

SPECIES CHARACTERISTICS

SPECIES: ASH, BIRCH, MAPLE, POPLAR										
Cut: Plain sliced (flat cut), quarter, rotary										
GRADE DESCRIPTION	AA			A			B			
COLOR AND MATCHING	SAP (WHITE)	HEART (BROWN)	NATURAL	SAP (WHITE)	HEART (BROWN)	NATURAL	SAP (WHITE)	HEART (BROWN)	NATURAL	
Sapwood	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	
Heartwood	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	
Color Streaks or Spots	Slight			Slight	Yes			Yes		
Color Variation	Slight		Yes	Slight	Yes			Yes		
Sharp Color Contrasts at Joints	AWI: Yes		WDMA: Yes	AWI: Yes		WDMA: Yes	WDMA: Yes			
TYPE OF MATCHING										
Book Matched	Yes			Yes			Specify			
Slip Matched	Specify			Specify			Specify			
Pleasuring Matched	Not applicable			Not applicable			Yes			
Random Matched	Specify			Specify			Specify			
End Matched	Specify			Specify			Specify			
Nominal Minimum Width of Face Components*		AWI	WDMA		AWI	WDMA		WDMA		
	Plain-Sliced	5" (127 mm)	5" (127 mm)	Plain-Sliced	4" (102 mm)	4" (102 mm)	Plain-Sliced	3" (76 mm)		
	Quarter/Rift	3" (76 mm)	3" (76 mm)	Quarter/Rift	3" (76 mm)	3" (76 mm)	Quarter/Rift	3" (76 mm)		
	Rotary	5" (127 mm)	5" (127 mm)	Rotary	4" (102 mm)	4" (102 mm)	Rotary	4" (102 mm)		
NATURAL CHARACTERISTICS										
Small Conspicuous Burls & Pin Knots - Combined Avg. Number	2 per 1 square meter (10 square feet)			4 per 1 square meter (10 square feet)			6 per 1 square meter (10 square feet)			
Conspicuous Burls - Max. Size	1/4" (6 mm)			3/8" (9 mm)			1/2" (13 mm)			
Conspicuous Pin Knots - Avg. Number	No			4 per 3 square meters (32 square feet)			3 per 1 square meter (10 square feet)			
Max. Pin Knot Size - Dark Part				1/8" (3 mm)			1/8" (3 mm)			
Max. Pin Knot Size - Total				1/4" (6 mm)			1/4" (6 mm)			
Scattered Sound and Repaired Knots - Combined Avg. Number	No			No			4 per 3 square meters (32 square feet)			
Maximum Size - Sound							3/8" (9 mm)			
Maximum Size - Repaired							1/8" (3 mm)			
Average Number - Repaired							4 per 3 square meters			
Mineral Streaks	No (Maple slight)			Slight			Slight			
Bark Pockets	No			No			Few to 1/8" x 1" (3 mm x 25 mm)			
Worm Tracks	Slight			Slight			Yes			
Vine Marks	Slight			Slight			Slight			
Cross Bars	Slight			Slight			Yes			
MANUFACTURING CHARACTERISTICS										
Rough Cut/Ruptured Grain	No			No			Slight			
Blended Repaired Tapering Hairline Splits	Two 1/32" x 3" (0.8 mm x 76 mm) on panel ends only			Two 1/16" x 6" (1.6 mm x 152 mm)			Four 1/8" x 8" (3 mm x 203 mm)			
Repairs	Very small blending			Small blending			Blending			
SPECIAL CHARACTERISTICS										
Under Color and Matching: Red available in Birch and some Maple only, Brown available in Ash Only.										
Unfilled worm holes, open splits, open joints, open bark pockets, or doze not permitted in above grades. *Outside components will be a different size to allow for edge trim loss and certain types of matching.										

