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Voluntary Product Standard

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CONSTRUCTION AND INDUSTRIAL PLYWOOD



American National Standards Institute

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VOLUNTARY PRODUCT STANDARDS

Voluntary Product Standards are developed under procedures published by the Department of Commerce in Part 10, Title 15, of the Code of Federal Regulations. The purpose of the standards is to establish nationally recognized requirements for products, and to provide all concerned interests with a basis for common understanding of the characteristics of the products. The National Bureau of Standards administers the *Voluntary Product Standards* program as a supplement to the activities of the private sector standardizing organizations.

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For copies of the *Voluntary Product Standards* procedures or for more information concerning the development and use of these standards, you may write to: Office of Engineering Standards Services; National Bureau of Standards; Washington, D.C. 20234.

Construction and Industrial Plywo

Effective August 1, 1974 (See section 7.)

(This Standard, which was initiated by the American Plywood Association, is the *Procedures for the Development of Voluntary Product Standards* of Commerce as a revision of PS 1-66, *Softwood Plywood, Construction and Ind*

1. PURPOSE

The purpose of this voluntary Product Standard is to establish nationally recognized requirements for the principal types and grades of construction and industrial plywood and to provide a basis for common understanding among producers, distributors, and users of the product.

2. SCOPE AND CLASSIFICATION

2.1. Scope—This voluntary Product Standard covers the wood species, veneer grading, glue bonds, panel construction and workmanship, dimensions and tolerances, marking, moisture content, and packing of plywood intended for construction and industrial uses. Also included are test methods to determine compliance, and a glossary of trade terms and definitions. A quality certification program is provided for herein, whereby qualified testing agencies inspect, sample, and test products identified as complying with this Standard. Information regarding generally available sizes, methods of ordering, and reinspecting practices, is provided in the appendix. As an aid in correlating U.S. customary units to metric units, conversion factors for the units used in this Standard are also given in the appendix.

2.2. Classification—The plywood covered by this Standard is classified by exposure capability and grade.

2.2.1. Exposure capability—The plywood covered by this Standard is classified into two types,

Interior and Exterior.
veneer grade and adhesi

2.2.1.1. Interior type—
for interior type plyw
listed in increasing orde

(a) Bonded with inter
glue bond is inten
Adhesive perform
vided in 3.7.1.

(b) Bonded with inter
this glue bond
construction and i
ate delays in pro
expected or condi
water leakage ma
ance requirements

(c) Bonded with ex
Plywood with thi
protected constru
where protection
due to long con
conditions of sir
Adhesive perform
vided in 3.7.3.

2.2.1.2. Exterior type—
retain its glue bond w
dried or otherwise subj
therefore, intended for
sure. Adhesive perform
vided in 3.7.4.

2.2.2. Grade—Within
type, there are a numb
the grade of the venee
tion.

3. REQUIREMENTS

3.1. General—All plywood panels represented as conforming to this Standard shall meet or exceed all applicable requirements set forth herein. Test methods are given in section 4. All terms shall be as defined in section 5. Requirements for grade-marking and certification shall be as given in section 6.

3.2. Wood species

3.2.1. Species groups—For the purpose of this Standard, species shall be any softwood or hardwood species or trade groups listed in table 1 and other species meeting the requirements of 3.2.3.

3.2.1.1. Species segregation—Species which cannot be distinguished in veneer form from similar species shall be classed as the largest numbered species group applicable (Group 4 is larger numbered than Group 1) unless the manufacturer provides valid evidence to the Qualified Inspection and Testing Agency that the species are segregated. Such segregation may be in the form of separation

prior to peeling, mechanical testing for performance capability, or other recognized means.

3.2.2. Species for faces and backs—The species of face and back plys may be from any group listed in table 1. When a face or back is made of more than one piece, the entire ply shall be of the same species. When outer layers consist of two or more plys, the outer or exposed plys are classified as faces (face plys) or backs (back plys) and the unexposed plys (sub-faces and sub-backs) are classified as inner plys, in terms of species requirements as provided in 3.2.3. Requirements for identification of all panels are given in 6.2.

3.2.3. Species for inner plys—Unless otherwise specified herein, inner plys of Groups 1, 2, 3 or 4 panels may be of any species listed in Groups 1, 2, 3 or 4 in table 1. Inner plys of Group 5 panels may be of any species listed in table 1. Unless otherwise specified herein, inner plys of all panels may also be of any softwood species or any hardwood species having a published average specific gravity value of 0.41 or more based on green volume and oven dry weight. The Forest Products Laboratory will be considered as final evaluator of published specific gravity data.

Table 1. Classification of species

Group 1	Group 2	Group 3	Group 4	Group 5	
Apitong ^{(a)(b)}	Cedar, Port Orford	Maple, Black	Alder, Red	Aspen	Basswood
Beech, American	Cypress	Mengkulang ^(a)	Birch, Paper	Bigtooth	Fir, Balsam
Birch	Douglas Fir 2 ^(c)	Meranti, Red ^{(a)(d)}	Cedar, Alaska	Quaking	Poplar, Balsam
Sweet	Fir	Mersawa ^(a)	Fir, Subalpine	Cativo	
Yellow	California Red	Pine	Hemlock, Eastern	Cedar	
Douglas Fir 1 ^(c)	Grand	Pond	Maple, Bigleaf	Incense	
Kapur ^(a)	Noble	Red	Pine	Western Red	
Keruing ^{(a)(b)}	Pacific Silver	Virginia	Jack	Cottonwood	
Larch, Western	White	Western White	Lodgepole	Eastern	
Maple, Sugar	Hemlock, Western	Spruce	Ponderosa	Black (Western Poplar)	
Pine	Lauan	Red	Spruce	Pine	
Caribbean	Almon	Sitka	Redwood	Eastern White	
Ocote	Bagtikan	Sweetgum	Spruce	Sugar	
Pine, Southern	Mayapis	Tamarack	Black		
Loblolly	Red Lauan	Yellow Poplar	Engelmann		
Longleaf	Tangile		White		
Shortleaf	White Lauan				
Slash					
Tanoak					

(a) Each of these names represents a trade group of woods consisting of a number of closely related species.

(b) Species from the genus *Dipterocarpus* are marketed collectively: Apitong if originating in the Philippines; Keruing if originating in Malaysia or Indonesia.

(c) Douglas fir from trees grown in the states of Washington, Oregon, California, Idaho,

Montana, Wyoming, and the Canadian Provinces of Alberta and British Columbia shall be classed as Douglas fir No. 1. Douglas fir from trees grown in the states of Nevada, Utah, Colorado, Arizona and New Mexico shall be classed as Douglas fir No. 2.

(d) Red Meranti shall be limited to species having a specific gravity of 0.41 or more based on green volume and oven dry weight.

3.3. Synthetic repairs

3.3.1. Synthetic fillers—Synthetic fillers shall be limited to the repair of minor defects as specified in this Standard. Synthetic fillers shall meet the requirements of the February 1972 edition of *Approval Procedures and Requirements for Synthetic Repairs*¹ published by the American Plywood Association.

