

Engineered Wood

CONSTRUCTION GUIDE



APA
THE ENGINEERED
WOOD ASSOCIATION

WOOD

The Natural Choice



Engineered wood products are a good choice for the environment. They are manufactured for years of trouble-free, dependable use. They help reduce waste by decreasing disposal costs and product damage. Wood is a renewable, recyclable, biodegradable resource that is easily manufactured into a variety of viable products.

A few facts about wood.

- **We're growing more wood every day.** Forests fully cover one-third of the United States' and one-half of Canada's land mass. 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.



- **Life Cycle Assessment shows wood is the greenest building product.** A 2004 Consortium for Research on Renewable Industrial Materials (CORRIM) study gave scientific validation to the strength of wood as a green building product. In examining building products' life cycles – from extraction of the raw material to demolition of the building at the end of its long lifespan – CORRIM found that wood was better for the environment than steel or concrete in terms of embodied energy, global warming potential, air emissions, water emissions and solid waste production. For the complete details of the report, visit www.CORRIM.org.

- **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: It's the natural choice for the environment, for design and for strong, lasting construction.



NOTICE:

The recommendations in this guide apply only to products that bear the APA trademark. Only products bearing the APA trademark are subject to the Association's quality auditing program.



APA engineered wood products are used in a wide range of construction applications. Time-tested panel products are used in traditional wood-frame construction and in combination with other engineered wood products and systems. For low in-place cost, versatility, and superior performance, engineered wood systems are simply hard to beat.

This guide from APA is designed as a reference manual for both residential and commercial construction. It contains up-to-date information on APA Performance Rated Panels, glulam, I-joists, structural composite lumber, specification practices, floor, wall and roof systems, diaphragms and shear walls, fire-rated systems and methods of finishing.

If what you want to know about engineered wood construction systems isn't fully explained here, chances are it is in one of our many other publications. Titles cited throughout this publication can be downloaded or ordered from the APA web site, at www.apawood.org. Or, for individual assistance with specific application questions or problems, contact the APA Product Support Help Desk at (253) 620-7400.

CONTENTS

GUIDE TO ENGINEERED WOOD PRODUCTS	5	WALL CONSTRUCTION	42
Panel Selection and Specification	5	APA Sturd-I-Wall	42
Manufacturing and Performance Standards	5	Siding Fasteners	45
Grade Designations	6	APA Panel and Lap Siding Over Nailable Sheathing	45
Sanded, Unsanded and Touch-Sanded Panels	6	APA Panel Wall Sheathing	48
Bond Classification	6	APA Sheathing Under Stucco	49
Moisture Exposure Recommendations	7	Siding Joint Details	49
Group Number	7	APA Rated Siding Patterns and Grades	51
Span Ratings	12	Finishing Plywood for Exterior Exposure	51
How To Order APA Panels	12	Interior Paneling	53
Grade Availability	13	Panel Backing	54
Nail Sizes	13	Wood Structural Panel Wall Bracing and Shear Walls	54
Metric Conversions	14	Wall Bracing	54
Panel Storage and Handling	14	Shear Walls	56
Panel Specification Guide	15		
Glulam Selection and Specification	19	ROOF CONSTRUCTION	57
Balanced and Unbalanced Beams	19	APA Panel Roof Sheathing	57
Allowable Design Properties	19	Preframed Roof Panels	59
Sizes	19	Long Span Systems	61
Appearance Classification	20	Plywood Under Special Coatings	62
Section Properties and Capacities	21	APA Panel Soffits	62
Camber	21	APA Panel Roof Diaphragms	64
Trademarks and Acceptances	22		
Glulam Beam Storage and Handling	22	BUILDING REQUIREMENTS AND	
Glulam Specification Guide	23	RELATED PANEL SYSTEMS	66
I-Joist Selection and Specification	24	Fire-resistant Construction	66
APA PRI-400	24	Wind-resistive Roofs	71
Residential Floor Spans	24	Noise Transmission Control	72
I-Joist Storage and Handling	25	Energy Conservation	73
APA Performance Rated I-Joist Specification Guide	27	Condensation: Its Cause and Control	74
SCL Selection and Specification	26	Thermal Resistance of Wood Structural Panels	75
Laminated Veneer Lumber (LVL)	26	The Permanent Wood Foundation	76
Parallel Strand Lumber (PSL)	26	Plywood for Outdoor Decks	76
Laminated Strand Lumber (LSL)	26	Plywood for Concrete Forming	76
Oriented Strand Lumber (OSL)	26	Structural Insulated Panels	77
Allowable Strength Properties	26	APA Panels Over Metal Framing	77
Structural Composite Lumber (SCL) Specification Guide	27	APA Panel Systems Over Concrete Slabs	78
FLOOR CONSTRUCTION	28	Special Floor Surfacing	78
APA Rated Sturd-I-Floor	28		
Sturd-I-Floor 32 oc and 48 oc	31	ADDITIONAL INFORMATION	79
APA Performance Rated Rim Board	32	About APA – The Engineered Wood Association and	
The APA Glued Floor System	32	Engineered Wood Systems	79
APA Panel Subflooring	34		
Lightweight Concrete Over APA Panels	35		
APA Plywood Underlayment	35		
Hardwood Flooring Over APA Panel Subfloors	37		
Ceramic Tile Over APA Plywood Floors	38		
APA Panel Stair Treads and Risers	40		
Heavy Duty Plywood Floors	40		



GUIDE TO ENGINEERED WOOD PRODUCTS

The evolution of engineered wood products has greatly expanded building options and methods in all forms of residential and commercial construction. The next 23 pages of this APA guide provide product information and specification recommendations for several of the most common engineered wood products – plywood, oriented strand board, glulam, and I-joists. Other engineered wood products that are often used in the construction systems described in this guide include Rim Board® and structural composite lumber (SCL).

“Engineered wood” describes wood products that are engineered for structural applications. Having been used since the 1940s, plywood is considered by many to be the original engineered wood product. All glued engineered wood products are made by combining wood strands, veneers, lumber or other wood fiber with glue to form a larger composite structural unit. They are designed and manufactured to maximize the natural strength and stiffness characteristics of wood by optimally orienting the wood veneers, strands or laminations and by combining wood with durable adhesives.

PANEL SELECTION AND SPECIFICATION

Manufacturing and Performance Standards

Panels for construction and industrial applications can be manufactured in a variety of ways – as plywood (cross-laminated wood veneer), oriented strand board (OSB) or other wood-based panel products.

Some plywood panels are manufactured under the detailed manufacturing specifications or under the performance testing provisions of Voluntary Product Standard PS 1-07 for Structural Plywood, developed cooperatively by the plywood industry and the U.S. Department of Commerce. Other plywood panels, however, as well as composite and OSB panels, are manufactured under the provisions of APA PRP-108, Performance Standards and Qualification Policy for Structural-Use Panels, or under Voluntary Product Standard PS 2-04, Performance Standard for Wood-Based Structural-Use Panels, that establish performance criteria for specific designated construction applications.

These APA Performance Rated Panels are easy to use and specify because the recommended end use and maximum support spacings are clearly indicated in the APA trademark located on the panel. By broadening the range of panel configurations and compositions, APA Performance Rated Panels allow more efficient use of raw materials.

APA PRP-108 Performance Standards are recognized through NER-108 by the International Code Council Evaluation

TABLE 1

VENEER GRADES

A	Smooth, paintable. Not more than 18 neatly made repairs, boat, sled, or router type, and parallel to grain, permitted. Wood or synthetic repairs permitted. May be used for natural finish in less demanding applications.
B	Solid surface. Shims, sled or router repairs, and tight knots to 1 inch across grain permitted. Wood or synthetic repairs permitted. Some minor splits permitted.
C Plugged	Improved C veneer with splits limited to 1/8-inch width and knotholes or other open defects limited to 1/4 x 1/2 inch. Wood or synthetic repairs permitted. Admits some broken grain.
C	Tight knots to 1-1/2 inch. Knotholes to 1 inch across grain and some to 1-1/2 inch if total width of knots and knotholes is within specified limits. Synthetic or wood repairs. Discoloration and sanding defects that do not impair strength permitted. Limited splits allowed. Stitching permitted.
D	Knots and knotholes to 2-1/2-inch width across grain and 1/2 inch larger within specified limits. Limited splits are permitted. Stitching permitted. Limited to Exposure 1.

Service (ICC-ES)^(a) and HUD^(b). PRP-108, PS 1 and/or the PS 2 grade conformance where applicable are given in the lower portion of the APA trademark. Plywood panels, depending on glue line classification, veneer species and thickness, etc., are in many instances identical to panel grades as defined in Product Standard PS 1-07.

Typical APA Performance Rated Panel trademarks are illustrated and explained at right.

Grade Designations

Structural panel grades are generally identified in terms of the veneer grade used on the face and back of the panel (e.g., A-B, B-C, etc.), or by a name suggesting the panel's intended end use (e.g., APA RATED SHEATHING, APA RATED STURD-I-FLOOR, etc.). See Tables 2–4.

Veneer grades define veneer appearance in terms of natural unrepaired growth characteristics and allowable number and size of repairs that may be made during manufacture. See Table 1. The highest quality veneer grade commonly available is A. The minimum grade of veneer permitted in Exterior plywood is C-grade. D-grade veneer is only permitted to be used in panels intended for applications protected from long-term exposure to weather.

Sanded, Unsanded and Touch-Sanded Panels

Panels with B-grade or better veneer faces are always sanded smooth in manufacture to fulfill the requirements of their intended end use – applications such as cabinets, shelving, furniture, built-ins, etc. APA RATED SHEATHING panels are unsanded since a smooth surface is not a requirement of their intended end use. Still other panels – APA UNDERLAYMENT, APA RATED STURD-I-FLOOR, APA C-D PLUGGED, and APA C-C PLUGGED – require only touch sanding for “sizing” to make the panel thickness more uniform.

Unsanded and touch-sanded panels, and panels with B-grade or better veneer on one side only, usually carry the APA trademark on the panel back. Panels with both sides of B-grade or better veneer, or with special overlaid surfaces (such as HIGH DENSITY OVERLAY) usually carry the APA trademark on the panel edge.

Bond Classification

APA trademarked panels may be produced in two bond classifications – Exterior and Exposure 1. The bond classification relates to moisture resistance of the glue bond, and thus to structural integrity of the panel. Since aesthetic (nonstructural) attributes of panels may be compromised to some degree by exposure to weather, installation recommendations in this publication are designed to provide optimum overall performance.

(a) ICC-ES is a nonprofit, public-benefit corporation that does technical evaluations of building products, components, methods, and materials. The evaluation process culminates with the issuance of reports on code compliance, which are made available free of charge, on the worldwide web, at www.icc-es.org, to building regulators, contractors, specifiers, architects, engineers, and anyone else with an interest in the building industry and construction.

ICC-ES came into being on February 1, 2003, when America's four building product evaluation services officially combined their operations. The four “legacy” evaluation services that came together to form ICC-ES were the National Evaluation Service, Inc.; BOCA Evaluation Services; ICBO Evaluation Service, Inc.; and SBCCI Public Service Testing and Evaluation Services, Inc.

Contact APA for the latest information about code recognition of wood structural panels.

(b) HUD recognition of wood-based APA Performance Rated Panels is contained in Use of Materials Bulletin UM-40.

