 8 in.)	5.46 m (17 ft 11 in.)	5.38 m (17 ft 8 in.)
	PRI-80	6.50 m (21 ft 4 in.)	6.02 m (19 ft 9 in.)	5.77 m (18 ft 11 in.)	5.66 m (18 ft 7 in.)
406 mm (16 in.)	PRI-90	6.63 m (21 ft 9 in.)	6.12 m (20 ft 1 in.)	5.87 m (19 ft 3 in.)	5.79 m (19 ft 0 in.)
	PRI-40	6.32 m (20 ft 9 in.)	5.87 m (19 ft 3 in.)	5.64 m (18 ft 6 in.)	5.56 m (18 ft 3 in.)
	PRI-50	6.35 m (20 ft 10 in.)	5.89 m (19 ft 4 in.)	5.66 m (18 ft 7 in.)	5.59 m (18 ft 4 in.)
	PRI-60	6.60 m (21 ft 8 in.)	6.12 m (20 ft 1 in.)	5.87 m (19 ft 3 in.)	5.79 m (19 ft 0 in.)
	PRI-70	6.68 m (21 ft 11 in.)	6.20 m (20 ft 4 in.)	5.94 m (19 ft 6 in.)	5.84 m (19 ft 2 in.)
	PRI-80	7.09 m (23 ft 3 in.)	6.55 m (21 ft 6 in.)	6.27 m (20 ft 7 in.)	6.17 m (20 ft 3 in.)
	PRI-90	7.21 m (23 ft 8 in.)	6.68 m (21 ft 11 in.)	6.38 m (20 ft 11 in.)	6.27 m (20 ft 7 in.)

(a) Clear span applicable to simple-span residential floor construction with a design dead load of 0.48 kPa (10 psf) and live load of 1.92 kPa (40 psf). The ultimate limit states are based on the factored loads of 1.25D + 1.50L. The serviceability limit states include the consideration for floor vibration and a live load deflection limit of span/480.

(b) Spans are based on a composite floor with glued-nailed sheathing meeting the requirements for APA Rated Sheathing or APA Rated STURD-I-FLOOR conforming to PRP-108, PS 1, PS 2, CSA O121, CSA O151, CSA O325, or CSA O437 with a minimum thickness of 15 mm (19/32 inch) (40/20 or 20 oc) for a joist spacing of 488 mm (19.2 inches) or less, or 18 mm (23/32 inch) (48/24 or 24 oc) for a joist spacing of 610 mm (24 inches). Adhesive shall meet the requirements given in ASTM D3498 or APA Specification AFG-01. No concrete topping, gypsum ceiling, or bridging element was assumed.

(c) Minimum bearing length shall be 44 mm (1-3/4 inches) for the end bearings.

(d) Web stiffeners are not required when I-joists are used with the spans and spacings given in this table, except as required by hanger manufacturers and over supports at load-bearing cantilever locations.

TABLE 1b

MAXIMUM CLEAR SPANS FOR APA EWS PERFORMANCE-RATED I-JOISTS – MULTIPLE SPAN ONLY^(a,b,c,d,e)