3.3.2. Synthetic shims, patches and plugs—These repairs shall completely fill kerfs or voids; shall present a smooth, level surface; and shall not crack, shrink, or lose their bond. Performance of synthetic shims, patches, and plugs under normal conditions of service shall be comparable to that of wood repairs. The equivalency shall be established by testing and evaluation in accordance with the February 1972 edition of *Approval Procedures and Requirements for Synthetic Repairs*¹ published by the American Plywood Association.

3.4. Grade description of veneers—All veneers in the finished plywood panel shall conform to one of the below listed grade requirements. Unless otherwise stated, these requirements apply to 4 foot by 8 foot panels and are proportionate for other sizes. N grade is the highest classification.

3.4.1. Grade N veneer (intended for natural finish)

General

Shall be smoothly cut 100 percent heartwood or 100 percent sapwood, free from knots, knot-holes, pitch pockets, open splits, other open defects, and stain.

—of not more than two pieces in 48 inch widths; not more than three pieces in wider panels.

—well matched for color and grain.

Synthetic fillers may be used to fill:

- (a) small cracks or checks not more than 1/32 inch wide.
- (b) small splits or openings up to 1/16 inch wide if not exceeding 2 inches in length.
- (c) small chipped areas or openings not more than 1/8 inch wide by 1/4 inch long.

¹American Plywood Association publications may be obtained at 1119 A Street, Tacoma, Washington 98401.

Growth characteristics

Where pitch streaks occur, each shall average not more than 3/8 inch in width and shall blend with the color of the wood.

Repairs

Shall be wood neatly made and parallel to grain.

—limited to a total of six in number.

—well matched for color and grain.

Patches shall be

limited to three "router" patches not exceeding 1 inch in width and 3-1/2 inches in length. There shall be no overlapping.

Shims shall not exceed 3/16 inch in width or 12 inches in length and shall occur only at the ends of the panel.

3.4.2. Grade A veneer (suitable for painting)

General

Shall be firm; smoothly cut; and free of knots, pitch pockets, open splits, and other open defects

—well joined when of more than one piece.

Synthetic fillers may be used to fill:

- (a) In Exterior type panels: small cracks or checks not more than 1/32 inch wide; small splits or openings up to 1/16 inch wide, if not exceeding 2 inches in length; small chipped areas or openings not more than 1/8 inch wide by 1/4 inch long.
- (b) In Interior type panels: small cracks or checks not more than 3/16 inch wide; openings or depressions up to 1/2 inch wide by 2 inches long or equivalent area.

Growth characteristics

Where pitch streaks occur, each shall average not more than 3/8 inch in width, and shall blend with the color of the wood. Sapwood and discolorations are permitted.

Repairs

Shall be wood or of synthetic patching material; neatly made and parallel to grain, limited to a total of 18 in number, excluding shims.

Patches

When of wood, shall be: "boat," "router," or "sled" type. Radius of ends of boat patches shall not exceed 1/8 inch.

Shall not be more than 2-1/4 inches in width singly.

Multiple wood repairs shall consist of not more than two patches, neither of which may exceed 7 inches in length if either is wider than 1 inch, except that, there may be one multiple repair consisting of three die-cut veneer patches.

Synthetic repairs shall not exceed 2-1/4 inches in width.

Shims are permitted, except that, they shall not be used over or around patches or as multiple repairs.

3.4.3. Grade B veneer

General

Shall be solid and free from open defects and broken grain, except as permitted below. Slightly rough grain is permitted.

Minor sanding and patching defects, including sander skips shall not exceed 5 percent of panel area.

Synthetic fillers may be used to fill:

- (a) In Exterior type panels: small splits or openings up to 1/16 inch wide if not exceeding 2 inches in length; small chipped areas or openings not more than 1/8 inch wide by 1/4 inch long.
- (b) In Interior type panels: small cracks or checks not more than 3/16 inch wide; openings or depressions up to 1/2 inch wide by 2 inches long or equivalent area.

Growth characteristics

Knots shall not exceed 1 inch measured across the grain and shall be both sound and tight.

Where pitch streaks occur, they shall average not more than 1 inch in width.

Discolorations are permitted.

Open defects

Splits shall not be wider than 1/32 inch.

Vertical holes shall not exceed 1/16 inch in diameter and shall not exceed an average of one per square foot in number.

Horizontal or surface tunnels shall be limited to 1/16 inch across, 1 inch in length, and to 12 in number.

Repairs

Shall be wood or synthetic patching material, neatly made.

Wood veneer repairs shall be die cut. Wood panel repairs shall be "router" or "sled" type.

Wood repairs shall not exceed 3 inches in width where occurring in multiple repairs, or 4 inches in width where occurring singly.

Synthetic veneer repairs shall not exceed 4 inches in width.

Synthetic panel repairs shall not exceed 2-1/4 inches in width.

Shims are permitted.

3.4.4. Grade C veneer

General

Sanding defects that will not impair the strength or serviceability of the panel are permitted.

Growth characteristics

Knots shall be tight and not more than 1-1/2 inches across the grain.

Discolorations are permitted.

Open defects

Knotholes shall not exceed 1 inch measured across the grain; except that, an occasional knothole more than 1 inch but not more than 1-1/2 inches measured across the grain, occurring in any section 12 inches along the grain is permitted, provided the aggregate width of all knots and knotholes occurring wholly within the section does not exceed 6 inches in a 48 inch width, and proportionately for other widths.

Splits measured at a point 8 inches from the end of the panel shall not exceed 1/2 inch in width by 1/2 panel length or 3/8 inch in width by any panel length, provided separation at one end does not exceed 1/16 inch where split runs full panel length; however, the maximum width within 8 inches of the end of the panel (open end of split) shall not exceed the maximum width of knotholes permitted within the grade.

Splits on panel faces and backs shall not exceed 1/4 inch where located within 1 inch of parallel panel edge.

Voids due to missing wood on panel faces and backs not otherwise specified above shall not exceed the maximum width of knotholes permitted in the grade and the length of such voids shall not exceed 6 inches.

Repairs

Shall be wood or synthetic patching material, neatly made.

Wood veneer repairs shall be die cut. Wood panel repairs shall be "router" or "sled" type.

Wood repairs shall not exceed 3 inches in width where occurring in multiple repairs, or 4 inches in width where occurring singly.

Synthetic veneer repairs shall not exceed 4 inches in width.

Synthetic panel repairs shall not exceed 2-1/4 inches in width.

Shims are permitted.

3.4.4.1. C Plugged veneer—This veneer may contain knotholes, worm and borer holes, and other open defects not larger than 1/4 inch by 1/2 inch; sound

and tight knots up to 1-1/2 inches measured across the grain; splits up to 1/8 inch wide; broken grain; pitch pockets, if solid and tight; plugs; patches, and shims. Synthetic repairs in veneer shall not exceed 4 inches in width. Synthetic panel repairs shall not exceed 2-1/4 inches in width. Where grades having C Plugged face veneer are identified as fully sanded, sanding defects shall be the same as admitted under B grade. Sander skips to any degree shall be admissible in touch-sanded C Plugged veneer.

3.4.5. Grade D veneer

General

Except as otherwise required herein, any number of plugs; patches, shims, worm or borer holes, sanding defects, and other characteristics shall be permitted, provided they do not seriously impair the strength or serviceability of the panels.