The image displays three APA Performance Rated Panel trademarks, each with a numbered legend explaining the components:

- APA RATED STURD-I-FLOOR:**
 - 1 — RATED STURD-I-FLOOR
 - 2 — 24 OC 23/32 INCH
 - 3 — SIZED FOR SPACING
 - 4 — T&G NET WIDTH 47-1/2
 - 5 — EXPOSURE 1
 - 6 — 000
 - 7 — PS 1-07 UNDERLAYMENT
 - 8 — PRP-108
- APA RATED SHEATHING:**
 - 1 — RATED SHEATHING
 - 2 — 48/24 23/32 INCH
 - 4 — SIZED FOR SPACING
 - 5 — EXPOSURE 1
 - 6 — 000
 - 7 — PS 2-04 SHEATHING
 - 8 — PRP-108 HUD-UM-40
 - 11 — CONSTRUCTION SHEATHING
 - 12 — 2R48/2F24
 - 13 — 18 mm
 - 14 — CSA 0325
 - 15 — STRENGTH AXIS THIS DIRECTION
- APA RATED SIDING:**
 - 1 — RATED SIDING
 - 2 — 303-18 S/W
 - 3 — 11/32 INCH
 - 4 — GROUP 1
 - 5 — SIZED FOR SPACING
 - 6 — EXTERIOR
 - 7 — 000
 - 8 — PS 1-07 PRP-108
 - 9 — HUD-UM-40
 - 10 — 16 OC
 - 11 — 11/32 INCH
 - 12 — GROUP 1
 - 13 — EXTERIOR
 - 14 — 000
 - 15 — PS 1-07 PRP-108
 - 16 — HUD-UM-40

Legend:

- 1 Panel grade
- 2 Span Rating
- 3 Tongue-and-groove
- 4 Bond classification
- 5 Product Standard
- 6 Thickness
- 7 Mill number
- 8 APA's performance rated panel standard
- 9 Siding face grade
- 10 Species group number
- 11 HUD recognition
- 12 Panel grade, Canadian standard
- 13 Panel mark – Rating and end-use designation per the Canadian standard
- 14 Canadian performance rated panel standard
- 15 Panel face grain orientation indicator

Panel surfaces may become uneven and irregular under prolonged moisture exposure. Panels should be allowed to dry, and panel joints and surfaces may need to be sanded before applying some finish materials.

Bond classification of the panel **does not** relate to fungal decay resistance of the panel. Fungal decay of wood products may occur when the moisture content exceeds 20 percent for an extended period. See APA Technical Note, *Controlling Decay in Wood Construction, Form R495*, for a discussion of fungal decay. Prevention of fungal decay is a function of proper design, material specification, construction and maintenance of the structure. While this publication includes many of the applicable provisions, reference to local building codes and other design documents is also necessary.

Exterior panels are suitable for repeated wetting and redrying or long-term exposure to weather or other conditions of similar severity.

Exposure 1 panels are suitable for uses **not** involving long-term exposure to weather. Panels classified as Exposure 1 are intended to resist the effects of moisture due to construction delays, or other conditions of similar severity. Exposure 1 panels may also be used when exposure to the outdoors is on the under-side only, such as at roof overhangs, although appearance characteristics of the panel grade should also be considered. Exposure 1 panels are made with the same exterior adhesives used in Exterior panels. However, because other panel compositional factors may affect bond performance, only Exterior panels should be used for long-term exposure to the weather.

C-D Exposure 1 APA Rated Plywood Sheathing, sometimes called “CDX” in the trade, is occasionally mistaken as an Exterior panel and erroneously used in applications for which it does not possess the required resistance to weather. “CDX” should only be used for applications as outlined under Exposure 1 above. For sheathing grade panels that will be exposed long-term to the weather, specify APA Rated Sheathing Exterior (C-C Exterior plywood under PS 1).

Moisture Exposure Recommendations

APA recommendations take into account bond classification as well as other panel compositional factors that may affect bond or panel performance.

The table at right provides guidance regarding moisture content and recommended bond classification.

By far, most wood structural panels are used in interior or dry-use moisture conditions, where in-service moisture content will be less than 16 percent over the service life. In North America the typical in-service equilibrium moisture content is in the 8 percent to 12 percent range for wood structural panels. Occasionally, however, an application will subject panels to higher long-term moisture conditions, such as in locations where relative humidity is 90 percent or more for long periods of time.

Group Number

Plywood can be manufactured from over 70 species of wood. These species are divided on the basis of strength and stiffness into five Groups under Voluntary Product Standard PS 1. Strongest species are in Group 1; the next strongest in Group 2, and so on. The Group number that appears in the trademark on some APA trademarked panels – primarily sanded grades – is based on the species used for face and back veneers or upon equivalent strength testing of the panel. Where face and back veneers are not from the same species Group, the higher Group number is used, except

In-Service Moisture Content	End-Use Moisture Conditions	Recommended Bond Classification	Design Moisture Conditions ^(a)
Less than 16%	Dry uses	Exposure 1 or Exterior	Dry
16% to 19%	Humid interior or protected uses	Exposure 1 or Exterior	Wet
Greater than 19%	Long-term exposure to weather	Exterior	Wet
	Other very humid or wet uses	Exterior	Wet
	Ground contact	Exterior	Wet

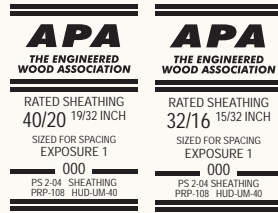
(a) Contact APA for specific design provisions.

Continued on page 12

TABLE 2

GUIDE TO APA PERFORMANCE RATED PANELS^{(a)(b)}**FOR APPLICATION RECOMMENDATIONS, SEE FOLLOWING PAGES.****APA RATED SHEATHING**

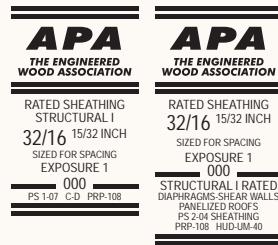
Typical Trademark



Specially designed for subflooring and wall and roof sheathing. Also good for a broad range of other construction and industrial applications. Can be manufactured as OSB, plywood, or other wood-based panel. BOND CLASSIFICATIONS: Exterior, Exposure 1. COMMON THICKNESSES (in.): 3/8, 7/16, 15/32, 1/2, 19/32, 5/8, 23/32, 3/4.

APA STRUCTURAL I RATED SHEATHING^(c)

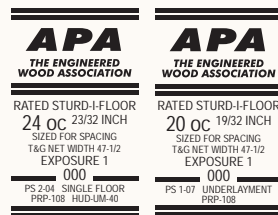
Typical Trademark



Unsanded grade for use where shear and cross-panel strength properties are of maximum importance, such as panelized roofs and diaphragms. Can be manufactured as OSB, plywood, or other wood-based panel. BOND CLASSIFICATIONS: Exterior, Exposure 1. COMMON THICKNESSES (in.): 3/8, 7/16, 15/32, 1/2, 19/32, 5/8, 23/32, 3/4.

APA RATED STURD-I-FLOOR

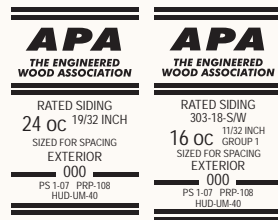
Typical Trademark



Specially designed as combination subfloor-underlayment. Provides smooth surface for application of carpet and pad and possesses high concentrated and impact load resistance. Can be manufactured as OSB, plywood, or other wood-based panel. Available square edge or tongue-and-groove. BOND CLASSIFICATIONS: Exterior, Exposure 1. COMMON THICKNESSES (in.): 19/32, 5/8, 23/32, 3/4, 1, 1-1/8.

APA RATED SIDING

Typical Trademark



For exterior siding, fencing, etc. Can be manufactured as plywood, as other wood-based panel or as an overlaid OSB. Both panel and lap siding available. Special surface treatment such as V-groove, channel groove, deep groove (such as APA Texture 1-11), brushed, rough sawn and overlaid (MDO) with smooth- or texture-embossed face. Span Rating (stud spacing for siding qualified for APA Sturd-I-Wall applications) and face grade classification (for veneer-faced siding) indicated in trademark. BOND CLASSIFICATION: Exterior. COMMON THICKNESSES (in.): 11/32, 3/8, 7/16, 15/32, 1/2, 19/32, 5/8.

- (a) Specific grades, thicknesses and bond classifications may be in limited supply in some areas. Check with your supplier before specifying.
- (b) Specify Performance Rated Panels by thickness and Span Rating. Span Ratings are based on panel strength and stiffness. Since these properties are a function of panel composition and configuration as well as thickness, the same Span Rating may appear on panels of different thickness. Conversely, panels of the same thickness may be marked with different Span Ratings.

- (c) For some Structural I plywood panel constructions, the plies are special improved grades. Panels marked PS 1 are limited to Group 1 species. Other panels marked Structural I Rated qualify through special performance testing.

TABLE 3

GUIDE TO APA SANDED AND TOUCH-SANDED PLYWOOD PANELS^{(a)(b)(c)}
FOR APPLICATION RECOMMENDATIONS, SEE FOLLOWING PAGES.

APA A-A

Typical Trademark (mark on panel edge)

A-A • 3/4 IN. • G-1 • EXTERIOR-APA • 000 • PS 1-07

Use where appearance of both sides is important for interior applications such as built-ins, cabinets, furniture, partitions; and exterior applications such as fences, signs, boats, shipping containers, tanks, ducts, etc. Smooth surfaces suitable for painting. BOND CLASSIFICATIONS: Exposure 1, Exterior. COMMON THICKNESSES (in.): 1/4, 11/32, 3/8, 15/32, 1/2, 19/32, 5/8, 23/32, 3/4.

APA A-B

Typical Trademark (mark on panel edge)

A-B • 1/4 IN. • G-1 • EXPOSURE 1-APA • 000 • PS 1-07

For use where appearance of one side is less important but where two solid surfaces are necessary. BOND CLASSIFICATIONS: Exposure 1, Exterior. COMMON THICKNESSES (in.): 1/4, 11/32, 3/8, 15/32, 1/2, 19/32, 5/8, 23/32, 3/4.

APA A-C

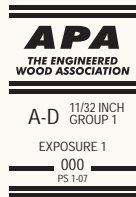
Typical Trademark



For use where appearance of only one side is important in exterior or interior applications, such as soffits, fences, farm buildings, etc.^(d) BOND CLASSIFICATION: Exterior. COMMON THICKNESSES (in.): 1/4, 11/32, 3/8, 15/32, 1/2, 19/32, 5/8, 23/32, 3/4.

APA A-D

Typical Trademark



For use where appearance of only one side is important in interior applications, such as paneling, built-ins, shelving, partitions, flow racks, etc.^(d) BOND CLASSIFICATION: Exposure 1. COMMON THICKNESSES (in.): 1/4, 11/32, 3/8, 15/32, 1/2, 19/32, 5/8, 23/32, 3/4.

APA B-B

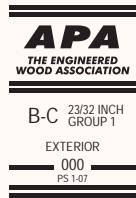
Typical Trademark (mark on panel edge)

B-B • 19/32 IN. • G-2 • EXTERIOR-APA • 000 • PS 1-07

Utility panels with two solid sides. BOND CLASSIFICATIONS: Exposure 1, Exterior. COMMON THICKNESSES (in.): 1/4, 11/32, 3/8, 15/32, 1/2, 19/32, 5/8, 23/32, 3/4.

APA B-C

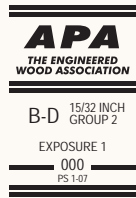
Typical Trademark



Utility panel for farm service and work buildings, boxcar and truck linings, containers, tanks, agricultural equipment, as a base for exterior coatings and other exterior uses or applications subject to high or continuous moisture.^(d) BOND CLASSIFICATION: Exterior. COMMON THICKNESSES (in.): 1/4, 11/32, 3/8, 15/32, 1/2, 19/32, 5/8, 23/32, 3/4.

APA B-D

Typical Trademark

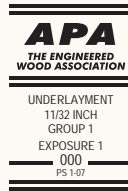


Utility panel for backing, sides of built-ins, industry shelving, slip sheets, separator boards, bins and other interior or protected applications.^(d) BOND CLASSIFICATION: Exposure 1. COMMON THICKNESSES (in.): 1/4, 11/32, 3/8, 15/32, 1/2, 19/32, 5/8, 23/32, 3/4.

Continued on next page

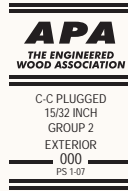
TABLE 3 *continued***GUIDE TO APA SANDED AND TOUCH-SANDED PLYWOOD PANELS^{(a)(b)(c)}
FOR APPLICATION RECOMMENDATIONS, SEE FOLLOWING PAGES.**

APA UNDERLAYMENT
Typical Trademark



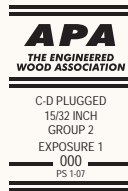
For application over structural subfloor. Provides smooth surface for application of carpet and pad and possesses high concentrated and impact load resistance. For areas to be covered with resilient flooring, specify panels with “sanded face.”^(e) BOND CLASSIFICATION: Exposure 1. COMMON THICKNESSES^(f) (in.): 1/4, 11/32, 3/8, 15/32, 1/2, 19/32, 5/8, 23/32, 3/4.