Reference: ©2009, AWI, AWMAC, WI - Architectural Woodwork Standards - 1st Edition, October 1, 2009

SPECIES CHARACTERISTICS

SPECIES: RED AND WHITE OAK									
Cut: Plain sliced (flat cut), quarter, rift and comb grain, rotary									
GRADE DESCRIPTION	AA			A			B		
COLOR AND MATCHING	RED	< OAK >	WHITE	RED	< OAK >	WHITE	RED	< OAK >	WHITE
Sapwood	No		No	5%*		Yes*	10-20%**		Yes
Heartwood	Yes		Yes	Yes		Yes	Yes		Yes
Color Streaks or Spots	Yes			Yes			Yes		
Color Variation	Slight			Slight			Yes		
Sharp Color Contrasts at Joints	AWS: Yes		WDMA: Yes	AWS: Yes		WDMA: Yes	AWS: N/A		WDMA: Yes
TYPE OF MATCHING									
Book Matched	Yes			Yes			Specify		
Slip Matched	Specify			Specify			Specify		
Pleasant Matched	Not applicable			Not applicable			Yes		
Random Matched	Specify			Specify			Specify		
End Matched	Specify			Specify			Specify		
Nominal Minimum Width of Face Components***		AWS	WDMA		AWS	WDMA		AWS	WDMA
	Plain-Sliced	5" (127 mm)	5" (127 mm)	Plain-Sliced	4" (102 mm)	4" (102 mm)	Plain-Sliced	N/A	3" (76 mm)
	Quarter/Rift	3" (76 mm)	3" (76 mm)	Quarter/Rift	3" (76 mm)	3" (76 mm)	Quarter/Rift	N/A	3" (76 mm)
	Rotary	5" (127 mm)	5" (127 mm)	Rotary	4" (102 mm)	4" (102 mm)	Rotary	N/A	4" (102 mm)
NATURAL CHARACTERISTICS									
Small Conspicuous Burls & Pin Knots - Combined Avg. Number	3 per 1 square meter (10 square feet)			4 per 1 square meter (10 square feet)			8 per 1 square meter (10 square feet)		
Conspicuous Burls - Max. Size	1/4" (6 mm)			3/8" (9 mm)			1/2" (13 mm)		
Conspicuous Pin Knots** - Avg. Number	No			4 per 1 square meter (10 square feet)			6 per 1 square meter (10 square feet)		
Max. Pin Knot Size - Dark Part				1/8" (3 mm)			1/8" (3 mm)		
Max. Pin Knot Size - Total				1/4" (6 mm)			1/4" (6 mm)		
Scattered Sound and Repaired Knots - Combined Avg. Number	No			No			4 per 3 square meters (32 square feet)		
Maximum Size - Sound							3/8" (9 mm)		
Maximum Size - Repaired							1/8" (3 mm)		
Average Number - Repaired							4 per 3 square meters		
Mineral Streaks	No			Slight, Blending			Few to 12" (305 mm)		
Bark Pockets	No			No			Few to 1/8" x 1" (3 mm x 25 mm)		
Worm Tracks	No			No			Slight		
Vine Marks	No			Slight			Yes		
Cross Bars	Slight			Slight			Yes		
MANUFACTURING CHARACTERISTICS									
Rough Cut/Ruptured Grain	No			No			Slight		
Blended Repaired Tapering Hairline Splits	Two 1/32" x 3" (0.8 mm x 76 mm) on panel ends only			Two 1/16" x 6" (1.6 mm x 152 mm)			Four 1/8" x 8" (3 mm x 203 mm)		
Repairs	Very small blending			Small blending			Blending		
SPECIAL CHARACTERISTICS									
Ray Fleck****	Slight, Blending			Slight, Blending			Slight, Blending		
Rift and Comb Grain	Rift permits 1" (25 mm) in 12" (305 mm) max. grain slope; 2.5" (63 mm) in 12" (305 mm) max. grain sweep; occasional flake not to exceed 3/8" (9 mm) in width. Comb grain permits 0.5" (12 mm) in 12" (305 mm) max. grain slope; 0.5" (12 mm) in 12" (305 mm) max. grain sweep; occasional flake not to exceed 3/32" (2.45 mm) in width.								
Unfilled worm holes, open splits, open joints, open bark pockets, or doze not permitted in above grades. *Sap allowed in Rotary only unless otherwise specified. **10% Sap allowed in Rift, Comb and Plain-Sliced; 20% sap allowed in Rotary. ***Outside components will be a different size to allow for edge trim loss and certain types of matching. ****In the absence of specific flitch selection by owner representative, the natural distribution of ray fleck in quarter cut Red and White Oak is unlimited.									