Growth characteristics

Tight knots in inner plys shall be permitted.

In D grade backs, knots shall be tight and not larger than 2-1/2 inches across the grain except that an occasional tight knot larger than 2-1/2 inches but not larger than 3 inches measured across the grain, occurring in any section 12 inches along the grain is permitted, provided the aggregate width of all knots and knotholes occurring wholly within the section does not exceed 10 inches in a 48 inch width and proportionately for other widths.

Open defects

Knotholes shall not exceed 2-1/2 inches across the grain, except that an occasional knothole larger than 2-1/2 inches but not larger than 3 inches across the grain occurring in any section 12 inches along the grain is permitted, provided the aggregate width of all knots and knotholes occurring wholly within the section does not exceed 10 inches in a 48 inch width, and proportionately for other widths.

Knotholes in sanded panels shall not exceed 2-1/2 inches across the grain in veneer thicker than 1/8 inch.

Knotholes shall not exceed 3-1/2 inches across the grain in veneers at least two plies removed from the face or back plies of C-D and C-D Plugged grades having five or more plies.

Splits measured at a point 8 inches from the end of the panel shall not exceed 1 inch in width, tapering to not more than 1/16 inch where split runs full panel length; however, the maximum width within 8 inches of the end of the panel (open end of split) shall not exceed the maximum width of knotholes permitted within the grade.

Splits on panel faces and backs shall not exceed 1/4 inch where located within 1 inch of parallel panel edge.

Voids due to missing wood on panel backs not otherwise specified above shall not exceed the maximum width of knotholes permitted in the grade and the length of such voids shall not exceed 6 inches.

White pocket

Any area 24 inches wide across the grain and 12 inches long, in which light or heavy white pocket occurs, shall not contain more than three of the following characteristics, in any combination:

- (a) 6 inch width of heavy white pocket.
- (b) 12 inch width of light white pocket.
- (c) One knot or knothole, 1-1/2 inches to 2-1/2 inches, or two knots or knotholes, 1 inch to 1-1/2 inches; knots or knotholes less than 1 inch shall not be considered. Sizes of any knot or knothole shall be measured across the grain. Any repair in white pocket area shall be considered for grading purposes as a knothole.

3.5. Veneers and layers

3.5.1. Veneer thickness—Except as provided for below, veneer shall be 1/10 inch or thicker in panels 3/8 inch rough (unsanded) thickness or over; 1/12 inch or thicker in panels of less than 3/8 inch rough (unsanded) thickness. In no case shall veneers used in face or back layers be thicker than 1/4 inch, or veneers used in inner layers thicker than 5/16 inch.

One-twelfth-inch veneer shall be used in 5-ply, 5-layer, laminated layers as

One-sixteenth-inch veneer shall be used in 5-ply, Exterior grades, and may be included as provided for in

For further limitations on panel construction

The average veneer thickness shall not be less than 5 percent of the nominal thickness measured dry

3.5.2. Parallel laminated veneer—The outer layers of parallel laminated veneer in Structural I C-C and C-D grades. Such veneer shall be 1/10 inch or thicker on face and back ply and shall conform to the requirements for the panel grade. The sub-faces of the inner plies of the veneer shall conform to 2 and 3 and 3.6 sub-faces and sub-faces of Structural I C-C and C-D parallel laminated veneer

Parallel laminated veneer shall consist of veneer thickness combination and total layer thickness shall conform to requirements for

3.5.3. Scarfed veneer—Veneer shall be used for any face or back ply with a slope steeper than 1:1 and shall not contain any cross section by scarfing joints shall be adhesive.

3.6. Panel grades—The standard combination of the veneers in 3.4 into the various panel grades shall be as provided in tables 2 and 3, with the additional requirements given below. The grain direction of the outer layers shall be either parallel or perpendicular to the long dimension of the panel.

3.6.1. Marine—Marine grades shall meet the requirements of Exterior type and shall be of one of the following grades: A-A, A-B, B-B, High Density Overlay, or Medium Density Overlay, all as modified below.

Only Douglas fir 1 and western larch veneers shall be used.

VENEERS—“A” faces shall be limited to a total of nine single repairs in a 4-foot by 8-foot sheet, or to a proportionate number in any other size as manufactured.

All inner plys shall be full length and

All wood repairs meeting the Exterments of 3.7.4 and panel using a te pressure.

When the inner pl of veneer, the ed and shall not overl

CROSSBAND GA edge of a panel edge split in exce gaps and edge sp shall not exceed gaps on either end inch in aggregate v

There shall be no splits.

Table 2. Interior type grades

Panel Grade Designations	Minimum Veneer Qual	
	Face	Back
N-N	N	N
N-A	N	A
N-B	N	B
N-D	N	D
A-A	A	A
A-B	A	B
A-D	A	D
B-B	B	B
B-D	B	D
Underlayment ^(a)	C Plugged	D
C-D Plugged	C Plugged	D
Structural I C-D		See 3.6.5
Structural I C-D Plugged, Underlayment		See 3.6.5
Structural II C-D		See 3.6.5
Structural II C-D Plugged, Underlayment		See 3.6.5.
C-D	C	D
C-D with exterior glue (See para. 3.6.6)	C	D

(a) See 3.6.3 and Table 5 for special limitations.

(b) Except for decorat sanded, surface tex means.

3.6.2. Decorative panels—Specialty panels with decorative face and veneer treatments in the form of striations, grooving, embossing, brushing, etc., which, except for the special face treatment, meet all of the requirements of this Standard, including veneer qualities, glue bond performance and workmanship, shall be considered as conforming to the Standard. All grades in tables 2 and 3 may be manufactured as decorative grades.

An occasional butt joint up to 6 inches in width shall be permitted for decorative effect in veneer on one panel face only. Where butt joints occur, the aggregate width of all knots and knotholes and two-thirds the aggregate width of all repairs, including butt joints, shall not exceed 6 inches in any area 12 inches along the grain by 48 inches wide or proportionately for other widths.

3.6.3. Underlayment, C-C Plugged—Face veneer shall be 1/10 inch or thicker before sanding. The veneer immediately adjacent to the face ply of C-C Plugged and Underlayment shall be C grade or

better with no knotholes over 1 inch across the grain; except that, veneer immediately adjacent to the face ply of Underlayment may be D grade provided open defects do not exceed 2-1/2 inches across the grain and panel face veneer is Group 1 or Group 2 species of 1/6 inch minimum thickness before sanding. Also see table 5 requirements.

3.6.4. B-B concrete form panels — Face veneers shall be not less than B grade and shall always be from the same species group. Inner plies shall be not less than "C" grade. This grade of plywood is produced in two classes and panels of each class shall be identified accordingly. Panels shall be sanded two sides and mill-oiled unless otherwise agreed upon between buyer and seller. Species shall be limited as follows and are applicable also to High Density Overlaid Exterior concrete form panels:

Class I—Faces of any Group 1 species, crossband of any Group 1 or Group 2 species, and centers of any Group 1, 2, 3, or 4 species.