APA C-C PLUGGED^(g)
Typical Trademark



For use as an underlayment over structural subfloor, refrigerated or controlled atmosphere storage rooms, pallet fruit bins, tanks, boxcar and truck floors and linings, open soffits, and other similar applications where continuous or severe moisture may be present. Provides smooth surface for application of carpet and pad and possesses high concentrated and impact load resistance. For areas to be covered with resilient flooring, specify panels with “sanded face.”^(e) BOND CLASSIFICATION: Exterior. COMMON THICKNESSES^(f) (in.): 11/32, 3/8, 15/32, 1/2, 19/32, 5/8, 23/32, 3/4.

APA C-D PLUGGED
Typical Trademark



For open soffits, built-ins, cable reels, separator boards and other interior or protected applications. Not a substitute for Underlayment or APA Rated Sturd-I-Floor as it lacks their puncture resistance. BOND CLASSIFICATION: Exposure 1. COMMON THICKNESSES (in.): 3/8, 15/32, 1/2, 19/32, 5/8, 23/32, 3/4.

(a) Specific plywood grades, thicknesses and bond classifications may be in limited supply in some areas. Check with your supplier before specifying.

(b) Sanded Exterior plywood panels, C-C Plugged, C-D Plugged and Underlayment grades can also be manufactured in Structural I (all plies limited to Group 1 species).

(c) Some manufacturers also produce plywood panels with premium N-grade veneer on one or both faces. Available only by special order. Check with the manufacturer. For a description of N-grade veneer, refer to the APA publication *Sanded Plywood*, Form K435.

(d) For nonstructural floor underlayment, or other applications requiring improved inner ply construction, specify panels marked either

“plugged inner plies” (may also be designated plugged crossbands under face or plugged crossbands or core); or “meets underlayment requirements.”

(e) Also available in Underlayment A-C or Underlayment B-C grades, marked either “touch sanded” or “sanded face.”

(f) Some panels 1/2 inch and thicker are Span Rated and do not contain species group number in trademark.

(g) Also may be designated APA Underlayment C-C Plugged.

TABLE 4

GUIDE TO APA SPECIALTY PLYWOOD PANELS^(a)
FOR APPLICATION RECOMMENDATIONS, SEE FOLLOWING PAGES.

APA Decorative
 Typical Trademark



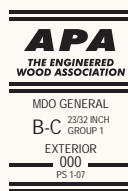
Rough-sawn, brushed, grooved, or striated faces. For paneling, interior accent walls, built-ins, counter facing, exhibit displays. Can also be made by some manufacturers in Exterior for exterior siding, gable ends, fences and other exterior applications. Use recommendations for Exterior panels vary with the particular product. Check with the manufacturer. BOND CLASSIFICATIONS: Exposure 1, Exterior. COMMON THICKNESSES (in.): 5/16, 3/8, 1/2, 5/8.

APA High Density Overlay (HDO)^(b)
 Typical Trademark (mark on panel edge)

HDO • INDUSTRIAL • A-A • 3/4 IN. • G-1 • EXTERIOR-APA • 000 • PS 1-07

Has a hard semi-opaque resin-fiber overlay on both faces. Abrasion resistant. For concrete forms, cabinets, countertops, signs, tanks. Also available with skid-resistant screen-grid surface. BOND CLASSIFICATION: Exterior. COMMON THICKNESSES (in.): 3/8, 1/2, 5/8, 3/4.

APA Medium Density Overlay (MDO)^(b)
 Typical Trademark



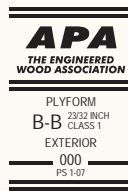
Smooth, opaque, resin-fiber overlay on one or both faces. Ideal base for paint, both indoors and outdoors. For exterior siding, paneling, shelving, exhibit displays, cabinets, concrete forms, signs. BOND CLASSIFICATION: Exterior. COMMON THICKNESSES (in.): 11/32, 3/8, 15/32, 1/2, 19/32, 5/8, 23/32, 3/4.

APA Marine
 Typical Trademark (mark on panel edge)

MARINE • A-A • 5/8 IN. • EXTERIOR-APA • 000 • PS 1-07

Ideal for boat hulls. Made only with Douglas-fir or western larch. Subject to special limitations on core gaps and face repairs. Also available with HDO or MDO faces. BOND CLASSIFICATION: Exterior. COMMON THICKNESSES (in.): 1/4, 3/8, 1/2, 5/8, 3/4.

APA Plyform Class I^(b)
 Typical Trademark



Concrete form grades with high reuse factor. Sanded both faces and mill-oiled unless otherwise specified. Special restrictions on species. Also available in HDO or MDO for very smooth concrete finish, and with special overlays. BOND CLASSIFICATION: Exterior. COMMON THICKNESSES (in.): 19/32, 5/8, 23/32, 3/4.

APA Plyron
 Typical Trademark (mark on panel edge)

PLYRON • 3/4 IN. • EXPOSURE 1-APA • 000

Hardboard face on both sides. Faces tempered, untempered, smooth or screened. For countertops, shelving, cabinet doors, flooring. BOND CLASSIFICATIONS: Exposure 1, Exterior. COMMON THICKNESSES (in.): 1/2, 5/8, 3/4.

(a) Specific plywood grades, thicknesses and bond classifications may be in limited supply in some areas. Check with your supplier before specifying.

(b) Can also be manufactured in Structural I (all plies limited to Group 1 species).

for sanded panels 3/8 inch thick or less and Decorative panels of any thickness. These are identified by face species because they are chosen primarily for appearance and used in applications where structural integrity is not critical. Sanded panels greater than 3/8 inch are identified by face species if C or D grade backs are at least 1/8 inch and are no more than one species group number larger. Some species are used widely in plywood manufacture; others rarely. Check local availability if a particular species is desired.

Span Ratings

APA RATED SHEATHING, APA RATED STURD-I-FLOOR and APA RATED SIDING carry numbers in their trademarks called Span Ratings. These denote the maximum recommended center-to-center spacing in inches of supports over which the panels should be placed in construction applications. Except for APA RATED SIDING panels, the Span Rating applies when the long panel dimension or strength axis is across supports, unless the strength axis is otherwise identified. The Span Rating of APA RATED SIDING panels applies when installed vertically.

The Span Rating on APA RATED SHEATHING panels appears as two numbers separated by a slash, such as 32/16, 48/24, etc.^(a) The left-hand number denotes the maximum recommended spacing of supports when the panel is used for roof sheathing with the **long dimension or strength axis of the panel across three or more supports (two or more spans)**. The right-hand number indicates the maximum recommended spacing of supports when the panel is used for subflooring with the **long dimension or strength axis of the panel across three or more supports**. A panel marked 32/16, for example, may be used for roof decking over supports up to 32 inches on center or for subflooring over supports up to 16 inches on center.

The Span Rating on APA RATED STURD-I-FLOOR and APA RATED SIDING panels appears as a single number. APA RATED STURD-I-FLOOR panels are designed specifically for single-floor (combined subfloor-underlayment) applications under carpet and pad and are manufactured with Span Ratings of 16, 20^(b), 24, 32 and 48. The Span Ratings for APA RATED STURD-I-FLOOR panels, like those for APA RATED SHEATHING, are based on application of the panel with the **long dimension or strength axis across three or more supports**.

APA RATED SIDING is available with Span Ratings of 16 and 24 inches. Span-rated panels and lap siding may be used direct to studs or over nonstructural wall sheathing (Sturd-I-Wall construction), or over nailable panel or lumber sheathing (double wall construction). Panels and lap siding with a Span Rating of 16 inches may be applied direct to studs spaced 16 inches on center. Panels and lap siding bearing a Span Rating of 24 inches may be used direct to studs 24 inches on center. All RATED SIDING panels may be applied horizontally direct to studs 16 or 24 inches on center provided horizontal joints are blocked. When used over nailable structural sheathing, the Span Rating of APA RATED SIDING panels refers to the maximum recommended spacing of vertical rows of nails rather than to stud spacing.

For a description of Span Ratings under the Canadian Standard for Construction Sheathing, refer to the [*APA Product Guide: Oriented Strand Board, Form W410*](#).

How to Order APA Panels

Sanded and Touch-Sanded Panels: Designate thickness, APA trademark, grade, Group number^(c), bond classification, dimensions, number of pieces. For example:

- 3/4" APA A-A, Group 1, Exterior, 48" x 96", 100 pcs.
- 3/8" APA Underlayment, Group 1, Exposure 1, 48" x 96", 100 pcs.

(Designate "sanded face" if touch-sanded grades are to be used under resilient flooring, or [see Table 13](#) for additional grades.)

Performance Rated Panels: Designate thickness, APA trademark, grade, Span Rating, bond classification, dimensions, number of pieces. For example:

- 15/32" APA RATED SHEATHING, 32/16, Exposure 1, 48" x 96", 100 pcs.
- 23/32" APA RATED STURD-I-FLOOR 24 oc, Exposure 1, 48"^(d) x 96", 100 pcs. (Note "square edge" or "tongue-and-groove" as desired.)

Rated Sidings: Designate thickness, APA trademark, face grade (for APA RATED SIDING-303), Span Rating, texture, pattern, dimensions, number of pieces. For example:

- 19/32" APA RATED SIDING 303-18-W, 16 oc, rough-sawn Texture 1-11[®], grooves 4" o.c., 48" x 96", 100 pcs. (Note manufacturer's trade name if desired.)

Concrete Form: Designate thickness, APA trademark, Class, dimensions, number of pieces. For example:

- 5/8" APA PLYFORM Class I, 48" x 96", 100 pcs. (Plyform panels are manufactured only as Exterior panels and are mill-oiled unless otherwise specified.)

Overlaid Panels: Designate thickness, APA trademark, grade, Group number, dimensions, number of pieces. For example:

- 1/2" APA MEDIUM DENSITY OVERLAY (MDO) GENERAL or (APA RATED SIDING 303-OL in the case of overlaid panels produced under the APA RATED SIDING-303 manufacturing specification), Group 1, 48" x 96", 100 pcs. (Any special requirements, such as only one side overlaid, surface texture or weight of surfacing material, should be stated after the standard specification.)

Grade Availability

Some panel grades, thicknesses, Span Ratings, or species may be difficult to obtain in some areas. Check with your supplier for availability or include an alternate panel in specifications. Standard panel dimensions are 4 feet by 8 feet, although some mills also produce panels 9 or 10 feet or longer.

Nail Sizes

Various nail penny sizes are referenced throughout this document. For most cases, the appropriate lengths and wire sizes can be found in [Table 5](#).

(a) Exceptions are APA RATED SHEATHING intended for use as wall sheathing only, and APA RATED WALL BRACING. The trademarks for such panels contain a single number similar to the Span Rating for APA RATED SIDING.

(b) For Span Rating of 20, actual support spacing is 19.2 inches.

(c) Underlayment and C-C Plugged panels 1/2 inch and thicker are generally span rated and do not contain species group number in trademark. Designate Span Rating.

(d) Most tongue-and-groove panels are manufactured with a 47-1/2-inch net face width, although manufacturing practices vary. Check with your supplier.

TABLE 5

NAIL SIZES (ASTM F 1667)

Penny Size (d)	Type	Length (in.)	Wire Diameter (in.)
3d	Ring- or screw-shank	1-1/4	0.099*
4d	Finish	1-1/2	0.072
	Box and casing	1-1/2	0.080
	Ring- or screw-shank	1-1/2	0.099*
6d	Finish	2	0.092
	Box and casing	2	0.099
	Siding	1-7/8	0.106
	Common	2	0.113
	Ring- or screw-shank	2	0.120*
8d	Finish	2-1/2	0.099
	Box and casing	2-1/2	0.113
	Siding	2-3/8	0.128
	Common	2-1/2	0.131
	Ring- or screw-shank	2-1/2	0.120* or 0.131*
10d	Box and casing	3	0.128
	Common	3	0.148
16d	Box and casing	3-1/2	0.135
	Common	3-1/2	0.162
	Sinker	3-1/4	0.148

*International Staple, Nail and Tool Association (ISANTA) ESR-1539
link = www.icc-es.org

Metric Conversions

Metric equivalents of nominal thicknesses and common sizes of wood structural panels are tabulated at right (1 inch = 25.4 millimeters):

Panel Storage and Handling

Like all building materials, APA trademarked structural wood panels should be properly stored, handled and installed to assure superior in-service performance.