Reference: © 2009, AWI, AWMAC, WI – AWS – 1st Edition, October 1, 2009 and WDMA 1.5.1A-04

SPECIES CHARACTERISTICS

SPECIES: WALNUT AND CHERRY								
Cut: Plain sliced (flat cut), quarter, rotary								
GRADE DESCRIPTION	AA			A			B	
COLOR AND MATCHING								
Sapwood	No			No*			No*	
Heartwood	Yes			Yes			Yes	
Color Streaks or Spots	Slight			Slight			Yes	
Color Variation	Slight			Slight			Yes	
Sharp Color Contrasts at Joints	AWI: Yes	WDMA: Yes		AWI: Yes	WDMA: Yes		WDMA: Yes	
TYPE OF MATCHING								
Book Matched	Yes			Yes			Specify	
Slip Matched	Specify			Specify			Specify	
Pleasant Matched	Not applicable			Not applicable			Yes	
Random Matched	Specify			Specify			Specify	
End Matched	Specify			Specify			Specify	
Nominal Minimum Width of Face Components**		AWI	WDMA		AWI	WDMA		WDMA
	Plain-Sliced	5" (127 mm)	5" (127 mm)	Plain-Sliced	4" (102 mm)	4" (102 mm)	Plain-Sliced	3" (76 mm)
	Quarter/Rift	3" (76 mm)	3" (76 mm)	Quarter/Rift	3" (76 mm)	3" (76 mm)	Quarter/Rift	3" (76 mm)
	Rotary	5" (127 mm)	5" (127 mm)	Rotary	4" (102 mm)	4" (102 mm)	Rotary	4" (102 mm)
NATURAL CHARACTERISTICS								
Small Conspicuous Burls & Pin Knots - Combined Avg. Number	3 per 1 square meter (10 square feet)			8 per 1 square meter (10 square feet)			22 per 1 square meter (10 square feet)	
Conspicuous Burls - Max. Size	1/4" (6 mm)			3/8" (9 mm)			1/2" (13 mm)	
Conspicuous Pin Knots - Avg. Number	3 per 1 square meter (10 square feet)			6 per 1 square meter (10 square feet)			11 per 1 square meter (10 square feet)	
Max. Pin Knot Size - Dark Part	1/8" (3 mm)			1/8" (3 mm)			1/8" (3 mm)	
Max. Pin Knot Size - Total	1/4" (6 mm)			1/4" (6 mm)			1/4" (6 mm)	
Scattered Sound and Repaired Knots - Combined Avg. Number	No			No			4 per 3 square meters (32 square feet)	
Maximum Size - Sound							3/8" (9 mm)	
Maximum Size - Repaired							1/8" (3 mm)	
Average Number - Repaired							4 per 3 square meters	
Mineral Streaks	Slight			Slight			Yes	
Bark Pockets	No			No			Few to 1/8" x 1" (3 mm x 25 mm)	
Worm Tracks	No			No			Slight	
Vine Marks	Slight			Occasional			Yes	
Cross Bars	Slight			Occasional			Yes	
MANUFACTURING CHARACTERISTICS								
Rough Cut/Ruptured Grain	No			No			Slight	
Blended Repaired Tapering Hairline Splits	Two 1/32" x 3" (0.8 mm x 76 mm) on panel ends only			Two 1/16" x 6" (1.6 mm x 152 mm)			Two 1/8" x 8" (3 mm x 203 mm)	
Repairs	Very small, blending			Small, blending			Blending	
SPECIAL CHARACTERISTICS								
Gum spots	Occasional (Permitted in Cherry)			Occasional (Permitted in Cherry)			Gum spots and gum streaks (Permitted in Cherry)	
Unfilled worm holes, open splits, open joints, open bark pockets, or doze not permitted in above grades. *Sap is allowed in A and B grades; however the percentage to be agreed to by buyer and seller. **Outside components will be a different size to allow for edge trim loss and certain types of matching. For Walnut and Cherry, conspicuous pin knots means sound knots 1/4" (6.4 mm) or less in diameter with dark centers larger than 1/16" (1.6 mm). Blending pin knots are sound knots 1/4" (6.4 mm) or less in diameter with dark centers of 1/16" (1.6 mm) or less and are allowed in all grades of Walnut and Cherry.								