Table 3. Exterior type grades (a)

Panel Grade Designations	Minimum Veneer Quality			Surface
	Face	Back	Inner Plys	
Marine, A-A, A-B, B-B, HDO, MDO		See 3.6.1		See regular grades
Special Exterior, A-A, A-B, B-B, HDO, MDO		See 3.6.7		See regular grades
A-A	A	A	C	Sanded 2 sides
A-B	A	B	C	Sanded 2 sides
A-C	A	C	C	Sanded 2 sides
B-B (concrete form)		See 3.6.4		
B-B	B	B	C	Sanded 2 sides
B-C	B	C	C	Sanded 2 sides
C-C Plugged ^(b)	C Plugged	C	C	Touch-sanded
C-C	C	C	C	Unsanded ^(c)
A-A High Density Overlay	A	A	C Plugged	—
B-B High Density Overlay	B	B	C Plugged ^(d)	—
B-B High Density Concrete Form Overlay (See para. 3.6.4)	B	B	C Plugged	—
B-B Medium Density Overlay	B	B	C	—
Special Overlays	C	C	C	—

(a) Available also in Structural I and Structural II classifications as provided in paragraph 3.6.5.

(b) See 3.6.3 and Table 5 for special limitations.

(c) Except for decorative grades, panels shall not be sanded, touch-sanded, surface textured, or thickness sized by any mechanical means.

(d) C centers may be used in panels of five or more plies.

Class II—Faces of any Group 1 or Group 2 species, and crossband and centers of any Group 1, 2, 3, or 4 species, or, faces of Group 3 species of 1/8 inch minimum thickness before sanding, crossband of any Group 1, 2, or 3 species, and centers of any Group 1, 2, 3, or 4 species.

3.6.5 Structural panels—These panels are especially designed for engineered applications such as structural components where design properties, including tension, compression, shear, cross-panel flexural properties and nail bearing may be of significant importance. In addition to the special species, grade and glue bond requirements set forth below, structural panels shall meet all other requirements in this Standard for the applicable types and grades.

Grade	Glue Bond	Species
Structural I C-D(a) C-D Plugged(a) Underlayment(a)	Shall meet the requirements of 3.7.3	Face, back and all inner plys limited to Group 1 species
Structural II C-D(a) C-D Plugged(a) Underlayment(a)	Shall meet the requirements of 3.7.3	Face, back and all inner plys may be of any Group 1, 2, or 3 species
Structural I All Exterior grades (see table 3)	Exterior	Face, back and all inner plys limited to Group 1 species
Structural II All Exterior grades (see table 3)	Exterior	Face, back and all inner plys may be of any Group 1, 2, or 3 species

(a) Special limitations applying to Structural (C-D, C-D Plugged, Underlayment) grade panels are:

- In D grade veneers white pocket in any area larger than the size of the largest knothole, pitchpocket or split specifically permitted in D grade shall not be permitted in any ply.
- Sound tight knots in D grade shall not exceed 2-1/2 inches measured across the grain, except as provided in table 5.
- Plugs, including multiple repairs, shall not exceed 4 inches in width.
- Panel construction shall be as specified in 3.8.

3.6.6. Interior type bonded with exterior glue—Regular Interior plywood bonded to meet the requirements of 3.7.3.

3.6.7. Special Exterior—An Exterior type panel that may be produced of any species covered by this Standard. Except in regard to species, it shall meet all of the requirements for Marine panels (see 3.6.1) and be produced in one of the following grades: A-A, A-B, B-B, High Density Overlay, or Medium Density Overlay.

3.6.8. Overlays—For overlaid plywood, the grade designation for face and back, as given in table 3, refers to the veneer directly underlying the surface. All overlaid plywood shall be overlaid on two sides unless otherwise agreed on between buyer and seller. When only one side is surfaced, the exposed back shall be C or better.

3.6.8.1. High Density Overlay—The standard grades of High Density Overlay shall be as listed in table 3. The surface of the finished product shall be hard, smooth, or uniformly textured, although some evidence of underlying grain may appear. The surface shall be of such a character that further finishing by paint or protective coating is not necessary. Although the common resin type employed in HDO is phenol, other resin systems that meet the requirements stated below may be used. A phenolic resin based overlay system shall consist of a cellulose-fiber sheet or sheets, containing not less than 45 percent resin solids based on the volatile-free weight of fiber and resin exclusive of glueline. The total resin-impregnated materials for each face, exclusive of gluelines, shall be not less than 0.012 inch thick before pressing and shall weigh not less than 60 pounds per 1,000 square feet in the ready-to-use conditions. The bond of the overlay system to the plywood shall be continuous and without voids or blisters. Other resin-cellulose fiber overlay systems having a weight of not less than 60 pounds per 1,000 square feet of single surface exclusive of glueline, and which possess performance capabilities of the above phenol system may be identified as High Density Overlay. Determination of equivalent performance shall be based on tests described in *Test Methods for PS 1 Overlays*² published by the American Plywood Association, February 1972.

3.6.8.2. Medium Density Overlay—The standard grade of Medium Density Overlay shall be as listed in table 3. The resin-treated facing on the finished product shall present a smooth, uniform or uniformly textured surface intended for high-quality paint finishes. Some evidence of underlying grain may appear. Although the characteristic resin type employed is phenol, other resin systems that meet the requirements stated below may be used. The typical thermosetting phenolic resin system shall consist of a cellulose-fiber sheet or sheets containing not less than 17 percent resin solids for a beater-loaded sheet, or 22 percent for an impregnated sheet, both based on the volatile-free weight

²See footnote 1, page 6.

of resin and fiber exclusive of glueline. The resin-treated material shall weigh not less than 58 pounds per 1,000 square feet of single face, including both resin and fiber but exclusive of glueline. After application, the material shall measure not less than 0.012 inch thick. Other resin-cellulose fiber overlay systems having a weight of 58 pounds per 1,000 square feet of single surface exclusive of glueline, and which possess performance capabilities of the above phenol system may be identified as Medium Density Overlay. Determination of equivalent performance shall be based on tests described in *Test Methods for PS 1 Overlays*³ published by the American Plywood Association, February 1972.

3.6.8.3. Special overlays—These are surfacing materials having special characteristics which do not fit the particular description of High Density or Medium Density types as given in 3.6.8.1 and 3.6.8.2 and which shall consist in significant part of resin-treated fiber. They shall meet the glue bond requirements for overlaid plywood. Although designed for a wide variety of uses, this overlaid plywood shall be Exterior type. This includes the base panel, bond of overlay to the panel, and the overlay itself. Panels shall be identified as "Special Overlay."

3.7. Adhesive bond requirements for a panel or a lot

General

Any adhesive or bonding system that causes degradation of the wood or latent failure of bond shall not be used.

3.7.1. Interior type bonded with interior glue—A panel shall be considered as meeting the requirements of the Standard if three or more of the five test specimens pass when tested in accordance with 4.3. Panels from lots shall be evaluated for conformance with the Standard in the following manner:

Underlayment, C-D Plugged, and C-D:

A panel shall be classed as failing if more than two of the five test specimens fail. The material represented by the sampling shall be considered

as meeting the requirements of the Standard if 90 percent or more of the specimens are as described in 4.3.

All Other Grades:

A panel shall be classed as meeting the requirements of the Standard if 85 percent or more of the specimens tested in accordance with 4.3 are as described in 4.3.