Protect the edges and ends of panels, especially tongue-and-groove and shiplap-edged panels. Place panels to be moved by forklift on pallets or bunks when received to avoid damage by fork tines.

Panels to be transported on open truck beds should be covered with standard tarpaulins. For open railcar shipment, use “lumber wrap” to avoid extended weather exposure.

Whenever possible, store panels under a roof, especially if they won't be used soon after received. Keep sanded and other appearance grades away from open doorways, and weight down the top panel in a stack to help avoid any possible warpage from humidity. If moisture absorption is expected, cut steel banding on panel bundles to prevent edge damage.

Panels to be stored outside should be stacked on a level platform supported by 4x4 stringers or other blocking. Never leave panels or the platform in direct contact with the ground. Use at least three full-width supports along the 8-foot length of the panel – one centered and the others 12 to 16 inches from each end.

Cover the stack loosely with plastic sheets or tarps. Anchor the covering at the top of the stack, but keep it open and away from the sides and bottom to assure good ventilation. Tight coverings prevent air circulation and, when exposed to sunlight, create a “greenhouse” effect which may encourage mold formation.

PANEL NOMINAL THICKNESS

in.	mm
1/4	6.4
5/16	7.9
11/32	8.7
3/8	9.5
7/16	11.1
15/32	11.9
1/2	12.7
19/32	15.1
5/8	15.9
23/32	18.3
3/4	19.1
7/8	22.2
1	25.4
1-3/32	27.8
1-1/8	28.6

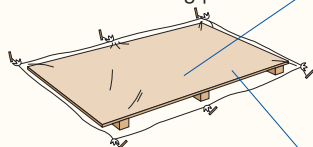
PANEL NOMINAL DIMENSIONS (Width x Length)

ft	Metric Soft Conversion
4 x 8	1220 x 2440
4 x 9	1220 x 2740
4 x 10	1220 x 3050

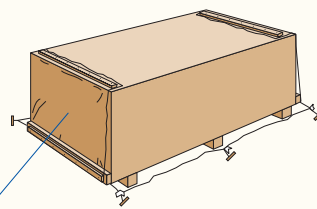
PANEL STORAGE

Build platform of cull panel and scrap lumber 4x4s for stacking panels

Stretch plastic film over platform to block passage of ground moisture



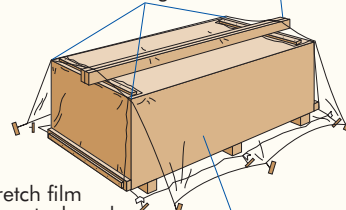
Nail film to top panel and drape over ends for protection against driving rain. Weight lower end with 2x4.



Lay two 2x4s on top of stack

Pad corners with rags

Stretch film over stack and secure to tie-down stakes



PANEL SPECIFICATION GUIDE⁽¹⁾

CSI* Division 3 – Concrete Formwork

A. Materials

1. Forms – Plywood concrete forms shall be (specify appropriate grade):⁽²⁾

APA PLYFORM CLASS I EXT,

APA HIGH DENSITY OVERLAY CON-
CRETE FORM PLYFORM CLASS I EXT, or

APA MEDIUM DENSITY OVERLAY CON-
CRETE FORM PLYFORM CLASS 1 EXT.

Use plywood thickness sufficient to support concrete at temperature and rate poured⁽³⁾; securely brace and shore forms to prevent displacement and to safely support construction loads.

CSI* Division 6 – Wood and Plastics

A. General Provisions

1. Identification Requirements – Each panel shall be identified with the appropriate trademark of APA, and shall meet the requirements of the latest edition of Voluntary Product Standard PS 1, Voluntary Product Standard PS 2 or APA PRP-108 Performance Standards.

2. All panels which have any edge or surface exposed long term to the weather shall be classed Exterior.⁽⁴⁾⁽⁵⁾

3. Panel thickness, grade, and Group number or Span Rating shall be at least equal to that shown on the drawings.⁽⁶⁾ Application shall be in accordance with recommendations of APA.⁽⁷⁾

B. Roof Sheathing

1. Panel roof sheathing shall be (specify appropriate grade):

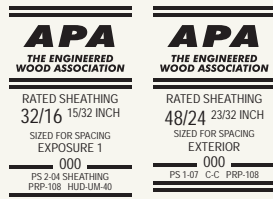
APA RATED SHEATHING EXP 1

APA RATED SHEATHING EXT

APA RATED SHEATHING/CEILING
DECK EXP 1

APA STRUCTURAL I RATED
SHEATHING EXP 1, or

APA STRUCTURAL I RATED
SHEATHING EXT.



Sheathing exposed long term to weather shall be classed Exterior.⁽⁵⁾

Install with the long dimension or strength axis of the panel across supports, except where noted⁽⁸⁾, and with panel continuous over two or more spans. For pitched roofs, place screened surface or side with skid-resistant coating up, if OSB panels are used. Wear skid-resistant shoes when installing roof sheathing and keep roof deck free of dirt, debris and sawdust during construction. Suitable edge support shall be provided where indicated on drawings (or in recommendations of APA)⁽⁶⁾ by use of panel clips, tongue-and-groove edges, or lumber blocking between joists. Panel end joints shall occur over framing.

Spacing of 1/8" is recommended at all panel ends and edges, unless otherwise indicated by the panel manufacturer.⁽⁹⁾

Unless special nail provisions are required (e.g., high wind areas), nail 6" o.c. along supported panel edges and 12" o.c. at intermediate supports, except that when supports are spaced 48" o.c. or more, space nails 6" o.c. at all supports. Use 8d common nails, except that when panels are 1-1/8", use 8d ring-shank or 10d common.⁽¹⁰⁾⁽¹¹⁾⁽¹²⁾⁽²⁴⁾

Cover roof sheathing as soon as possible with roofing felt or shingle underlayment for protection against excessive moisture prior to roofing application.

C. Floors

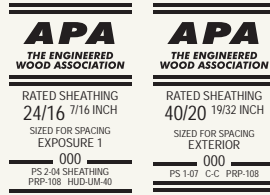
1. Subflooring (under structural finish floor such as wood strip or underlayment) – Panel subflooring shall be (specify appropriate grade):

APA RATED SHEATHING EXP 1

APA RATED SHEATHING EXT

APA STRUCTURAL I RATED
SHEATHING EXP 1, or

APA STRUCTURAL I RATED
SHEATHING EXT.



Install with the long dimension or strength axis of the panel across supports and with panel continuous over two or more spans. Panel end joints shall occur over framing. Spacing of 1/8" is recommended at panel ends and edges, unless otherwise indicated by the panel manufacturer.⁽⁹⁾

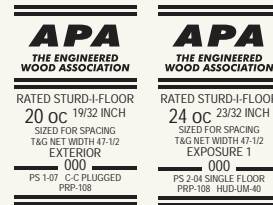
Nail 6" o.c. along supported panel edges and 12" o.c. at intermediate supports with 6d common nails for panels 1/2" or less, 8d for greater thicknesses.⁽²⁴⁾ Where panels are 1-1/8" thick and supports are 48" o.c., nails shall be 8d ring-shank or 10d common and spaced 6" o.c. at all supports.⁽¹⁰⁾⁽¹¹⁾⁽¹²⁾⁽²⁴⁾

Sand subfloor joints if necessary to smooth surface prior to installing underlayment or finish flooring.

2. Combined subfloor-underlayment (under carpet and pad)⁽¹³⁾ – Combined subfloor-underlayment panels shall be (specify appropriate grade):

APA RATED STURD-I-FLOOR EXP 1, or

APA RATED STURD-I-FLOOR EXT.



Install with the long dimension or strength axis of the panel across supports and with panel continuous over two or more spans. Panel edges shall be tongue-and-groove or supported on 2-inch lumber blocking installed between joists. Protect against damage until finish floor is installed.

Stagger panel end joints. Panel end joints shall occur over framing. Spacing of 1/8" is recommended at panel ends and edges, unless otherwise indicated by the panel manufacturer.⁽⁹⁾

*Construction Specifications Institute
Notes to Specifiers on page 18

For nailed floors, nail panels 6" o.c. at supported panel edges and 12" o.c. at intermediate supports, except that when supports are spaced 48" o.c., space nails 6" o.c. at all supports. Use 6d ring- or screw-shank nails for panels 3/4" thick or less, and 8d for thicker panels.⁽²⁴⁾ With 1-1/8" panels, 10d common nails may be used if supports are well seasoned.⁽¹⁰⁾⁽¹¹⁾⁽¹²⁾⁽²⁴⁾

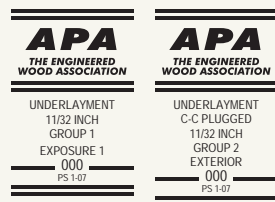
Fill and thoroughly sand edge joints.⁽¹⁴⁾ Lightly sand any surface roughness, particularly around fasteners.

For field-glued floors, use adhesives meeting **APA Specification AFG-01** or **ASTM D3498**, applied in accordance with the manufacturer's recommendations. If OSB panels with sealed surfaces and edges are used, use only solvent-based glues; check with panel manufacturer. Apply continuous line of glue (1/4" thick) on joists, and continuous or spaced line of glue (1/8" thick) in groove of tongue-and-groove panels. Use 6d ring- or screw-shank nails spaced 12" o.c. at panel ends and intermediate bearings.⁽¹⁵⁾⁽²⁴⁾

3. Underlayment (over subflooring)

– Plywood underlayment shall be (specify appropriate grade)⁽¹⁶⁾:

APA UNDERLAYMENT EXP 1
APA UNDERLAYMENT C-C
PLUGGED EXT, or
APA C-C PLUGGED EXT.



Plywood 19/32" or thicker, APA RATED STURD-I-FLOOR EXP 1 or APA RATED STURD-I-FLOOR EXT may be specified. Apply underlayment just prior to laying finish floor and protect against damage until finish floor is installed.

For maximum stiffness, install underlayment with the face grain across supports. Stagger underlayment end joints at least one joist spacing (optional under carpet and pad) with respect to subfloor end joints and offset all edge joints by at least two inches from edge joints in the subfloor panels. Underlayment panel end joints should be offset two inches from framing below subfloor to avoid

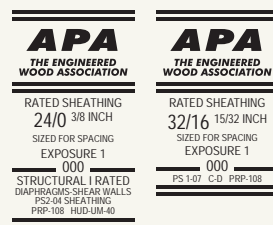
nailling into framing (which may lead to nail pops). **Butt panel ends and edges to a close but not tight fit (1/32" space is recommended).** Nail 6" o.c. along panel edges and 8" o.c. each way throughout remainder of panel with 3d ring-shank nails for panel thicknesses of 11/32" to 1/2", or 4d spaced 6" o.c. along edges and 12" o.c. each way for thicker panels up to 3/4".⁽¹¹⁾⁽¹⁷⁾⁽²⁴⁾ Fastener length should be approximately equal to the total thickness of the underlayment and subfloor.

Fill and thoroughly sand edge joints.⁽¹⁴⁾ Lightly sand any surface roughness, particularly around fasteners.

D. Wall Sheathing

1. Panel wall sheathing shall be (specify appropriate grade):

APA RATED SHEATHING EXP 1
APA RATED SHEATHING EXT
APA STRUCTURAL I RATED SHEATHING EXP 1,
APA STRUCTURAL I RATED SHEATHING EXT, OR
APA RATED WALL BRACING EXP 1.