Depth	Joist Series	Multiple Spans			
		On Center Spacing			
		305 mm (12 in.)	406 mm (16 in.)	488 mm (19.2 in.)	610 mm (24 in.)
241 mm (9-1/2 in.)	PRI-20	4.83 m (15 ft 10 in.)	4.57 m (15 ft 0 in.)	4.42 m (14 ft 6 in.)	4.39 m (14 ft 5 in.)
	PRI-30	4.93 m (16 ft 2 in.)	4.65 m (15 ft 3 in.)	4.52 m (14 ft 10 in.)	4.47 m (14 ft 8 in.)
	PRI-40	5.08 m (16 ft 8 in.)	4.80 m (15 ft 9 in.)	4.65 m (15 ft 3 in.)	4.60 m (15 ft 1 in.)
	PRI-50	5.05 m (16 ft 7 in.)	4.78 m (15 ft 8 in.)	4.62 m (15 ft 2 in.)	4.57 m (15 ft 0 in.)
	PRI-60	5.23 m (17 ft 2 in.)	4.93 m (16 ft 2 in.)	4.78 m (15 ft 8 in.)	4.72 m (15 ft 6 in.)
302 mm (11-7/8 in.)	PRI-20	5.44 m (17 ft 10 in.)	5.13 m (16 ft 10 in.)	4.98 m (16 ft 4 in.)	4.45 m (14 ft 7 in.)
	PRI-30	5.56 m (18 ft 3 in.)	5.23 m (17 ft 2 in.)	5.08 m (16 ft 8 in.)	4.98 m (16 ft 4 in.)
	PRI-40	5.77 m (18 ft 11 in.)	5.38 m (17 ft 8 in.)	5.21 m (17 ft 1 in.)	5.16 m (16 ft 11 in.)
	PRI-50	5.74 m (18 ft 10 in.)	5.36 m (17 ft 7 in.)	5.18 m (17 ft 0 in.)	5.13 m (16 ft 10 in.)
	PRI-60	5.99 m (19 ft 8 in.)	5.56 m (18 ft 3 in.)	5.36 m (17 ft 7 in.)	5.31 m (17 ft 5 in.)
	PRI-70	6.07 m (19 ft 11 in.)	5.64 m (18 ft 6 in.)	5.44 m (17 ft 10 in.)	5.36 m (17 ft 7 in.)
	PRI-80	6.45 m (21 ft 2 in.)	5.97 m (19 ft 7 in.)	5.72 m (18 ft 9 in.)	5.64 m (18 ft 6 in.)
356 mm (14 in.)	PRI-90	6.60 m (21 ft 8 in.)	6.10 m (20 ft 0 in.)	5.84 m (19 ft 2 in.)	5.77 m (18 ft 11 in.)
	PRI-40	6.40 m (21 ft 0 in.)	5.94 m (19 ft 6 in.)	5.72 m (18 ft 9 in.)	5.64 m (18 ft 6 in.)
	PRI-50	6.40 m (21 ft 0 in.)	5.94 m (19 ft 6 in.)	5.72 m (18 ft 9 in.)	5.36 m (17 ft 7 in.)
	PRI-60	6.68 m (21 ft 11 in.)	6.20 m (20 ft 4 in.)	5.94 m (19 ft 6 in.)	5.87 m (19 ft 3 in.)
	PRI-70	6.76 m (22 ft 2 in.)	6.27 m (20 ft 7 in.)	6.02 m (19 ft 9 in.)	5.92 m (19 ft 5 in.)
406 mm (16 in.)	PRI-80	7.19 m (23 ft 7 in.)	6.63 m (21 ft 9 in.)	6.35 m (20 ft 10 in.)	6.27 m (20 ft 7 in.)
	PRI-90	7.34 m (24 ft 1 in.)	6.78 m (22 ft 3 in.)	6.50 m (21 ft 4 in.)	6.38 m (20 ft 11 in.)
	PRI-40	6.99 m (22 ft 11 in.)	6.48 m (21 ft 3 in.)	6.22 m (20 ft 5 in.)	6.15 m (20 ft 2 in.)
	PRI-50	6.99 m (22 ft 11 in.)	6.50 m (21 ft 4 in.)	6.22 m (20 ft 5 in.)	5.36 m (17 ft 7 in.)
	PRI-60	7.29 m (23 ft 11 in.)	6.76 m (22 ft 2 in.)	6.48 m (21 ft 3 in.)	6.38 m (20 ft 11 in.)
	PRI-70	7.37 m (24 ft 2 in.)	6.83 m (22 ft 5 in.)	6.55 m (21 ft 6 in.)	6.12 m (20 ft 1 in.)
	PRI-80	7.82 m (25 ft 8 in.)	7.24 m (23 ft 9 in.)	6.93 m (22 ft 9 in.)	6.81 m (22 ft 4 in.)
	PRI-90	7.98 m (26 ft 2 in.)	7.39 m (24 ft 3 in.)	7.06 m (23 ft 2 in.)	6.93 m (22 ft 9 in.)

(a) Clear span applicable to multiple-span residential floor construction with a design dead load of 0.48 kPa (10 psf) and live load of 1.92 kPa (40 psf). The ultimate limit states are based on the factored loads of 1.25D + 1.50L. The serviceability limit states include the consideration for floor vibration and a live load deflection limit of span/480. The end spans shall be 40% or more of the adjacent span.