3.7.1.1. Mold resistant and C-D—These are adhesive bonding systems that are created by admixing 100 pounds of dry pentachlorophenol with 100 pounds of dry protein glue. The test procedure is specifically designed for approval and is not subject to testing, as covered in 4.3.

3.7.1.2. Resistance to water and mold—These are adhesive bonding systems that are created by admixing 100 pounds of dry pentachlorophenol with 100 pounds of dry protein glue. The test procedure is specifically designed for approval and is not subject to testing, as covered in 4.3.

3.7.2. Interior type bonded with interior glue—A panel of interior type bonded with interior glue shall be considered as meeting the requirements of the Standard if three or more of the five test specimens taken from a lot pass when tested in accordance with 4.4.

Lots represented by a panel shall be considered as meeting the requirements of the Standard if 90 percent or more of the following requirements are met:

1. The average of the five test specimens, regardless of the number tested, shall be as described in 4.3.

³See footnote 1 page 6.

2. When more than one panel is tested, at least 90 percent of the panels represented by the test pieces shall have 30 percent wood failure or better.

Specimens cut through localized defects permitted in the grade shall be discarded. Test specimens showing delamination in excess of 1/8 inch deep and 1 inch long shall be rated as 0.0 percent wood failure.

3.7.2.1. Intermediate glue heat durability—Requirements shall be the same as for exterior glue. See 3.7.4.1.

3.7.2.2. Bacteria-mold resistance—Adhesives, in order to qualify as intermediate glue, shall meet the *Bacteria Test*⁴ requirements as published by the American Plywood Association, August 13, 1968. This procedure is specifically designed for adhesive qualification and is not applicable to inspection and testing, as covered in section 4.

3.7.3. Interior type bonded with exterior glue—A panel of Interior plywood bonded with exterior glue shall be considered as meeting the requirements of this Standard if the test specimens taken from a panel average 80 percent wood failure or greater when tested in accordance with 4.5.

Lots represented by test panels shall be considered as meeting the requirements of this Standard if all of the following minimum requirements are met:

1. The average wood failure of all test specimens, regardless of the number of panels tested, shall be not less than 80 percent.
2. When more than one panel is tested:
 - a. at least 90 percent of the panels represented by the test pieces shall have 60 percent wood failure or better.
 - b. at least 95 percent of the panels represented by the test pieces shall have 30 percent wood failure or better.

The above requirements are applicable separately and independently to the results obtained from the

⁴See footnote 1 page 6.

vacuum-pressure test in section 4. Specimens with defects permitted in section 4. Test specimens shall be 1/8 inch deep and 10 percent failure.

3.7.3.1. Interior type bonded with exterior glue—Requirements shall be the same as for exterior glue. See 3.7.4.1.

3.7.4. Exterior type bonded with exterior glue—Requirements shall be the same as for exterior glue. See 3.7.4.1.

Lots represented by test panels shall be considered as meeting the requirements of this Standard if all of the following minimum requirements are met:

1. The average wood failure of all test specimens, regardless of the number of panels tested, shall be not less than 80 percent.
2. When more than one panel is tested:
 - a. at least 70 percent of the panels represented by the test pieces shall have 60 percent wood failure or better.
 - b. at least 90 percent of the panels represented by the test pieces shall have 30 percent wood failure or better.
 - c. at least 95 percent of the panels represented by the test pieces shall have 30 percent wood failure or better.

The above requirements are applicable separately and independently to the results obtained from the vacuum-pressure test in section 4. Specimens with defects permitted in section 4. Test specimens shall be 1/8 inch deep and 10 percent wood failure.

3.7.4.1. Exterior type bonded with exterior glue—Requirements shall be the same as for exterior glue. See 3.7.4.1.

when tested in accordance with 4.5.4. When testing overlaid plywood, blisters or bubbles in the surface caused by combustion shall not be considered delamination.

3.7.4.2. Overlaid plywood—The bond between veneers of overlaid plywood as well as the bond between the overlay and the base panel shall meet the wood failure requirements described above for exterior. In evaluating specimens for separation of the resin-treated face from the plywood, fiber failure shall be considered the same as wood failure.

3.8. Panel constructions and workmanship—Constructions for all panels shall conform to the minimum number of plies and layers and the proportion and orientation of inner plies, as set forth in table 4. The grain of all layers shall be perpendicular to the grain of adjacent layers and to the ends or edges of the panel. The entire area of each contacting surface of the adjacent plies, including repairs, shall be bonded with an adhesive in a manner to assure compliance with the performance requirements for its type as set forth in the test described in section 4. For the purpose of veneer repairing or edge joining; strings, ribbons, or tapes up to 3/8 inch maximum width can occur in a glueline and shall be considered as allowable localized defects in the evaluation of glueline test specimens. Wider strings, ribbons, or tapes may be used for veneer repairing or joining if they are pre-qualified to show bonding equal to the required bonding for the panel. Glueline test specimens cut to include the strings, ribbons, or tapes wider than 3/8 inch shall not be discarded because of the presence of these materials.

Rough or unsanded plywood may have paper tape on either face or back, or both; except that, in C-C Exterior, no tape used for veneer splicing shall be permitted.

Shims or strips of veneer shall not be used to repair panel edge voids. However, filling of permissible edge voids with synthetic fillers neatly applied will be allowed, except as prohibited in Marine grades (see 3.6.1). Staples of ferrous metal shall not be used.

Where face or back plies consist of more than one piece of edge joined veneer, gaps between adjacent pieces shall be graded as splits.

End butt joints are prohibited in any ply except as provided for decorative grades in 3.6.2.

Panels shall have no continuous holes or through openings from face to back. Plywood shall be clean, and free from blisters.

3.8.1. Crossband gaps and center gaps—Crossband gaps or center gaps, except as noted for plugged crossband and jointed crossband, shall not exceed 1 inch in width for a depth of 8 inches (measured from panel edge) and the average of all gaps occurring in a panel shall not exceed 1/2 inch. Where inner layers are thicker than 1/4 inch, gaps in the laminated plies shall be offset 1 inch if over 1/4 inch wide.

Where plugged inner plies are specified, inner plies shall be of C Plugged veneer and gaps between adjacent pieces of inner plies shall not exceed 1/2 inch.

Where jointed inner plies are specified, gaps between pieces of inner plies shall not exceed 3/8 inch, and the average of all gaps occurring in a panel shall not exceed 3/16 inch.

3.8.2. Veneer requirements—The veneers used in each ply of each panel and the completed panel shall conform with the applicable veneer grade and with the construction and workmanship requirements given herein. Additionally, in recognition of the requirements of selected end uses, the type and frequency of specific characteristics shall be further limited for grades in table 5.