Spacing of 1/8" is recommended at panel ends and edges, unless otherwise indicated by the panel manufacturer.⁽⁹⁾

Nail 6" o.c. along supported panel edges and 12" o.c. at intermediate supports with 6d common nails for panels 1/2" and less, and 8d for greater thicknesses.⁽¹⁰⁾⁽¹²⁾⁽²⁴⁾

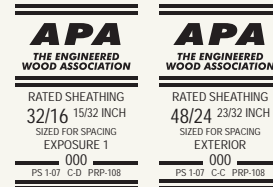
Apply weather-resistant barrier over panel wall sheathing.

E. Treated Plywood

1. **Fire-retardant-treated plywood** – All plywood shall be pressure-treated in accordance with American Wood-Preservers' Association Standard AWPA U1 with an approved (high temperature Interior Type A-HT) (Exterior Type) fire retardant. Each panel shall be labeled or marked by an approved independent

testing agency. After treatment, plywood shall be dried to an average moisture content of 15 percent or less.

Plywood shall be all-veneer APA RATED SHEATHING (or better, depending on appearance desired) EXP 1 or EXT.

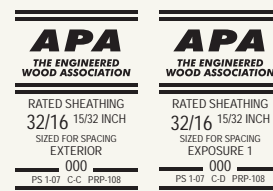


Note: Span Ratings and load capacities are based on untreated panels, and may not apply following fire-retardant treatment (FRT). Obtain structural performance characteristics of FRT panels from the company providing the treatment and redrying service.

2. **Preservative-treated plywood** – Treated plywood for (state application) shall be pressure-treated in accordance with AWPA U1 with (creosote) (penta-chlorophenol) (waterborne) preservatives, as required for (coastal water) (wood foundation) (ground contact) (above ground) exposure. Plywood treated with waterborne preservatives shall be dried after treatment to a moisture content of 18 percent or less.

All treated plywood used in the Permanent Wood Foundation System (PWF) shall be marked PS 1, PS 2 or APA Standard PRP-108, and marked by an approved inspection agency certified to inspect preservative-treated wood, indicating compliance with the treating, drying, retention and penetration requirements of AWPA Standard U1, or equivalent code-approved preservative-treating and quality control requirements. The mark shall also identify the intended use as Permanent Wood Foundation material.

Plywood shall be all-veneer APA RATED SHEATHING (or better, depending on appearance desired) EXP 1 or EXT.



Notes to Specifiers on page 18

F. Glued Plywood Components

1. General – All plywood components shall be fabricated in accordance with the appropriate APA Fabrication Specification.⁽¹⁸⁾ Each original plywood panel shall bear the appropriate trademark of APA. Glue shall be of resorcinol or phenolic resin base (for outdoor exposure), or casein with a mold inhibitor (for indoor exposure).

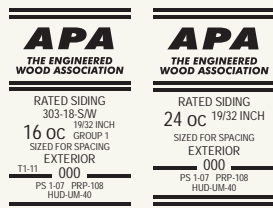
CSI* Division 7 – Thermal and Moisture Protection

A. Siding

Siding shall be (specify appropriate grade):⁽¹⁹⁾

APA RATED SIDING EXT, or

APA MEDIUM DENSITY OVERLAY (MDO) GENERAL EXT.



Spacing of 1/8" is recommended at panel ends and edges, unless otherwise indicated by the panel manufacturer. Nail panel siding 6" o.c. along panel edges and 12" o.c. at intermediate supports with 6d nonstaining⁽²⁰⁾ box, casing or siding nails for panels 1/2" and less, and 8d for greater thicknesses.⁽¹⁰⁾⁽²⁴⁾

Nail lap siding installed over nailable panel or lumber sheathing 8" o.c. along bottom edge, unless otherwise recommended by manufacturer. Nail lap siding installed direct to studs or over nonstructural sheathing at each stud. Use 6d nonstaining⁽²⁰⁾ box, casing, or siding nails for siding 1/2" thick, and 8d for thicker panels.⁽²⁴⁾ If siding is applied over non-structural sheathing, use next regular nail size. Use nonstaining box nails for siding installed over foam insulation sheathing.

Prior to installing siding, apply weather resistant barrier (e.g., building paper) over studs or sheathing.⁽⁶⁾

All panel edges should be sealed. For panels to be painted, sealer can be paint primer; for panels to be stained, sealer should be a water-repellent preservative compatible with the finish.

B. Soffits

Soffits shall be (specify appropriate grade):⁽⁵⁾

APA A-C EXT

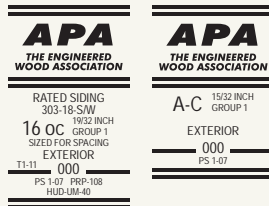
APA B-C EXT

APA C-C P&TS EXT

APA RATED SIDING 303 EXT,⁽¹⁹⁾ or

APA MEDIUM DENSITY OVERLAY (MDO) GENERAL EXT.⁽²¹⁾

Nail 6" o.c. at supported panel edges and 12" o.c. at intermediate supports, with 6d nonstaining⁽²⁰⁾ box, casing, or siding nails for panels 1/2" and less, and 8d for thicker panels up to 3/4".⁽²⁴⁾



CSI* Division 9 – Finishes (Painting)⁽¹⁹⁾

A. Preparation of Surfaces

1. Exterior Panels – Panels to be exposed outdoors shall have all edges sealed. With paint, sealer may be a liberal coat of exterior house paint primer. With stain, seal with water-repellent preservative compatible with finish coat.

Surface shall be clean, dry and free of loose wood fibers.

2. Interior Panels – Surface shall be clean, dry and free of loose wood fibers. Holes and cracks shall be filled with putty or plastic wood (except for rustic type panels intended for stain finish). After dry, sand lightly in the direction of the grain of face veneer or texture to match existing surfaces.

Any tree pitch or sap spots shall be first touched up with a sealer.

B. Application of Finish

(Specify by brush, roller, or spray; brush application of the first coat gives best performance.)

Exterior Panels, Painted – *First coat:* Exterior stain-blocking primer as recommended by manufacturer of finish coat. (May be tinted.) Apply quantity as recommended by paint manufacturer.

Second coat: Top-quality exterior all-acrylic latex house paint designed for use with primer; color as selected. Two topcoats provide better performance.

Exterior Panels, Stained – *First coat:* Top-quality exterior penetrating semitransparent oil stain where grain showthrough is desired⁽²²⁾; or heavily pigmented solid-color oil or latex stain where grain is to be masked⁽²³⁾; color as selected. Apply in one or two coats as recommended by manufacturer.

Use stain-blocking primer with light-colored solid-color latex stains.

Interior Panels, Painted – *First coat:* Stain-blocking primer as recommended by manufacturer of finish coat.

Second coat: Flat, semi-gloss or gloss topcoat designed for use with primer; color as selected. Use two topcoats if needed to cover.

Interior Panels, Color Tone – *First coat:* Stain and companion sealer mixed to selected color (or sealer, then stain applied separately).

Second coat: Interior satin varnish (additional coats can be applied as desired for depth of luster).

Interior Panels, Light Stain – *First coat:* Pigmented resin sealer (wiped off when tacky).

Second coat: Clear resin sealer.

Third coat: Tinted undercoat; thin enamel; pigmented sealer; or light stain applied thinly and wiped to the desired color depth; color as selected.

Fourth coat: Interior satin varnish (additional coats can be applied as desired for depth of luster).

*Construction Specifications Institute
Notes to Specifiers on page 18

Notes to Specifiers:

- (1) The APA trademarks shown here are typical examples only. Refer to the following sections for specific panel grade and thickness recommendations.
- (2) Structural I grade (all plies limited to Group 1 species) can be specified when greater stiffness or strength is required.
- (3) Thickness recommendations are contained in *APA Design/Construction Guide: Concrete Forming*, Form V345.
- (4) Exposure 1 may be specified for applications where temporary exposure to the weather will be required.
- (5) Open soffits or roof sheathing exposed on the underside may be any panel classed Exposure 1 where appearance is not a major consideration.
- (6) Refer to the appropriate application recommendations in this brochure.
- (7) References to APA's recommendations may allow subsequent specification concerning nailing, edge support and panel orientation to be omitted.
- (8) Long dimension of panel may be parallel to supports if panel has adequate thickness. See Table 32 for roof panels applied parallel to supports.
- (9) Supported panel joints shall occur approximately along the centerline of framing with a minimum bearing of 1/2".
- (10) Engineered shear walls and diaphragms may require additional nailing. See recommendations in Tables 28 and 37. Diagonal bracing is not required for braced wall sections when panel wall sheathing, APA RATED WALL BRACING or panel siding (APA RATED SIDING) is used.
- (11) Other code-approved fasteners may be used.
- (12) Fasteners shall be located 3/8" from panel edges.
- (13) Specify veneer-faced STURD-I-FLOOR with "sanded face" when resilient flooring is to be applied (or see note 16 for additional grades). Otherwise, an additional layer of "sanded face" underlayment is recommended when resilient flooring is to be applied over STURD-I-FLOOR.
- (14) This step may not be necessary under some carpet and structural flooring products – check with flooring manufacturer.
- (15) Major model building codes accept 12" spacing with glue but some local codes may require closer spacing at edges. When panels greater than 3/4" thick are used in glued floors, use same fastener schedule as for nailed-only construction.
- (16) For areas to be covered with resilient flooring or fully adhered carpeting, specify Underlayment or C-C Plugged panel grades marked "sanded face." Underlayment A-C, Underlayment B-C, Marine EXT or sanded plywood grades marked "Plugged Crossbands Under Face," "Plugged Crossbands (or Core)," "Plugged Inner Plies" or "Meets Underlayment Requirements" may also be used under resilient flooring or fully adhered carpeting.
- (17) For 1/4"-thick panels, nail 3" o.c. along panel edges and 6" o.c. each way throughout remainder of panel, with 3d ring-shank nails.
- (18) Design and fabrication specifications for plywood box beams, stressed-skin panels, curved panels, sandwich panels and all-plywood beams are available from APA.
- (19) See *APA Product Guide: Performance Rated Siding*, Form E300.
- (20) Hot-dip or hot-tumbled galvanized steel nails are recommended for most siding applications. For best performance, stainless steel nails or aluminum nails should be considered. APA tests also show that electrically or mechanically galvanized steel nails appear satisfactory when plating meets or exceeds thickness requirements of ASTM A641 Class 2 coatings, and is further protected by yellow chromate coating.

Note: Galvanized fasteners may react under wet conditions with the natural extractives of some wood species and may cause staining if left unfinished. Such staining can be minimized if the siding is finished in accordance with APA recommendations, or if the roof overhang protects the siding from direct exposure to moisture and weathering.
- (21) Specify MDO plywood with one face of Medium Density Overlay as described in Voluntary Product Standard PS 1.
- (22) Semitransparent stains may be used on plywood face grades 303-OC, 303-NR and 303-6-W. Other 303 face grades should not be finished with semitransparent stains unless specifically recommended by the panel manufacturer.
- (23) Only latex formulations are recommended on APA 303-SR and 303-NR grades of plywood siding.
- (24) See Table 5 for nail dimensions.

GLULAM SELECTION AND SPECIFICATION

Glued laminated timber (glulam) is made up of wood laminations, or “lams,” that are bonded together with adhesives. The grain of all laminations runs parallel with the length of the member. Individual lams typically are 1-3/8 inches thick for southern pine and 1-1/2 inches thick for Western species, although other thicknesses may also be used. Glulam products typically range in net widths from 2-1/2 to 10-3/4 inches, although virtually any width can be custom produced.

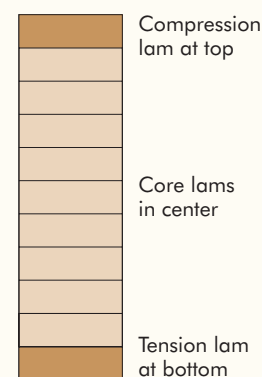
Balanced and Unbalanced Beams

Glulam may be manufactured as unbalanced or balanced members.

The most critical zone of a glulam bending member with respect to controlling strength is the outermost tension zone. In unbalanced beams, the quality of lumber used on the tension side of the beam is higher than the lumber used on the corresponding compression side, allowing a more efficient use of the timber resource. Therefore, unbalanced beams have different bending stresses assigned to the compression and tension zones and must be installed accordingly. To assure proper installation of unbalanced beams, the top of the beam is clearly stamped with the word “TOP.” Unbalanced beams are primarily intended for simple-span applications even though they can also be used in multiple-span applications when properly designed.