(b) Spans are based on a composite floor with glued-nailed sheathing meeting the requirements for APA Rated Sheathing or APA Rated STURD-I-FLOOR conforming to PRP-108, PS 1, PS 2, CSA O121, CSA O151, CSA O325, or CSA O437 with a minimum thickness of 15 mm (19/32 inch) (40/20 or 20 oc) for a joist spacing of 488 mm (19.2 inches) or less, or 18 mm (23/32 inch) (48/24 or 24 oc) for a joist spacing of 610 mm (24 inches). Adhesive shall meet the requirements given in ASTM D3498 or APA Specification AFG-01. No concrete topping, gypsum ceiling, or bridging element was assumed.

(c) Minimum bearing length shall be 44 mm (1-3/4 inches) for the end bearings, and 89 mm (3-1/2 inches) for the intermediate bearings.

(d) Web stiffeners are not required when I-joists are used with the spans and spacings given in this table, except as required by hanger manufacturers and over supports at load-bearing cantilever locations.

(e) The ends of the joists shall be anchored to resist a factored uplift force of 0.48 kPa (10 psf) x joist spacing x largest span, due to pattern loading.

TABLE 2

FACTORED RESISTANCE FOR APA EWS PERFORMANCE-RATED I-JOISTS^(a)

Depth	Joist Series	EI ^(b)		M _r ^(c)		V _r ^(d)		IR _r ^(e)		ER _r ^(f)		K ^(g)	
		10 ⁶ kN•mm ²	(10 ⁶ lbf-in. ²)	kN•mm	(lbf-ft)	kN	(lbf)	kN	(lbf)	kN	(lbf)	kN	(10 ⁶ lbf)
241 mm (9-1/2 in.)	PRI-20	416	(145)	5,683	(4,191)	7.86	(1,768)	11.94	(2,683)	5.83	(1,310)	21,973	(4.94)
	PRI-30	462	(161)	7,272	(5,364)	7.86	(1,768)	13.37	(3,007)	6.63	(1,492)	21,973	(4.94)
	PRI-40	554	(193)	6,167	(4,549)	7.86	(1,768)	15.16	(3,409)	7.58	(1,705)	21,973	(4.94)
	PRI-50	534	(186)	8,569	(6,320)	7.86	(1,768)	14.32	(3,220)	7.13	(1,602)	21,973	(4.94)
	PRI-60	663	(231)	8,524	(6,287)	7.86	(1,768)	15.16	(3,409)	7.58	(1,705)	21,973	(4.94)
302 mm (11-7/8 in.)	PRI-20	726	(253)	7,362	(5,430)	9.97	(2,241)	11.94	(2,683)	5.83	(1,310)	27,489	(6.18)
	PRI-30	804	(280)	9,403	(6,936)	9.97	(2,241)	13.37	(3,007)	6.63	(1,492)	27,489	(6.18)
	PRI-40	947	(330)	7,994	(5,896)	9.97	(2,241)	17.55	(3,946)	8.42	(1,894)	27,489	(6.18)
	PRI-50	924	(322)	11,083	(8,175)	9.97	(2,241)	14.32	(3,220)	7.13	(1,602)	27,489	(6.18)
	PRI-60	1,136	(396)	11,049	(8,150)	9.97	(2,241)	17.55	(3,946)	8.42	(1,894)	27,489	(6.18)
	PRI-70	1,205	(420)	14,872	(10,969)	9.97	(2,241)	16.39	(3,686)	8.14	(1,831)	27,489	(6.18)
	PRI-80	1,570	(547)	15,649	(11,543)	9.97	(2,241)	19.38	(4,356)	8.99	(2,020)	27,489	(6.18)
	PRI-90	1,733	(604)	19,776	(14,586)	13.52	(3,038)	23.55	(5,296)	9.83	(2,210)	27,489	(6.18)
356 mm (14 in.)	PRI-40	1,383	(482)	9,629	(7,102)	12.01	(2,699)	17.55	(3,946)	8.42	(1,894)	32,381	(7.28)
	PRI-50	1,377	(480)	13,214	(9,746)	12.01	(2,699)	14.32	(3,220)	7.13	(1,602)	32,381	(7.28)
	PRI-60	1,676	(584)	13,293	(9,805)	12.01	(2,699)	17.55	(3,946)	8.42	(1,894)	32,381	(7.28)
	PRI-70	1,759	(613)	17,735	(13,081)	12.01	(2,699)	16.39	(3,686)	8.14	(1,831)	32,381	(7.28)
	PRI-80	2,301	(802)	18,852	(13,904)	12.01	(2,699)	21.20	(4,767)	8.99	(2,020)	32,381	(7.28)
	PRI-90	2,528	(881)	23,587	(17,397)	14.92	(3,354)	23.55	(5,296)	9.83	(2,210)	32,381	(7.28)
406 mm (16 in.)	PRI-40	1,885	(657)	11,162	(8,233)	13.83	(3,109)	17.55	(3,946)	8.42	(1,894)	37,007	(8.32)
	PRI-50	1,903	(663)	15,142	(11,168)	13.83	(3,109)	14.32	(3,220)	7.13	(1,602)	37,007	(8.32)
	PRI-60	2,293	(799)	15,413	(11,368)	13.83	(3,109)	17.55	(3,946)	8.42	(1,894)	37,007	(8.32)
	PRI-70	2,413	(841)	20,317	(14,985)	13.83	(3,109)	16.39	(3,686)	8.14	(1,831)	37,007	(8.32)
	PRI-80	3,134	(1,092)	21,851	(16,116)	13.83	(3,109)	21.20	(4,767)	8.99	(2,020)	37,007	(8.32)
	PRI-90	3,421	(1,192)	27,026	(19,933)	16.36	(3,678)	23.55	(5,296)	9.83	(2,210)	37,007	(8.32)