3.8.3. Sanded panels—Unless otherwise specified, sanded plywood shall be sanded on two sides. Sanding defects for N, A, B, and C Plugged faces shall be as given in 3.4. Exposed N, A, and B veneer surfaces of panels shall have the bark or tight surface out. Plies directly under the surface of overlaid panels are not considered exposed veneers. Faces and backs of panels shall be full width and full length; except that, C grade and D grade backs may be narrow on one edge or short on one end only, but by not more than 1/8 inch for half the panel length or width. Inner plies shall be full width and length; except that, panels other than Marine may have one edge or end void not exceeding 1/8 inch in depth and 8 inches in length per panel. Except as otherwise specified in table 5 for specific panel grade designations, crossband veneers not exceeding 1/8 inch in thickness may be lapped but by not more than 3/16 inch when adjacent to faces, or 1/2 inch when adjacent to backs, and provided such laps create no adjacent visible opening. Sanding defects resulting from crossband laps shall not be permitted in panel faces.

Table 4. Panel constructions

Panel Grades	Finished Panel Nominal Thickness Range (inch)	Minimum Number of Plys	Minimum Number of Layers
Exterior Marine Special Exterior (See para. 3.6.7) B-B concrete form High Density Overlay High Density concrete form overlay	Through 3/8 Over 3/8, through 3/4 Over 3/4	3 5 7	3 5 7
Interior N-N, N-A, N-B, N-D, A-A, A-B, A-D B-B, B-D Structural I (C-D, C-D Plugged and Underlayment) Structural II (C-D, C-D Plugged and Underlayment) Exterior A-A, A-B, A-C, B-B, B-C Structural I and Structural II (See para. 3.6.5) Medium Density and special overlays	Through 3/8 Over 3/8, through 1/2 Over 1/2, through 7/8 Over 7/8	3 4 5 6	3 3 5 5
Interior (including grades with exterior glue) Underlayment Exterior C-C Plugged	Through 1/2 Over 1/2, through 3/4 Over 3/4	3 4 5	3 3 5
Interior (including grades with exterior glue) C-D C-D Plugged Exterior C-C	Through 5/8 Over 5/8, through 3/4 Over 3/4	3 4 5	3 3 5

Note: The proportion of wood based on nominal finished panel thickness and dry veneer thickness before layup, as used, with grain running perpendicular to the panel face grain shall fall within the range of 33 percent to 70 percent. The combined

thickness of all inner layers shall be not less than 1/2 of panel thickness based on nominal finished panel thickness and dry veneer thickness before layup, as used, for panels with 4 or more plys.

Table 5. Characteristics prohibited or restricted in certain panel grades

Panel Grade Designation	Description and Number of Characteristics Per Panel
N-N, N-A	No crossband laps adjacent to faces and backs
N-B	No crossband laps adjacent to N faces No more than 2 crossband laps adjacent to B grade side (3.8.3) Laps are limited to 3/16 inch
N-D	No crossband laps adjacent to faces No more than a total of 2 of any combination of the following: <ul style="list-style-type: none"> - Knothole in D veneer over 2-1/2 inches but not over 3 inches - Split in D veneer over 1/2 inch (not over 1 inch) - Crossband lap adjacent to backs
Underlayment & C-C Plugged	No knotholes in veneer adjacent to face over 1 inch across the grain where C grade is required per Tables 2 and 3 No knotholes in veneer adjacent to face over 2-1/2 inches where D grade is permitted per 3.6.3 No laps adjacent to face
Structural I and II C-D	No splits in faces over 1/4 inch No splits in backs over 1/2 inch No more than a total of 2 of any combination of the following: <ul style="list-style-type: none"> - Knothole in C veneer over 1 inch but not over 1-1/2 inches - Knot in D backs over 2-1/2 inches but not over 3 inches - Knothole in D veneer over 2-1/2 inches but not over 3 inches - Crossband lap adjacent to faces (See 3.8.4) - Crossband lap adjacent to backs (See 3.8.4)
Structural I and II C-D Plugged	No splits in backs over 1/2 inch No more than a total of 2 of any combination of the following: <ul style="list-style-type: none"> - Knot in D backs over 2-1/2 inches but not over 3 inches - Knothole in D veneer over 2-1/2 inches but not over 3 inches - Crossband lap adjacent to faces (See 3.8.4) - Crossband lap adjacent to backs (See 3.8.4)
Structural I and II Underlayment	No knotholes in core veneer next to face over 1 inch No crossband laps adjacent to faces No splits in backs over 1/2 inch No more than a total of 2 of any combination of the following: <ul style="list-style-type: none"> - Knot in D backs over 2-1/2 inches but not over 3 inches - Knothole in D veneer over 2-1/2 inches but not over 3 inches - Crossband lap adjacent to backs (See 3.8.3, 3.8.4)

3.8.4. Unsanded and touch-sanded panels—Core veneers may be lapped by not more than 1/2 inch provided such laps create no adjacent visible opening. Additional limitations on laps adjacent to panel faces and backs are included in table 5. All plies of C-D panels shall be full length and full width; except that, no more than half the length of one edge nor half the width of one end may contain short or narrow plies, provided:

- (a) Such plies shall not be short or narrow by more than 3/16 inch; except that, crossbands may be short by 1/2 inch and centers may be narrow by 1/2 inch provided they taper to within 3/16 inch or less of the panel edge in 8 inches.
- (b) When short or narrow by more than 3/16 inch, the aggregate area in the plane of the plies of such edge characteristics shall not exceed 6 square inches in the entire panel.
- (c) Such edge characteristics shall not occur in more than one ply at any panel cross section.

In grades other than C-D, backs may be narrow on one edge or short on one end only, but by not more than 1/8 inch for half the panel length or width; inner plies shall be full width and length; except that, one edge or end void not exceeding 1/8 inch in depth and 8 inches in length per panel shall be acceptable.

3.8.5. Identification Index for sheathing—Grade trademarking of C-C, C-D, Structural C-C and Structural C-D shall include an "Identification Index" for the thicknesses shown in table 6. Identification Indexes for thicknesses between those listed in table 6 shall be those shown for the next lower thickness.

3.8.6. Thickness and construction of Group 2 and Group 4 sheathing panels—C-C Exterior, C-D, and Structural panels of Group 2 woods may be marked with the same Identification Index as Group 1 woods, if the 5/16, 3/8, 1/2, 5/8, and 3/4 inch thick panels are manufactured 1/32 inch thicker than the standard nominal thickness, and the 5/8 inch and 3/4 inch panels have 1/8 inch minimum thick faces and backs, or if the 1/2, 5/8, and 3/4 inch panels are manufactured to the standard nominal thickness and have outer layers of Group 2 woods of 1/6 inch minimum thickness.

C-C Exterior and C-D panels of Group 4 woods may be marked with the same Identification Index

as Group 3 woods if the 5/16, 3/8, 5/8, 3/4, and 7/8 inch thick panels are manufactured 1/32 inch thicker than standard nominal thickness, and the 3/4 and 7/8 inch constructions have 1/8 inch minimum thick faces and backs, or if the 5/8 inch and 3/4 inch panels are manufactured to the standard nominal thickness and have outer layers of Group 4 woods of 1/6 inch minimum thickness.

The standard nominal thickness of panels provided for in this section shall be used in applying the requirements of table 4.