Reference: ©2009 AWI, AWMAC, WI - Architectural Woodwork Standards - 1st Edition October 1, 2009

SPECIES CHARACTERISTICS

SPECIES: AFRICAN AND HONDURAS MAHOGANY, ANIGRE, MAKORE AND SAPELE								
Cut: Plain sliced (flat cut), quarter, rotary								
GRADE DESCRIPTION	AA			A			B	
COLOR AND MATCHING								
Sapwood	No			No			No	
Heartwood	Yes			Yes			Yes	
Color Streaks or Spots	Slight			Slight			Occasional	
Color Variation	Slight			Slight			Moderate	
Sharp Color Contrasts at Joints	AWI: Yes	WDMA: Yes		AWI: Yes	WDMA: Yes		WDMA: Yes	
TYPE OF MATCHING								
Book Matched	Yes			Yes			Specify	
Slip Matched	Specify			Specify			Specify	
Pleasant Matched	Not applicable			Not applicable			Yes	
Random Matched	Specify			Specify			Specify	
End Matched	Specify			Specify			Specify	
Nominal Minimum Width of Face Components*		AWI	WDMA		AWI	WDMA		WDMA
	Plain-Sliced	5" (127 mm)	5" (127 mm)	Plain-Sliced	4" (102 mm)	4" (102 mm)	Plain Sliced	3" (76 mm)
	Quarter/Rift	3" (76 mm)	3" (76 mm)	Quarter/Rift	3" (76 mm)	3" (76 mm)	Quarter/Rift	3" (76 mm)
	Rotary	5" (127 mm)	5" (127 mm)	Rotary	4" (102 mm)	4" (102 mm)	Rotary	4" (102 mm)
NATURAL CHARACTERISTICS								
Small Conspicuous Burls & Pin Knots - Combined Avg. Number	2 per 1 square meter (10 square feet)			4 per 1 square meter (10 square feet)			6 per 1 square meter (10 square feet)	
Conspicuous Burls - Max. Size	1/4" (6 mm)			3/8" (9 mm)			1/2" (13 mm)	
Conspicuous Pin Knots - Avg. Number				4 per 3 square meters (32 square feet)			3 per 1 square meter (10 square feet)	
Max. Pin Knot Size - Dark Part	No			1/8" (3 mm)			1/8" (3 mm)	
Max. Pin Knot Size - Total				1/4" (6 mm)			1/4" (6 mm)	
Scattered Sound and Repaired Knots - Combined Avg. Number							4 per 3 square meters (32 square feet)	
Maximum Size - Sound	No			No			3/8" (9 mm)	
Maximum Size - Repaired							1/8" (3 mm)	
Average Number - Repaired							4 per 3 square meters	
Mineral Streaks	No			Slight			Occasional	
Bark Pockets	No			No			Few to 1/8" x 1" (3 mm x 25 mm)	
Worm Tracks	No			No			Slight	
Vine Marks	Slight			Slight			Yes	
Cross Bars	Occasional			Occasional			Yes	
MANUFACTURING CHARACTERISTICS								
Rough Cut/Ruptured Grain	No			No			Slight	
Blended Repaired Tapering Hairline Splits	Two 1/32" x 3" (0.8 mm x 76 mm) on panel ends only			Two 1/16" x 6" (1.6 mm x 152 mm)			Two 1/8" x 8" (3 mm x 203 mm)	
Repairs	Very small blending			Small blending			Blending	
SPECIAL CHARACTERISTICS								
*Grade AA will permit occasional slight worm tracks, and Grade A will permit occasional worm tracks.								
Unfilled worm holes, open splits, open joints, open bark pockets, or doze not permitted in above grades.								
*Outside components will be a different size to allow for edge trim loss and certain types of matching.								

Reference: ©2009, AWI, AWMAC, WI - Architectural Woodwork Standards - 1st Edition, October 1, 2009

STRENGTH AND MECHANICAL PROPERTIES (INCH-POUND)