(a) The tabulated values are for the standard term of load duration (K_D = 1.0). All values, except for EI and K, are permitted to be adjusted for other load durations as permitted by the code.

(b) Bending stiffness (EI) of the I-joist.

(c) Factored moment capacity (M_r) of the I-joist, which shall not be increased by any code allowed system effect factor.

(d) Factored shear resistance (V_r) of the I-joist.

(e) Factored intermediate reaction (IR_r) of the I-joist with a minimum bearing length of 89 mm (3-1/2 inches) without web stiffeners.

(f) Factored end reaction (ER_r) of the I-joist with a minimum bearing length of 44 mm (1-3/4 inches) without web stiffeners. Higher end reactions are permitted. For a bearing length of 102 mm (4 inches) (127 mm (5 inches) for 356 mm (14 in.) and 406 mm (16 in.) PRI-50s), the end reaction may be set equal to the tabulated shear value. Interpolation on the end reaction between 44 and 102 mm (1-3/4 and 4-inch) (127 mm (5-inch) for 356 mm (14 in.) and 406 mm (16 in.) PRI-50s) bearing is permitted. For end reaction values over 10.88 kN (2,447 lbf), web stiffeners are required with the exception of PRI-90, which requires bearing stiffeners when end reaction values exceed 13.23 kN (2,975 lbf).

(g) Coefficient of shear deflection (K), which shall be used to calculate uniform load and center-point load deflections of the I-joist in a simple-span application based on Eqs. 1 and 2.

$$\text{Uniform Load: } \delta = \frac{5\omega\ell^4}{384EI} + \frac{\omega\ell^2}{K} \quad [1]$$

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

where: δ = calculated deflection (mm),
 ω = unfactored uniform load (kN/mm),
 ℓ = design span (mm),
 P = concentrated load (kN),
 EI = bending stiffness of the I-joist (kN•mm²), and
 K = coefficient of shear deflection (kN).