Table 6. Identification Index^(a) table for sheathing panels

Species of face and back	Grade			
	Group 1		Group 2	
Group 1	{ C-C Str. I C-C, C-D Str. II C-C, C-D (c) C-D } (b)			
Group 2	{ C-C Str. II C-C, C-D C-D } (d)	{ C-C Str. II C-C, C-D } (b)		
Group 3		{ C-C Str. II C-C, C-D C-D } (b)		
Group 4	{ C-C } (d)		{ C-C } (b) { C-D } (b)	
Nominal Thickness	5/16	20/0	16/0	12/0
	3/8	24/0	20/0	16/0
	1/2	32/16	24/0	24/0
	5/8	42/20	32/16	30/12
	3/4	48/24	42/20	36/16
	7/8		48/24	42/20
(e)				

- (a) Identification Index refers to the numbers in the lower portion of the table which are used in the marking of sheathing grades of plywood. The numbers are related to the species of panel face and back veneers and panel thickness in a manner to describe the bending properties of a panel. They are particularly applicable where panels are used for subflooring and roof sheathing to describe recommended maximum spans in inches under normal use conditions and to correspond with commonly accepted criteria. The left hand number refers to spacing of roof framing with the right hand number relating to spacing of floor framing. Actual maximum spans are established by local building codes. See reference source given in section 2 for complete description and product use information.
- (b) Panels of standard nominal thickness and construction.
- (c) Panels manufactured with Group 1 faces but classified as Structural II by reason of Group 2 or Group 3 inner plies.
- (d) Panels conforming to the special thickness and panel construction provisions of 3.8.6.
- (e) Panels thicker than 7/8 inch shall be identified by group number.

3.9. Scarf and finger jointed panels—Neither panels with N faces, nor the faces of such panels, unless longer than 10 feet, shall be scarf or finger jointed unless otherwise agreed on by buyer and seller. Panels of other grades may be scarf or finger jointed unless otherwise agreed on by buyer and seller, and panels longer than 12 feet are necessarily scarf or finger jointed. Plain scarfed joints and the scarfed portion of finger joints shall not have a slope greater than 1 to 8. All plies with grain perpendicular to the finger joint shall be included in the scarfed portions of the joint, except that such plies may include up to 1/32 inch of vertical shoulder in the scarf. See figure 5. Joints shall be glued with a waterproof adhesive and shall meet the test requirements set forth in 3.9.1, 3.9.2, 3.9.3, and 3.9.4 as applicable. In addition, the adhesive shall not show creep or flow characteristics greater than unjointed wood when subject to load under any conditions of temperature and moisture.

3.9.1. Strength requirements (Interior and Exterior) scarf and finger jointed panels—If the average ultimate stress of the three test specimens of any one panel is less than 4,000 psi for panels of Group 1 species, or less than 2,800 psi for panels of Group 2 or Group 3 species, or 2,400 psi for panels of Group 4 species, or less than 2,000 psi for panels of Group 5 species, when tested in accordance with 4.7.1, then that panel fails. The jointed panels represented by the sampling are acceptable if not more than one of the panels fails.

3.9.2. Scarf and finger joint durability for Interior panels bonded with interior glue—Scarfed panels shall be tested in accordance with 4.7.2. Finger jointed panels shall be tested in accordance with 4.7.4. Test specimens showing continuous delamination in excess of 1/16 inch deep and 1/2 inch long at the joint glueline shall be considered as failing. More than one failing specimen in a panel shall constitute failure of that panel. The jointed panels represented by the sampling are acceptable if not more than one of the panels fails.

3.9.3. Scarf joint durability for Exterior type plywood and Interior type bonded with exterior and intermediate glue—Panels shall be tested in accordance with 4.7.3. The material represented by the sampling shall be evaluated in accordance with 3.7.2, 3.7.3, and 3.7.4, as applicable.

3.9.4. Finger joint durability for Exterior type panels and Interior type panels bonded with

exterior or intermediate glue—Panels shall be tested in accordance with 4.7.5. The joints shall meet the following minimum conditions:

1. The average wood failure rating of all specimens from each panel when tested in accordance with 4.7.5 shall not be less than 85 percent.
2. No single specimen from a panel (average of face and back gluelines) shall rate less than 60 percent wood failure.
3. No single face or back glueline in any specimen shall rate less than 30 percent wood failure.

3.10. Dimensional tolerances and squareness of panels

3.10.1. Size tolerances—A tolerance of plus 0.0 inch, minus 1/16 inch shall be allowed on the specified length and/or width.

3.10.2. Thickness tolerances—Sanded panels shall have a tolerance of plus or minus 1/64 inch for specified thicknesses of 3/4 inch and less and plus or minus 3.0 percent of the specified thickness for panels thicker than 3/4 inch. Unsanded, touch sanded, and overlaid panels shall have a tolerance of plus or minus 1/32 inch for specified thicknesses of 13/16 inch and less and plus or minus 5.0 percent of the specified thickness for panels thicker than 13/16 inch.

3.10.3. Squareness and straightness—Panels 4 feet or greater in length and width shall be square within 1/64 inch per lineal foot. Panels less than 4 feet in length or width shall be square within 1/16 inch measured along the short dimension. All panels shall be manufactured so that a straight line drawn from one corner to the adjacent corner shall fall within 1/16 inch of panel edge.

3.11. Moisture content—Moisture content of panels at time of shipment shall not exceed 18 percent of oven dry weight when tested in accordance with 4.6.

3.12. Loading or packing—The plywood shall be securely loaded or packed to insure delivery to destination in a clean and serviceable condition.

4. SPECIMEN PREPARATION AND TESTING

4.1. General—The tests set forth in this section shall be used to determine the glue bond quality of plywood produced under this Standard.

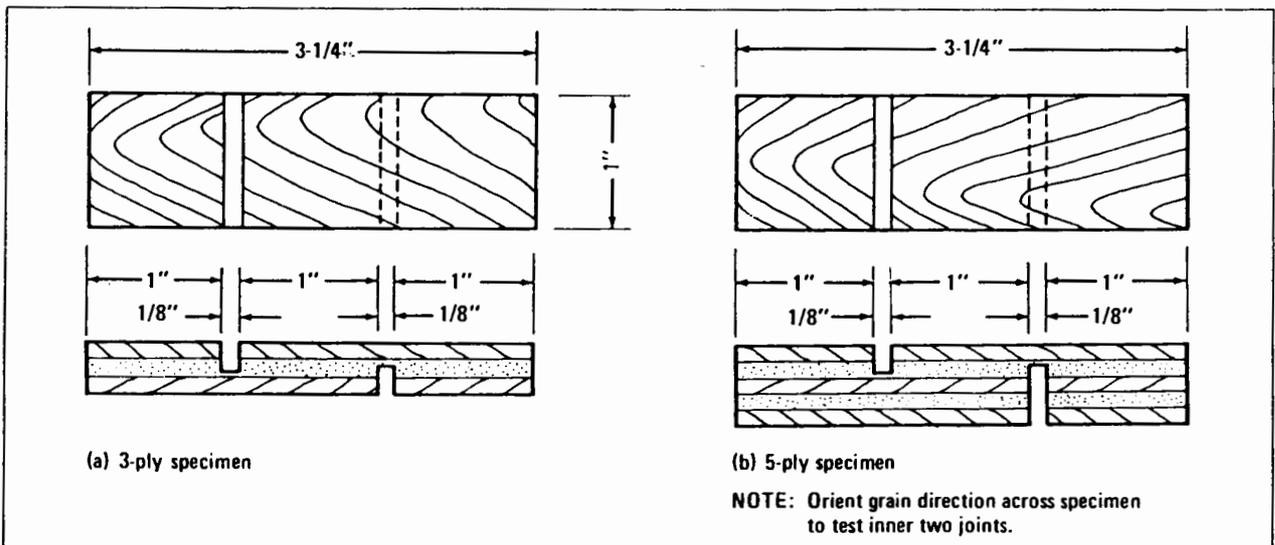
4.2. Specimen preparation (See appendix A4 for sampling for reinspection)—One test piece shall be cut from each panel selected. For panels bonded with interior glue the test piece shall be cut into five test specimens 2 inches wide by 5 inches along the grain. For panels bonded with intermediate glue, five test specimens shall be cut as described in 4.4.1. For panels bonded with exterior glue, 10 test specimens shall be cut as described in 4.5.1. Of the 10 specimens cut from each test piece for panels bonded with exterior glue five shall be for the vacuum pressure test and five shall be for the boil test. From each overlaid panel selected, 10 additional test specimens shall be cut (as described in 4.5.1) to test the bond between the overlay and the base panel. In addition, from each panel selected, excluding Interior type panels bonded with interior glue, a 5-1/2 inch by 8 inch specimen shall be cut and tested as described in 4.5.4.