WOOD SPECIES

Common species names	Moisture content	Specific gravity ^b	Static Bending				Compression parallel to grain (lbf/in ²)	Compression perpendicular to grain (lbf/in ²)	Shear parallel to grain (lbf/in ²)	Tension perpendicular to grain (lbf/in ²)	Side hardness (lbf)
			Modulus of rupture (lbf/in ²)	Modulus of elasticity ^c (10 ⁶ lbf/in ²)	Work to maximum load (in-lbf/in ³)	Impact bending (in.)					
Red Alder	Green - 12%	0.37-0.41	6,500-9,800	1.17 - 1.38	8.0 - 8.4	22 - 20	2,960 - 5,820	250 - 440	770 - 1,080	390 - 420	440 - 590
Ash	Green - 12%	0.45-0.60	6,000-15,000	1.04 - 1.74	11.8 - 16.6	-- 43	2,300 - 7,410	350 - 1,420	860 - 2,030	-- 940	-- 1,320
Aspen	Green - 12%	0.35-0.39	5,100-9,100	0.86 - 1.43	5.7 - 7.7	-- 22	2,140 - 5,300	180 - 450	660 - 1,080	-- 260	-- 350
Basswood	Green - 12%	0.32-0.37	5,000-8,700	1.04 - 1.46	5.3 - 7.2	16 --	2,220 - 4,730	170 - 370	600 - 990	280 - 350	250 - 410
Beech	Green - 12%	0.56-0.64	8,600-14,900	1.38 - 1.72	11.9 - 15.1	41 - 43	3,550 - 7,300	540 - 1,010	1,290 - 2,010	720 - 1,010	850 - 1,300
Birch	Green - 12%	0.48-0.65	6,400-16,900	1.17 - 2.17	15.7 - 20.8	34 - 55	2,360 - 8,540	270 - 1,080	840 - 2,240	-- 950	560 - 1,470
Cherry	Green - 12%	0.47-0.50	8,000-12,300	1.31 - 1.49	11.4 - 12.8	29 - 33	3,540 - 7,110	360 - 690	1,130 - 1,700	560 - 570	660 - 950
Elm	Green - 12%	0.46-0.63	7,200-14,800	1.11 - 1.54	11.8 - 19.8	38 - 56	2,910 - 7,050	360 - 1,230	1,000 - 1,920	-- 660	620 - 1,320
Hickory and pecan	Green - 12%	0.56-0.75	9,100-20,200	1.29 - 2.26	13.8 - 31.7	-- 104	3,920 - 9,210	760 - 1,980	-- 2,430	-- 680	-- 1,820
Hard maple	Green - 12%	0.52-0.63	7,900-15,800	1.33 - 1.83	12.5 - 16.5	39 - 48	3,270 - 7,830	600 - 1,470	1,130 - 2,330	-- 720	840 - 1,450
Soft maple	Green - 12%	0.44-0.54	5,800-13,400	0.94 - 1.64	7.8 - 12.5	23 - 32	2,490 - 6,540	370 - 1,000	1,050 - 1,850	-- 600	590 - 950
Red oak	Green - 12%	0.52-0.69	7,400-18,100	1.14 - 2.28	8.0 - 21.5	26 - 54	3,000 - 8,740	550 - 1,250	930 - 2,080	-- 1,050	860 - 1,510
White oak	Green - 12%	0.57-0.88	7,200-18,400	0.88 - 2.05	9.4 - 19.2	-- 50	3,290 - 8,900	530 - 2,840	1,210 - 2,660	-- 940	-- 1,620
Poplar	Green - 12%	0.40-0.42	6,000-10,100	1.22 - 1.58	7.5 - 8.8	24 - 26	2,660 - 5,540	270 - 500	790 - 1,190	510 - 540	440 - 540
Sycamore	Green - 12%	0.46-0.49	6,500-10,000	1.06 - 1.42	7.5 - 8.5	26 --	2,920 - 5,380	360 - 700	1,000 - 1,470	630 - 720	610 - 770
Black walnut	Green - 12%	0.51-0.55	9,500-14,600	1.42 - 1.68	10.7 - 14.6	34 - 37	4,300 - 7,580	490 - 1,010	1,220 - 1,370	570 - 690	900 - 1,010

a Results of tests on small clear specimens in the green and air-dried conditions. Definition of properties impact bending is height of drop that causes complete failure, using 0.71-kg (50-lb) hammer; compression parallel to grain is also called maximum crushing strength; compression perpendicular to grain is fiber stress at proportional limit; shear is maximum shearing strength; tension is maximum tensile strength; and side hardness is hardness measured when load is perpendicular to grain.

b Specific gravity is based on weight when oven-dry and volume when green or at 12% moisture content.

c Modulus of elasticity measured from a simply supported, center-loaded beam, on a span depth ratio of 14/1. To correct for shear deflection, the modulus can be increased by 10%.

Source: Wood Handbook, Wood as an Engineering Material, USDA Forest Service