TABLE 3

CHARACTERISTIC TEST VALUES FOR APA EWS PERFORMANCE-RATED I-JOISTS^(a)

Depth	Joist Series	EI ^(b)		M _c ^(c)		V _c ^(d)		IR _c ^(e)		ER _c ^(f)		K ^(g)	
		10 ⁶ kN•mm ²	(10 ⁶ lbf-in. ²)	kN•mm	(lbf-ft)	kN	(lbf)	kN	(lbf)	kN	(lbf)	kN	(10 ⁶ lbf)
241 mm (9-1/2 in.)	PRI-20	416	(145)	7,179	(5,295)	11.81	(2,655)	17.93	(4,030)	8.76	(1,970)	21,973	(4.94)
	PRI-30	462	(161)	9,186	(6,775)	11.81	(2,655)	20.08	(4,515)	9.96	(2,240)	21,973	(4.94)
	PRI-40	554	(193)	7,789	(5,745)	11.81	(2,655)	22.77	(5,120)	11.39	(2,560)	21,973	(4.94)
	PRI-50	534	(186)	10,819	(7,980)	11.81	(2,655)	21.51	(4,835)	10.72	(2,410)	21,973	(4.94)
	PRI-60	663	(231)	10,765	(7,940)	11.81	(2,655)	22.77	(5,120)	11.39	(2,560)	21,973	(4.94)
302 mm (11-7/8 in.)	PRI-20	726	(253)	9,301	(6,860)	14.99	(3,370)	17.93	(4,030)	8.76	(1,970)	27,489	(6.18)
	PRI-30	804	(280)	11,877	(8,760)	14.99	(3,370)	20.08	(4,515)	9.96	(2,240)	27,489	(6.18)
	PRI-40	947	(330)	10,094	(7,445)	14.99	(3,370)	26.35	(5,925)	12.65	(2,845)	27,489	(6.18)
	PRI-50	924	(322)	13,999	(10,325)	14.99	(3,370)	21.51	(4,835)	10.72	(2,410)	27,489	(6.18)
	PRI-60	1,136	(396)	13,951	(10,290)	14.99	(3,370)	26.35	(5,925)	12.65	(2,845)	27,489	(6.18)
	PRI-70	1,205	(420)	18,778	(13,850)	14.99	(3,370)	24.62	(5,535)	12.23	(2,750)	27,489	(6.18)
	PRI-80	1,570	(547)	19,761	(14,575)	14.99	(3,370)	29.11	(6,545)	13.50	(3,035)	27,489	(6.18)
	PRI-90	1,733	(604)	24,974	(18,420)	20.31	(4,565)	35.38	(7,955)	14.77	(3,320)	27,489	(6.18)
356 mm (14 in.)	PRI-40	1,383	(482)	12,162	(8,970)	18.04	(4,055)	26.35	(5,925)	12.65	(2,845)	32,381	(7.28)
	PRI-50	1,377	(480)	16,690	(12,310)	18.04	(4,055)	21.51	(4,835)	10.72	(2,410)	32,381	(7.28)
	PRI-60	1,676	(584)	16,785	(12,380)	18.04	(4,055)	26.35	(5,925)	12.65	(2,845)	32,381	(7.28)
	PRI-70	1,759	(613)	22,398	(16,520)	18.04	(4,055)	24.62	(5,535)	12.23	(2,750)	32,381	(7.28)
	PRI-80	2,301	(802)	23,808	(17,560)	18.04	(4,055)	31.85	(7,160)	13.50	(3,035)	32,381	(7.28)
	PRI-90	2,528	(881)	29,787	(21,970)	22.42	(5,040)	35.38	(7,955)	14.77	(3,320)	32,381	(7.28)
406 mm (16 in.)	PRI-40	1,885	(657)	14,094	(10,395)	20.77	(4,670)	26.35	(5,925)	12.65	(2,845)	37,007	(8.32)
	PRI-50	1,903	(663)	19,124	(14,105)	20.77	(4,670)	21.51	(4,835)	10.72	(2,410)	37,007	(8.32)
	PRI-60	2,293	(799)	19,463	(14,355)	20.77	(4,670)	26.35	(5,925)	12.65	(2,845)	37,007	(8.32)
	PRI-70	2,413	(841)	25,659	(18,925)	20.77	(4,670)	24.62	(5,535)	12.23	(2,750)	37,007	(8.32)
	PRI-80	3,134	(1,092)	27,591	(20,350)	20.77	(4,670)	31.85	(7,160)	13.50	(3,035)	37,007	(8.32)
	PRI-90	3,421	(1,192)	34,125	(25,170)	24.58	(5,525)	35.38	(7,955)	14.77	(3,320)	37,007	(8.32)

(a) The tabulated values are test values. Use the values given in Table 2 for design.