Balanced members are symmetrical in lumber quality about the mid-height. Balanced beams are used in applications, such as long cantilevers or continuous spans, where either the top or bottom of the member may be highly stressed in tension due to service loads. They can also be used in single-span applications, although an unbalanced beam is more efficient for this use.

STANDARD BEAM LAYUP



Allowable Design Properties

Allowable design properties are a key factor in specifying glulam. Bending members are typically specified on the basis of the maximum allowable bending stress of the member. For example, a 24F designation indicates a member with an allowable bending stress of 2400 psi. Similarly, a 30F designation refers to a member with an allowable bending stress of 3000 psi. These different stress levels are achieved by varying the species and percentages and grade of higher quality lumber in the beam layup.

To identify whether the lumber used in the beam is visually or mechanically graded, the stress combination also includes a second set of designations. For example, for an unbalanced 24F layup using visually graded lumber, the layup designation may be identified as a 24F-V4. The “V” indicates that the layup uses visually graded lumber. (“E” is used for mechanically graded lumber.) The number “4” further indicates a specific combination of lumber used to which a full set of design stresses, such as horizontal shear, MOE, etc., are assigned. The glulam industry recently introduced the concept of specifying glulam based on a stress class system similar to that used for MSR lumber or LVL. This requires only specifying an F_b - E value. Typical stress classifications are in [Table 6](#). See also [Engineered Wood Systems Data File: Glulam Design Properties and Layup Combinations, Form EWS Y117](#).

Sizes

Glulam is available in both custom and stock sizes. Stock beams are manufactured in commonly used dimensions and cut to length when the beam is ordered from a distributor or dealer. Typical stock beam widths used in residential construction include: 3-1/8, 3-1/2, 5-1/8, 5-1/2, and 6-3/4 inches.

TABLE 6

**DESIGN VALUES FOR STRUCTURAL GLUED LAMINATED SOFTWOOD TIMBER
(Members stressed primarily in bending)**

(Tabulated design values are for normal load duration and dry service conditions.)

Stress Class	Bending About X-X Axis Loaded Perpendicular to Wide Faces of Laminations					Bending About Y-Y Axis Loaded Parallel to Wide Faces of Laminations				Axially Loaded			Fasteners
	Extreme Fiber in Bending					Extreme Fiber in Bending	Compres- sion Perpen- dicular to Grain	Shear Parallel to Grain (Hori- zontal)	Modulus of Elasticity	Tension Parallel to Grain	Compres- sion Parallel to Grain	Modulus of Elasticity	Specific Gravity for Fastener Design
	Tension Zone Stressed in Tension (Positive Bending)	Compres- sion Zone Stressed in Tension (Negative Bending)	Compres- sion Perpen- dicular to Grain	Shear Parallel to Grain (Hori- zontal)	Modulus of Elasticity								
	F _{bx} ⁺ (psi)	F _{bx} ^{-(a)} (psi)	F _{c,ix} (psi)	F _{vx} ^(d) (psi)	E _x (10 ⁶ psi)	F _{by} (psi)	F _{c,ly} (psi)	F _{vy} ^(e) (psi)	E _y (10 ⁶ psi)	F _t (psi)	F _c (psi)	E _{axial} (10 ⁶ psi)	G
16F-1.3E	1600	925	315	195	1.3	800	315	170	1.1	675	925	1.2	0.42
20F-1.5E	2000	1100	425	210 ^(f)	1.5	800	315	185	1.2	725	925	1.3	0.42
24F-1.7E	2400	1450	500	210 ^(f)	1.7	1050	315	185	1.3	775	1000	1.4	0.42
24F-1.8E	2400	1450 ^(b)	650	265 ^(c)	1.8	1450	560	230 ^(c)	1.6	1100	1600	1.7	0.50 ⁽ⁱ⁾
26F-1.9E ^(a)	2600	1950	650	265 ^(c)	1.9	1600	560	230 ^(c)	1.6	1150	1600	1.7	0.50 ⁽ⁱ⁾
28F-2.1E SP ^(a)	2800	2300	740	300	2.1 ⁽ⁱ⁾	1600	650	260	1.7	1250	1750	1.7	0.55
30F-2.1E SP ^{(a)(h)}	3000	2400	740	300	2.1 ⁽ⁱ⁾	1750	650	260	1.7	1250	1750	1.7	0.55

(a) For balanced layouts, F_{bx}^- shall be equal to F_{bx}^+ for the stress class. Designer shall specify when balanced layout is required.(b) Negative bending stress, F_{bx}^- , is permitted to be increased to 1850 psi for Douglas-fir and to 1950 psi for southern pine for specific combinations. Designer shall specify when these increased stresses are required.(c) For structural glued laminated timber of **southern pine**, the basic shear design values, F_{vx} and F_{vy} , are permitted to be increased to **300 psi**, and **260 psi**, respectively.(d) The design value for shear, F_{vx} , shall be decreased by multiplying by a factor of 0.72 for non-prismatic members, notched members, and for all members subject to impact or cyclic loading. The reduced design value shall be used for design of members at connections that transfer shear by mechanical fasteners. The reduced design value shall be used for determination of design values for radial tension and torsion.

(e) Design values are for timbers with laminations made from a single piece of lumber across the width or multiple pieces that have been edge bonded. For timbers manufactured from multiple piece laminations (across width) that are not edge bonded, value shall be multiplied by 0.4 for members with 5, 7, or 9 laminations or by 0.5 for all other members. This reduction shall be cumulative with the adjustment in footnote d.

(f) Certain southern pine combinations may contain lumber with wane. If lumber with wane is used, the design value for shear parallel to grain, F_{vx} , shall be multiplied by 0.67 if wane is allowed on both sides. If wane is limited to one side, F_{vx} shall be multiplied by 0.83. This reduction shall be cumulative with the adjustment in footnote d.

(g) 26F, 28F, and 30F beams are not produced by all manufacturers, therefore, availability may be limited. Contact supplier or manufacturer for details.

(h) 30F combinations are restricted to a maximum 6 in. nominal width.

(i) For 28F and 30F members with more than 15 laminations, E_x = 2.0 million psi.

(j) For structural glued laminated timber of southern pine, specific gravity for fastener design is permitted to be increased to 0.55.

Design values in this table represent design values for groups of similar glued laminated timber combinations. Higher design values for some properties may be obtained by specifying a particular combination in *Glulam Design Properties and Layout Combinations*, Form EWS Y117. Design values are for members with 4 or more laminations. Some stress classes are not available in all species. Contact manufacturer for availability.

For nonresidential applications, where long spans, unusually heavy loads, or other circumstances control design, custom members are typically specified. Common custom shapes include straight beams, curved beams, pitched and curved beams, radial arches and tudor arches.

Appearance Classification

Glulam is available in a range of appearances, all looking different but having the same structural characteristics for a given strength grade. Glulam appearance classifications are:

Framing. An EWS classification that denotes the member is intended only for use in concealed applications. Beams with this appearance classification are provided in widths designed to fit flush with 2x4 and 2x6 wall framing. **Framing-L** is the same as Framing but denotes that LVL has been used for the outer tension laminations.

Industrial. Used for concealed applications or where appearance is not of primary importance. **Industrial-L** is the same as Industrial but denotes that LVL has been used for outer tension laminations.

Architectural. The appearance of choice in applications where members are exposed to view, because they have a smooth, attractive finish. Stock beams are often supplied with this appearance so they may be exposed to view in the finished structure.

Premium. Available only as a custom order where finished appearance is of primary importance.

All appearance classifications permit natural growth characteristics with varying degrees of open voids permitted. Voids are filled as required by the appearance grade specified using inserts and wood fillers. The appearance classification is not related to lumber layup requirements and thus does not affect design values for the beam. For additional information, refer to *Engineered Wood Systems Technical Note: Glued Laminated Timber Appearance Classifications for Construction Applications*, Form EWS Y110.

Section Properties and Capacities

When selecting a glulam member, the builder, designer, or specifier must use a member with the required section properties to satisfy the load carrying requirements. Different load capacities are possible for different stress level combinations of glulam. Tables giving the load carrying capacities for glulam are included in the *Engineered Wood Systems Data File: Glued Laminated Beam Design Tables*, Form EWS S475.

Camber

Camber is curvature built into a fabricated member (see figure below) which is opposite in direction and magnitude to the calculated deflection which will occur under gravity loads.

The glulam industry recommends that roof beams be cambered for 1-1/2 times the calculated dead load deflection. This will generally be sufficient to assure that the beam will not visibly sag over a period of many years of loading, as may occur with non-cambered wood products. To achieve a level profile, it is recommended that floor beams be only cambered for 1.0 times the calculated dead load deflection.

Camber for glulam beams is specified as either “inches of camber” or as a radius of curvature that is to be used in the manufacturing process. Commonly used curvature radii for commercial applications are 1,600 and 2,000 feet, although any camber may be specified.

Most residential applications require very little or no camber which, in turn, makes glulam the ideal choice. Stock beams are typically supplied with a relatively flat camber radius of 3,500 feet as shown in Table 7, or zero camber. Thus, they have just the right camber for residential construction. If, however, more camber is required, such as for a long-span roof beam, custom beams are available through manufacturers to meet the most exacting specifications.

For additional information on cambering glulam beams, refer to *Engineered Wood Systems Technical Note: Glulam Beam Camber*, Form EWS S550, which provides a camber table for various beam spans and radii of curvature.

BEAM CAMBER PARAMETERS

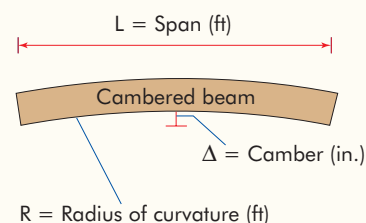


TABLE 7

CAMBER FOR 3,500-FOOT RADIUS

Span in feet:	10	12	14	16	18	20	22	24	26	28
Camber in inches:	.04	.06	.08	.11	.14	.17	.21	.25	.29	.34

Trademarks and Acceptances

Glulam beams manufactured by APA members are certified with the APA EWS (APA Engineered Wood Systems) trademark. The mark (as shown) signifies that the manufacturer is committed to a rigorous program of quality verification and testing and that products are manufactured in conformance with ANSI Standard A190.1-2007, American National Standard for Structural Glued Laminated Timber. The APA EWS trademark is recognized by all major model building codes.

The diagram shows the APA EWS trademark with the following components and callouts:

- 1** Points to **B IND** (Structural use designation)
- 2** Points to **MILL 0000** (Mill number)
- 3** Points to **ANSI A190.1-2007** (ANSI Standard)
- 4** Points to **EWS Y117** (Applicable laminating specification)
- 5** Points to **WW** (Western woods)
- 6** Points to **EWS 24F-1.8E** (Structural grade designation)
- 7** Points to the entire mark (Designation of appearance grade)

Legend:

- 1 Indicates structural use: B-Simple span bending member. C-Compression member. T-Tension member. CB-Continuous or cantilevered span bending member.
- 2 Mill number.
- 3 Identification of ANSI Standard A190.1, Structural Glued Laminated Timber. ANSI A190.1 is the American National Standard for glulam beams.
- 4 Applicable laminating specification.
- 5 Western woods (see note 6).
- 6 Structural grade designation. The APA EWS 24F-1.8E designation is a glulam grade commonly used in residential applications. Allowing a group of six layup combinations made with Douglas fir-larch, spruce-pine-fir, southern pine, and/or hem-fir, this grade provides strength (allowable bending stress of 2,400 psi and allowable shear stress of 215 psi) and stiffness (modulus of elasticity of 1.8×10^6 psi) needed for typical residential applications, while greatly simplifying the design specification.
- 7 Designation of appearance grade. FRAMING, FRAMING-L*, INDUSTRIAL, INDUSTRIAL-L*, ARCHITECTURAL, or PREMIUM.
*LVL used for tension laminations.

Typical information included in an APA EWS trademark is shown above. This information may vary depending on whether the member is supplied as a custom or stock product.