(b) Bending stiffness (EI) of the I-joist.

(c) Characteristic moment capacity (M_c) of the I-joist.

(d) Characteristic shear capacity (V_c) of the I-joist.

(e) Characteristic intermediate reaction (IR_c) of the I-joist with a minimum bearing length of 89 mm (3-1/2 inches) without web stiffeners.

(f) Characteristic end reaction (ER_c) of the I-joist with a minimum bearing length of 44 mm (1-3/4 inches) without web stiffeners. Higher end reactions are permitted. For a bearing length of 102 mm (4 inches) (127 mm (5 inches) for 356 mm (14 in.) and 406 mm (16 in.) PRI-50s), the end reaction may be set equal to the tabulated shear value. Interpolation on the end reaction between 44 and 102 mm (1-3/4 and 4-inch) (127 mm (5-inch) for 356 mm (14 in.) and 406 mm (16 in.) PRI-50s) bearing is permitted. For end reaction values over 16.35 kN (3,675 lbf), web stiffeners are required with the exception of PRI-90, which requires bearing stiffeners when end reaction values exceed 19.88 kN (4,470 lbf).

(g) Coefficient of shear deflection (K).

5. Qualification Requirements

5.1 All APA EWS performance-rated I-joists shall be qualified based on the requirements specified in this section. Qualification tests shall be conducted in accordance with the principles set forth in ASTM D5055 with exceptions specifically noted in this standard.

5.2 Flange Materials

5.2.1. Flanges can be sawn lumber or structural composite lumber with a net dimension in conformance with Section 4.1.5.

5.2.2 End joints are permitted for flange materials provided that such joints conform to the strength requirements of Section 5.2.4 and glue bond durability requirements of ANSI A190.1 or CSA O122.

5.2.3 Flange materials used for the top of the I-joist shall be the same grade/type as those used for the bottom (balanced construction).

5.2.4 All flange materials, regardless of the dimension, shall have adequate strength and stiffness to provide the I-joist with the required moment and stiffness capacities specified in Table 3.

5.2.5 Qualification for flange materials shall be in accordance with ASTM D5055 and *Quality Assurance Policy for APA EWS Performance-Rated I-Joists*.

5.3 Web Materials

5.3.1 Structural-use panels in conformance with PS 1, PS 2, APA PRP-108, CSA O121, CSA O151, CSA O325, or CSA O437 shall be used as web materials provided that the glue bond characteristics meet the requirements of EXPOSURE 1 or EXTERIOR, and *Quality Assurance Policy for APA EWS Performance-Rated I-Joists*.

5.4 Adhesives

5.4.1 Adhesives for flange-to-web and web-to-web joints shall conform to the requirements of ASTM D2559, CSA O112.6, or CSA O112.7 for wet use adhesives.

5.5 I-Joist Products

5.5.1 Sampling procedures, number of samples, test methods, and data analyses for the I-joist qualification shall conform to the principles set forth in ASTM D5055 with exceptions specifically noted in this section.

5.5.2 Manufacturing parameters, such as web types, thicknesses, and grades; flange types and sizes; web-flange joints; and web joints shall be identified as part of the qualification procedures. Changes in these parameters shall require an engineering evaluation or re-qualification by APA.

5.5.3 Qualification test results for APA EWS performance-rated I-joists shall conform to the characteristic test values given in Table 3.

5.5.4 Moment Capacity Qualification – The I-joist moment capacity shall be determined based on either the analytical method or empirical method given in ASTM D5055. Tests for moment capacity qualification shall be conducted in accordance with the *Quality Assurance Policy for APA EWS Performance-Rated I-Joists*.

5.5.5 Stiffness Capacity Qualification – The I-joist EI shall be determined based on the transformed thickness of web materials and the gross dimension of flange materials. As an alternative, a constant thickness of 2.79 mm (0.11 inch) can be used for both plywood and OSB webs. A different transformed web thickness can be used provided that the I-joist EI can be substantiated by full-scale I-joist bending tests. For qualification purposes, the measured mid-span deflection from full-scale tests in accordance with the principles set forth in ASTM D5055 shall not exceed the calculated I-joist deflection based on the EI and K values given in Table 3.

5.5.6 Shear Capacity Qualification – The I-joist shear capacity shall be determined from qualification tests in accordance with the principles set forth in ASTM D5055. The shear qualification shall include the evaluation of web stiffeners, web holes (round and rectangular), web knock-outs, and intermediate bearing. Tests for shear capacity qualification shall be conducted in accordance with the *Quality Assurance Policy for APA EWS Performance-Rated I-Joists*.

6. Quality Assurance

6.1 Qualification Tests

6.1.1 Required qualification tests and criteria are detailed in Sections 4 and 5 of this standard. Retest shall be conducted using a new independent sample set.

6.2 Product Evaluation

6.2.1 Upon satisfactory completion of the requirements in Sections 4 and 5, all manufacturing variables shall be documented in the in-plant quality manual in accordance with the *Quality Assurance Policy for APA EWS Performance-Rated I-Joists*.

6.2.2 Periodic reevaluation of structural capacities shall be conducted in accordance with the requirements given in ASTM D5055 and the *Quality Assurance Policy for APA EWS Performance-Rated I-Joists*. This reevaluation shall be performed at the end of the first 6 months for any new plant or any new production line and shall not be longer than every 12 months for any existing plant or any existing production line.

6.3 Quality Assurance

6.3.1 Quality assurance of APA EWS performance-rated I-joists shall follow the in-plant manufacturing standard and the *Quality Assurance Policy for APA EWS Performance Rated I-Joists*.

6.4 Trademarking

6.4.1 All APA EWS performance-rated I-joists shall be identified with an APA EWS trademark, as shown in Section 7, bearing the net I-joist depth, joist designation, applicable spans for given spacings (optional), and manufacturing plant number.

7. Typical Information Shown on Trademarks (Spans and Spacings are Optional).

7.1 APA EWS 9-1/2-inch depth

9-1/2" PRI™-40 LSD

SPACING	12	16	19.2	24	APA EWS Glued Residential Floors PLANT 0000 • PRI-400
SIMPLE SPAN	15-5	14-7	14-2	14-0	
MULTIPLE SPAN	16-8	15-9	15-3	15-1	

7.2 APA EWS 11-7/8-inch depth

11-7/8" PRI™-40 LSD

SPACING	12	16	19.2	24	APA EWS Glued Residential Floors PLANT 0000 • PRI-400
SIMPLE SPAN	17-4	16-4	15-10	15-8	
MULTIPLE SPAN	18-11	17-8	17-1	16-11	

7.3 APA EWS 14-inch depth

14" PRI™-40 LSD

SPACING	12	16	19.2	24	APA EWS Glued Residential Floors PLANT 0000 • PRI-400
SIMPLE SPAN	19-1	17-9	17-2	17-0	
MULTIPLE SPAN	21-0	19-6	18-9	18-6	

7.4 APA EWS 16-inch depth

16" PRI™-40 LSD

SPACING	12	16	19.2	24	APA EWS Glued Residential Floors PLANT 0000 • PRI-400
SIMPLE SPAN	20-9	19-3	18-6	18-3	
MULTIPLE SPAN	22-11	21-3	20-5	20-2	

We have field representatives in many major U.S. cities and in Canada who can help answer questions involving APA and APA EWS trademarked products. For additional assistance in specifying engineered wood products, contact us::

**APA – THE ENGINEERED
WOOD ASSOCIATION
HEADQUARTERS**

7011 So. 19th St.
Tacoma, Washington 98466
(253) 565-6600 ■ Fax: (253) 565-7265

Web Address:
@

www.apawood.org

PRODUCT SUPPORT HELP DESK

(253) 620-7400
E-mail Address: help@apawood.org

The product use recommendations in this publication are based on the continuing programs of laboratory testing, product research, and comprehensive field experience of Engineered Wood Systems. However, because EWS has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility for product performance or designs as actually constructed. Because engineered wood product performance requirements vary geographically, consult your local architect, engineer or design professional to assure compliance with code, construction, and performance requirements.

Issued April 2004

ENGINEERED WOOD SYSTEMS
APA EWS