Glulam Beam Storage and Handling

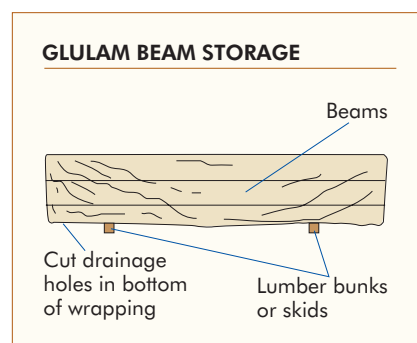
APA EWS trademarked glulam beams are commonly protected with sealants, primers or wrappings when they leave the mill. But care must be taken during loading, unloading and transporting, as well as in the yard and on the job site.

Sealants on the ends of beams help guard against moisture penetration and checking. Apply a coat of sealant to the ends of beams after trimming. Surface sealants, which can be applied to the top, bottom and sides of beams, resist dirt and moisture and help control checking and grain raising. Use a penetrating sealant if beams will be stained or given a natural finish.

A primer coat also protects beams from moisture and dirt and provides a paintable surface.

Water-resistant wrappings are another way to protect beams from moisture, dirt and scratches. Because sunlight can discolor beams, opaque wrappings are recommended. Beams can be wrapped individually, by the bundle or by the load. In situations where appearance is especially important, the wrapping can be removed after installation to avoid damage.

If possible, store glulam under cover to protect them from rain and sunlight. Place the beams on spaced lumber bunks on level, well-drained ground. In some instances, the wrappings can be used to protect beams until installation. Again, seal ends of beams immediately after trimming. Once beams are installed, allow them to gradually season and adjust to the temperature and moisture conditions of the structure.



GLULAM SPECIFICATION GUIDE

The following is a guide for preparing specifications for structural glued laminated timber used for bending members such as purlins, beams, or girders or for axially loaded members such as columns or truss chords.

A. General

1. Structural glued laminated timber shall be furnished as shown on the plans and in accordance with the following specifications. (Where other uses or requirements are applicable, modify specifications accordingly.)

2. For custom designed members, shop drawings and details shall be furnished by the (manufacturer) (seller) and approval obtained from the (architect) (engineer) (general contractor) (buyer) before fabrication is begun.

3. The (manufacturer) (seller) (general contractor) shall furnish connection steel and hardware for joining structural glued laminated timber members to each other and to their supports, exclusive of anchorage embedded in masonry or concrete, setting plates, and items field-welded to structural steel. Steel connections shall be finished with a minimum of one coat of rust-inhibiting paint.

B. Manufacture

1. Materials, Manufacture and Quality Assurance – Structural glued laminated timber of softwood species shall be in conformance with *ANSI Standard A190.1, American National Standard for Structural Glued Laminated Timber*, or other code-approved design, manufacturing and/or quality assurance procedures.

2. End-Use Application – Structural glued laminated timber members shall be manufactured for the following structural uses as applicable: (Simple span bending member – B) (continuous or cantilever span bending member – CB) (compression member – C) (tension member – T).

3. Design Values – Structural glued laminated timber shall provide design values for normal load duration and dry-use condition.⁽¹⁾⁽²⁾ The design should specify a layup combination from *Engineered Wood Systems Glulam Design Properties, Form EWS Y117*, or specify a stress combination from Table 6.

4. Appearance Grade – Glulam shall be (framing) (framing-L) (industrial) (industrial-L) (architectural) (premium) grade⁽³⁾ in accordance with ANSI Standard A190.1.

5. Laminating Adhesives – Adhesives used in the manufacture of structural glued laminated timber shall meet requirements for (wet-use) (dry-use) service conditions.⁽¹⁾

6. Camber (when applicable) – Structural glued laminated timber (shall) (shall not) be manufactured with a built-in camber.

7. Preservative Treatment (when applicable) – Glulam shall be pressure treated after manufacture in accordance with American Wood Protection Association (AWPA) Standard U1 with (creosote or creosote/coal tar solution) (pentachlorophenol in oil) (pentachlorophenol in light solvent) (copper naphthenate) preservatives as required for (soil contact) (above ground) exposure.

8. Fire Resistance (when applicable) – Glulam shall be sized and manufactured for one-hour fire resistance.⁽⁴⁾ The use of pressure impregnated fire retardant treatments is **not** recommended.

9. Protective Sealers and Finishes – Unless otherwise specified, sealer shall be applied to the ends of all members. Surfaces of members shall be (not sealed) (sealed with penetrating sealer) (sealed with primer/sealer coating).⁽⁵⁾

10. Trademarks – Members shall be marked with the Engineered Wood Systems APA EWS trademark indicating conformance with the manufacturing, quality assurance and marking provisions of ANSI Standard A190.1.

11. Certificates (when applicable) – A Certificate of Conformance may be provided by the (manufacturer) (seller) to indicate conformance with ANSI Standard A190.1 if requested.

12. Protection for Shipment – Members shall be (not wrapped) (load wrapped) (bundle wrapped) (individually wrapped) with a water-resistant covering for shipment.

Notes to Specifiers:

- (1) Dry service condition – moisture content of the member will be below 16 percent in service; wet service condition – moisture content of the member will be at or above 16 percent in service. When structural glued laminated timber members are to be preservative treated, wet-use adhesives must be specified.
- (2) An alternative to specifying a layup combination or stress combination is to specify the required allowable design stresses for the specific design application.
- (3) Appearance classifications are described in *Engineered Wood Systems Technical Note: Glued Laminated Timber Appearance Classifications for Construction Applications, Form EWS Y110*.
- (4) When structural glued laminated timber with one-hour fire resistance is specified, minimum size limitations and additional lamination requirements are applicable. Supporting steel connectors and fasteners also must be protected to achieve a one-hour fire rating. Cover with fire-rated (Type X) gypsum wallboard or 1-1/2" wood, to provide the needed protection.
- (5) Specify a penetrating sealer when the finish will be natural or a semitransparent stain. Primer/sealer coatings have a higher solids content and provide greater moisture protection, and are suitable for use with opaque or solid-color finishes.

I-JOIST SELECTION AND SPECIFICATION

I-joists are “I”-shaped engineered wood structural members designed for use in residential and nonresidential construction. The product is prefabricated using sawn or structural composite lumber flanges and plywood or OSB webs, bonded together with exterior type adhesives. To simplify the specification and use of I-joists, APA introduced the APA Performance Rated I-Joist (PRI). The joist is limited to a $L/480$ live load maximum deflection (where L = span) for glued-nailed residential floor applications, a criteria which provides superior floor performance.

APA Performance Rated I-Joists are identified by their net depth followed by a designation, such as PRI-30, which relates to the joist strength and stiffness. APA PRIs are available in four depths: 9-1/2, 11-7/8, 14, and 16 inches.

Most manufacturers supply I-joists to distributors and dealers in lengths up to 60 feet. These are then cut to frequently used lengths such as 16 to 36 feet. Check local supplier for availability.

APA PRI-400

APA PRIs are manufactured in accordance with *Performance Standard for APA EWS I-Joists, PRI-400, Form X720*. This Performance Standard provides an easy-to-use table of allowable spans for applications in residential floor construction, allowing designers and builders to select and use I-joists from various member manufacturers using just one set of span tables.

Residential Floor Spans

Some APA PRIs include in their trademarks allowable spans for uniformly loaded residential floor construction at various I-joist spacings. The specific I-joist needed is easily determined by selecting the span and then choosing the I-joist that meets the span, spacing, and loading criteria. [See Tables 8 and 9.](#)

TABLE 8

ALLOWABLE SPANS FOR APA EWS PERFORMANCE RATED I-JOISTS – SIMPLE SPAN ONLY

Depth	Joist Designation	Simple Span On Center Spacing			
		12"	16"	19.2"	24"
9-1/2"	PRI-20	16'-7"	15'-2"	14'-4"	13'-5"
	PRI-30	17'-1"	15'-8"	14'-10"	13'-10"
	PRI-40	18'-0"	16'-5"	15'-6"	14'-6"
	PRI-50	17'-10"	16'-4"	15'-5"	14'-5"
	PRI-60	18'-11"	17'-4"	16'-4"	15'-3"
11-7/8"	PRI-20	19'-10"	18'-2"	17'-2"	16'-0"
	PRI-30	20'-6"	18'-9"	17'-8"	16'-6"
	PRI-40	21'-5"	19'-7"	18'-6"	16'-8"
	PRI-50	21'-4"	19'-6"	18'-5"	17'-2"
	PRI-60	22'-7"	20'-8"	19'-6"	18'-2"
	PRI-70	23'-0"	21'-0"	19'-10"	18'-6"
	PRI-80	24'-11"	22'-8"	21'-4"	19'-10"
14"	PRI-90	25'-8"	23'-4"	22'-0"	20'-5"
	PRI-40	24'-4"	22'-3"	20'-6"	18'-4"
	PRI-50	24'-4"	22'-2"	21'-0"	19'-7"
	PRI-60	25'-9"	23'-6"	22'-2"	20'-8"
	PRI-70	26'-1"	23'-10"	22'-6"	20'-11"
	PRI-80	28'-3"	25'-9"	24'-3"	22'-7"
16"	PRI-90	29'-1"	26'-5"	24'-11"	23'-2"
	PRI-40	26'-11"	24'-3"	22'-1"	19'-9"
	PRI-50	27'-0"	24'-8"	23'-4"	20'-2"
	PRI-60	28'-6"	26'-0"	24'-7"	22'-10"
	PRI-70	29'-0"	26'-5"	24'-11"	23'-1"
	PRI-80	31'-4"	28'-6"	26'-10"	25'-0"
	PRI-90	32'-2"	29'-3"	27'-7"	25'-7"

Notes:

1. Allowable **clear** span applicable to simple-span residential floor construction with a design dead load of 10 psf and live load of 40 psf. The live load deflection is limited to $\text{span}/480$.
2. 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, or PS 2 with a minimum thickness of 19/32 inch (40/20 or 20 oc) for a joist spacing of 19.2 inches or less, or 23/32 inch (48/24 or 24 oc) for a joist spacing of 24 inches. Adhesive shall meet APA Specification AFG-01 or ASTM D3498. Spans shall be reduced 1 foot when the floor sheathing is nailed only.
3. Minimum bearing length shall be 1-3/4 inches for the end bearings.
4. Bearing stiffeners are **not** required when I-joists are used with the spans and spacings given in this table, except as required for hangers.
5. This span chart is based on uniform loads. For applications with other than uniformly distributed loads, an engineering analysis may be required based on the use of the design properties in [Table 7 of APA Performance Rated I-Joists, Form Z725](#).

TABLE 9

ALLOWABLE SPANS FOR APA EWS PERFORMANCE RATED I-JOISTS – MULTIPLE SPAN ONLY

Depth	Joist Designation	Multiple Span On Center Spacing			
		12"	16"	19.2"	24"
9-1/2"	PRI-20	18'-1"	16'-6"	15'-7"	13'-5"
	PRI-30	18'-7"	17'-0"	16'-1"	15'-0"
	PRI-40	19'-7"	17'-11"	16'-4"	14'-7"
	PRI-50	19'-5"	17'-9"	16'-9"	15'-7"
	PRI-60	20'-8"	18'-10"	17'-9"	16'-6"
11-7/8"	PRI-20	21'-8"	19'-7"	16'-9"	13'-5"
	PRI-30	22'-4"	20'-5"	18'-10"	15'-0"
	PRI-40	23'-5"	20'-5"	18'-7"	16'-7"
	PRI-50	23'-3"	21'-2"	20'-0"	16'-1"
	PRI-60	24'-8"	22'-6"	21'-2"	19'-7"
	PRI-70	25'-1"	22'-10"	21'-7"	18'-6"
	PRI-80	27'-1"	24'-8"	23'-3"	21'-7"
	PRI-90	27'-11"	25'-5"	23'-11"	22'-2"
14"	PRI-40	25'-11"	22'-5"	20'-5"	18'-3"
	PRI-50	26'-6"	24'-2"	20'-2"	16'-1"
	PRI-60	28'-0"	25'-7"	24'-1"	19'-9"
	PRI-70	28'-5"	25'-11"	23'-2"	18'-6"
	PRI-80	30'-10"	28'-0"	26'-5"	23'-11"
16"	PRI-90	31'-8"	28'-10"	27'-1"	25'-2"
	PRI-40	27'-11"	24'-2"	22'-0"	19'-8"
	PRI-50	29'-6"	24'-3"	20'-2"	16'-1"
	PRI-60	31'-1"	28'-4"	24'-9"	19'-9"
	PRI-70	31'-7"	27'-10"	23'-2"	18'-6"
	PRI-80	34'-2"	31'-1"	29'-3"	23'-11"
	PRI-90	35'-1"	31'-10"	30'-0"	26'-7"

Notes:

1. Allowable **clear** span applicable to multiple-span residential floor construction with a design dead load of 10 psf and live load of 40 psf. The end spans shall be 40 percent or more of the adjacent span. The live load deflection is limited to span/480.
2. 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, or PS 2 with a minimum thickness of 19/32 inch (40/20 or 20 oc) for a joist spacing of 19.2 inches or less, or 23/32 inch (48/24 or 24 oc) for a joist spacing of 24 inches. Adhesive shall meet APA Specification AFG-01 or ASTM D3498. Spans shall be reduced 1 foot when the floor sheathing is nailed only.
3. Minimum bearing length shall be 1-3/4 inches for the end bearings, and 3-1/2 inches for the intermediate bearings.
4. Bearing stiffeners are **not** required when I-joists are used with the spans and spacings given in this table, except as required for hangers.
5. This span chart is based on uniform loads. For applications with other than uniformly distributed loads, an engineering analysis may be required based on the use of the design properties in [Table 7 of APA Performance Rated I-Joists, Form Z725](#).

For more information on selecting APA I-joists, and for design tables, refer to [APA Performance Rated I-Joists, Form Z725](#), available on APA's web site at www.apawood.org.

APA Performance Rated Rim Board®

See page 32 for a description of APA Performance Rated Rim Board.

I-Joist Storage and Handling

Store, stack and handle I-joists vertically, and try to keep joists level. Do not store I-joists in direct contact with the ground. Maintain at least 12 inches between the ground and the I-joists. Protect I-joists from weather, and use stick-ers to separate the bundles. If I-joists are delivered wrapped, do not open bundles until time of installation.

When handling I-joists with a crane on the job site ("picking"), take a few simple precautions to prevent damage to the joists and injury to the work crew: pick I-joists in bundles as shipped by the supplier; orient the bundles so that the webs of the I-joists are vertical; and pick the bundles using a spreader bar if necessary. Do not twist or apply loads to the I-joists when they are horizontal. Never use or try to repair a damaged I-joist.

I-joists are not stable until completely installed, and will not carry any load until fully braced and sheathed. Do not allow workers to walk on joists until the joists are fully installed and braced. To avoid accidents, brace and nail each I-joist as it is installed, using hangers, blocking panels, Rim Board, and/or cross-bridging at joist ends and over each support. For additional storage and handling recommendations, refer to the [Builder Tip: Storage, Handling and Safety Recommendations for APA Performance Rated I-Joists, Form Z735](#).

SCL SELECTION AND SPECIFICATION

Structural composite lumber (SCL), which includes laminated veneer lumber (LVL), parallel strand lumber (PSL), laminated strand lumber (LSL) and oriented strand lumber (OSL), is a family of engineered wood products created by layering dried and graded wood veneers, strands or flakes with waterproof adhesive into blocks of material known as billets, which are subsequently resawn into specified sizes. A brief description of each product is as follows:

Laminated Veneer Lumber (LVL)

LVL is the most widely used of the structural composite lumber products. It is produced by bonding thin wood veneers together in a large billet. The grain of all veneers is parallel to the long direction. The LVL billet is then sawn to desired dimensions depending on the construction application. Some of the products' many uses are headers and beams, hip and valley rafters, scaffold planking, and the flange material for prefabricated wood I-joists. Because LVL is made with scarfed or lapped jointed veneers, LVL is available in lengths far beyond conventional lumber lengths.

Parallel Strand Lumber (PSL)

PSL is manufactured from veneers clipped into long strands laid in parallel formation and bonded together with an adhesive to form the finished structural section. The length-to-thickness ratio of the strands in PSL is around 300. Like LVL and glulam, this product is used for beam and header applications where high bending strength is needed. PSL is also frequently used as load-bearing columns.

Laminated Strand Lumber (LSL)

Similar to PSL, laminated strand lumber is made from flaked wood strands that have a length-to-thickness ratio of approximately 150. Combined with an adhesive, the strands are oriented and formed into a large mat or billet and pressed. LSL is used in a variety of applications from studs to millwork components.

Oriented Strand Lumber (OSL)

Similar to LSL, oriented strand lumber is also made from flaked wood strands. The strand geometry for OSL results in length-to-thickness ratios of approximately 75. Combined with an adhesive, the strands are oriented and formed into a large mat or billet and pressed. OSL is used in a variety of applications from studs to millwork components.

In SCL billets, the grain of each layer of veneer or flakes runs primarily in the same direction. The resulting products out-perform conventional lumber when either face- or edge-loaded. SCL is a solid, highly predictable and uniform engineered wood product that is sawn to consistent sizes and is virtually free from warping and splitting.

Typical uses for SCL include rafters, headers, beams, joists, studs, and columns. Two or three sections of SCL can be joined together to form 3-1/2-inch or 5-1/4-inch members. These thicker sections readily nest into 2x4 or 2x6 framed walls as headers or columns.

Allowable Strength Properties

Structural properties of SCL are evaluated using methods specified in ASTM Standard Specification D 5456 for Structural Composite Lumber. Ongoing quality auditing of SCL is performed by APA. The structural design values for SCL are published on a proprietary basis by manufacturers of SCL and are recognized in their evaluation reports published by model code agencies. [A list of APA EWS SCL manufacturers is available on APA's web site \(www.apawood.org\).](http://www.apawood.org)

APA PERFORMANCE RATED I-JOIST SPECIFICATION GUIDE

The following is a guide for specifying APA Performance Rated I-Joists (PRI) to be used in residential floor applications. These structural products are available in net depths of 9-1/2 inches, 11-7/8 inches, 14 inches, and 16 inches, and can be used for simple- or multiple-span floor construction. Exterior use, or use of wood I-joists in other than protected dry conditions, is not recommended.

A. General

1. APA PRIs shall be furnished and installed as shown by the approved building plans and installation instructions.

2. The designation of APA PRI shall be based on the applicable loading, joist spacing and spans shown in the plans. PRIs may be selected using [Tables 1 and 2 of APA Performance Rated I-Joists, Form Z725](#). For non-uniform loading conditions requiring an engineering analysis, see [Table 7](#) of the above-mentioned guide for PRI joist design properties.

The specification for I-joists required for a specific floor application shall include joist depth, designation, length, and number of pieces required.

*Example: 21 pieces –
APA 9-1/2" PRI-30 x 30 feet long*

3. All accessory products such as I-joist blocking panels, rim boards, squash blocks, web stiffeners, etc., shall be provided and installed in accordance with the [applicable installation details shown in APA Performance Rated I-Joists, Form Z725](#).

4. APA EWS trademarked glued-laminated timber (glulam) or approved structural composite lumber (SCL) shall be furnished for load-bearing joist headers. The depth of these components shall be specified to match the I-joist depth when flush framing is required.

5. The contractor shall use approved connection hardware (joist hangers) as specified in the plans. Such hardware shall be compatible with the width and depth of APA PRIs furnished, to provide flush nailing surfaces at adjoining members and to prevent rotation.

B. Manufacture

1. Materials, Manufacture, and Quality Assurance. Product quality shall conform to the manufacturer's approved quality control manual, with compliance assurance services provided by APA in accordance with building code requirements and the applicable code evaluation report.

2. Trademarks. I-joists shall be marked with the APA EWS trademark indicating conformance with the manufacturing, quality assurance, and marking provisions of [APA EWS Standard PRI-400, Performance Standard for APA EWS I-Joists, Form X720](#), or the applicable manufacturer's code evaluation report.

3. Job Site Shipment. I-joists shall be protected from direct exposure to weather prior to installation.

STRUCTURAL COMPOSITE LUMBER (SCL) SPECIFICATION GUIDE

A. General

1. SCL shall be furnished and installed as shown on the approved building plans and in accordance with the specifications of the SCL manufacturer.

2. The contractor shall use approved hardware and connections as specified in the plans.

B. Manufacture

1. Materials, Manufacture and Quality Assurance. Product quality shall conform to the manufacturer's approved quality control manual, with certification services provided by APA EWS in accordance with building code requirements and the applicable code evaluation report.

2. Trademarks. SCL shall be marked with the APA EWS trademark, indicating conformance with the manufacturer's evaluation report.

3. Job Site Shipment. SCL shall be protected from direct exposure to weather prior to installation.

ADDITIONAL INFORMATION

About APA – The Engineered Wood Association and Engineered Wood Systems

APA – The Engineered Wood Association is a nonprofit trade association of and for structural wood panel, glulam timber, wood I-joist, structural composite lumber, and other engineered wood product manufacturers. Based in Tacoma, Washington, APA represents approximately 150 mills throughout North America, ranging from small, independently owned and operated companies to large integrated corporations.

Always insist on engineered wood products bearing the **mark of quality** – the APA or APA EWS trademark. Your APA engineered wood purchase is not only your highest possible assurance of product quality, but an investment in the many trade services that APA provides on your behalf. The Association's trademark appears only on products manufactured by member mills and is the manufacturer's assurance that the product conforms to the standard shown on the trademark.



For panels, that standard may be an APA performance standard, the Voluntary Product Standard PS 1-07 for Construction and Industrial Plywood or Voluntary Product Standard PS 2-04, Performance Standards for Wood-Based Structural-Use Panels. Panel quality of all APA trademarked products is subject to verification through APA audit.



The APA EWS trademark appears only on engineered wood products manufactured by members of APA. The mark signifies that the manufacturer is committed to a rigorous program of quality verification and testing and that products are manufactured in conformance with an APA or national standard such as ANSI Standard A190.1, American National Standard for Structural Glued Laminated Timber or with a manufacturer's building code evaluation report.

APA's services go far beyond quality testing and inspection. Research and promotion programs play important roles in developing and improving plywood and other panel construction systems, and in helping users and specifiers to better understand and apply engineered wood products. For more information, please see the back cover.

Engineered Wood Construction Guide



APA offers a comprehensive set of services and tools for design and construction professionals specifying and using engineered wood products and building systems. If you're looking for detailed product information, training material, or technical assistance, APA can help.

▶▶▶ **www.apawood.org**, APA's web site, is your link to in-depth design and building support, including a library of more than 400 publications available for instant pdf download or hard-copy purchase.

▶▶▶ **help@apawood.org** or (253) 620-7400 is your connection to the APA Product Support Help Desk. Staffed by specialists who have the knowledge to address a diverse range of inquiries related to engineered wood, the Help Desk can answer your questions about specification and application of APA products.

Tap into APA's extensive knowledge and resources.

- Training materials and assistance, including Wood University, APA's online portal for engineered wood education, located at www.wooduniversity.org
- Information to protect homes against damaging moisture infiltration through the Build a Better Home and Free From Mold programs, including guides and details for builders at www.buildabetterhome.org and an inspection regimen for homeowners at www.freefrommold.org
- More than 150 downloadable CAD details, found at www.apacad.org
- Field representatives in many major U.S. cities and Canada who can answer questions about APA trademarked products

For a list of APA and APA EWS publications, request or download the *APA Publications Index*, Form B300, or the *EWS Publications Index*, Form S400, at www.apawood.org/publications.

APA – THE ENGINEERED WOOD ASSOCIATION HEADQUARTERS

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

DISCLAIMER

The information contained herein is based on APA – The Engineered Wood Association's continuing programs of laboratory testing, product research, and comprehensive field experience. Neither APA, nor its members make any warranty, expressed or implied, or assume any legal liability or responsibility for the use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this publication. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed.

Form No. E30U/Revised September 2007/0800