4.3. Test for Interior type bonded with interior glue—The test specimens prepared as described in 4.2 shall be placed in a pressure vessel and completely submerged in 110°F water. A vacuum of 15 inches of mercury shall be drawn, maintained for 30 minutes and released. Specimens shall then be allowed to soak in the same water at atmospheric pressure for 4-1/2 hours with no additional heating. They shall be removed and dried for 15 hours at 150°F in an oven with fan forced air circulation of 45 to 50 air changes per minute. Specimens shall then be examined for delamination and evaluated in accordance with requirements given in 3.7.1. Total continuous visible delamination of 1/4 inch or more in depth and 2 inches in length along the edges of a 2 inch by 5 inch test specimen shall be considered as failure. When required, this shall be determined by probing with a suitable feeler gage not greater than 0.013 inch in thickness. When delamination occurs as a result of a localized defect permitted in the grade, other than white pocket, that specimen shall be discarded.

4.4. Tests for Interior type plywood bonded with intermediate glue.

4.4.1. Preparation of test specimens—Test specimens shall be cut 3-1/4 inches long and 1 inch wide, and kerfed one-third of the length of the specimen from each end as illustrated in figure 1 to provide a 1 inch square test area in the center. Specimens shall be oriented so that the grain

Figure 1. Shear test specimens.



prepared following the general procedure described in 4.4.1 and 4.5.1 but, in addition, shall be cut so that the joint runs through the test specimens as shown in figure 4.

For Exterior type panels and Interior type bonded with exterior glue five specimens shall be subjected to the vacuum pressure test described in 4.5.2, and five to the boiling test of 4.5.3. The panels shall be evaluated as described in 3.7.3 and 3.7.4.

For Interior type panels bonded with intermediate glue, the ten specimens shall be subjected to the vacuum soak test outlined in 4.4.2. The panels shall be evaluated as described in 3.7.2.

4.7.4. Finger joint durability of Interior type panels bonded with interior glue—Five specimens shall be cut at random along the finger joint from each panel selected and shall be prepared following the general procedure in 4.2, so that the middle of the joint coincides with the middle of the five specimens. The specimens shall be subjected to the same test procedure as outlined in 4.3.

4.7.5. Finger joint durability of Exterior type panels and Interior type panels bonded with exterior or intermediate type glue—Ten specimens shall be cut at random along the finger joint from each panel selected according to 4.2. These specimens shall be cut so as to include the joint and shall be prepared as illustrated in figure 6.

For Exterior type panels and Interior type panels bonded with exterior glue, five of the specimens shall be subjected to the vacuum pressure test of 4.5.2 and five to the boiling test of 4.5.3.

For Interior type panels bonded with intermediate glue, the ten specimens shall be subjected to the vacuum soak test of 4.4.2.

Upon completion of the vacuum pressure and boil tests, or vacuum soak tests, as applicable, a wedge or chisel (see figure 7) shall be inserted in locations shown in figure 6 in such a manner as to pry apart the scarfed portions of the joint without directly contacting the glued area. Test specimens shall be dried and percent wood failure in the test area estimated and applied separately for both the boil and vacuum pressure treatments. The panels shall be evaluated as described in 3.9.4.

Figure 4. Specimen preparation.

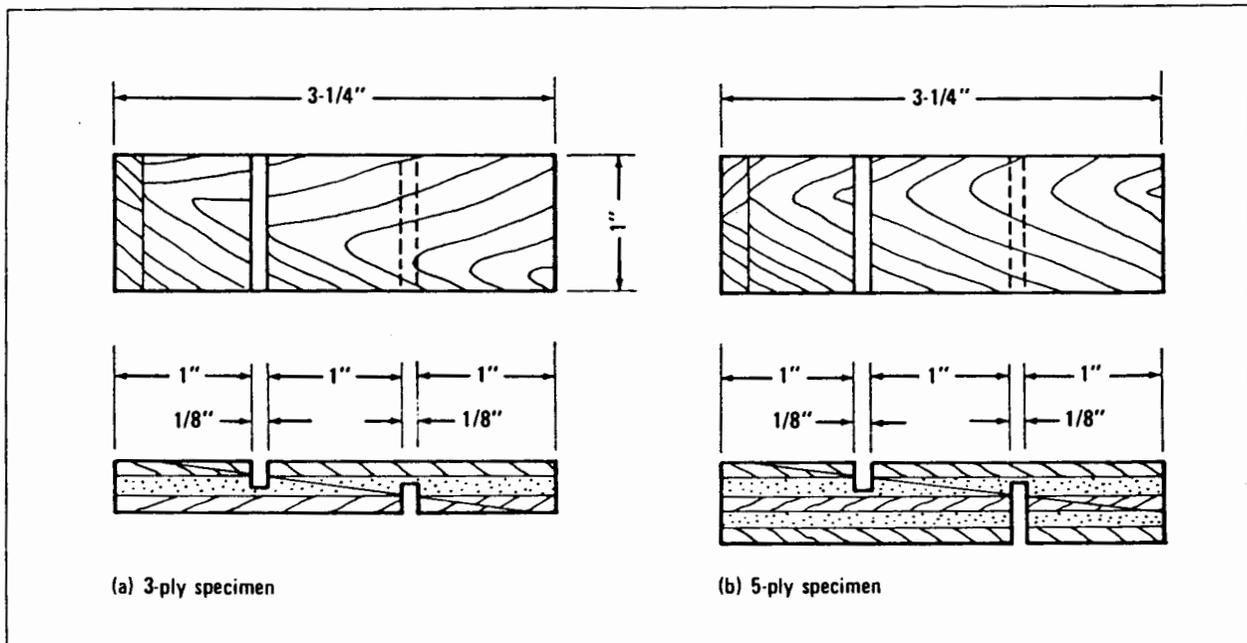


Figure 5. Finger joints -- location of scarfed portion of joints

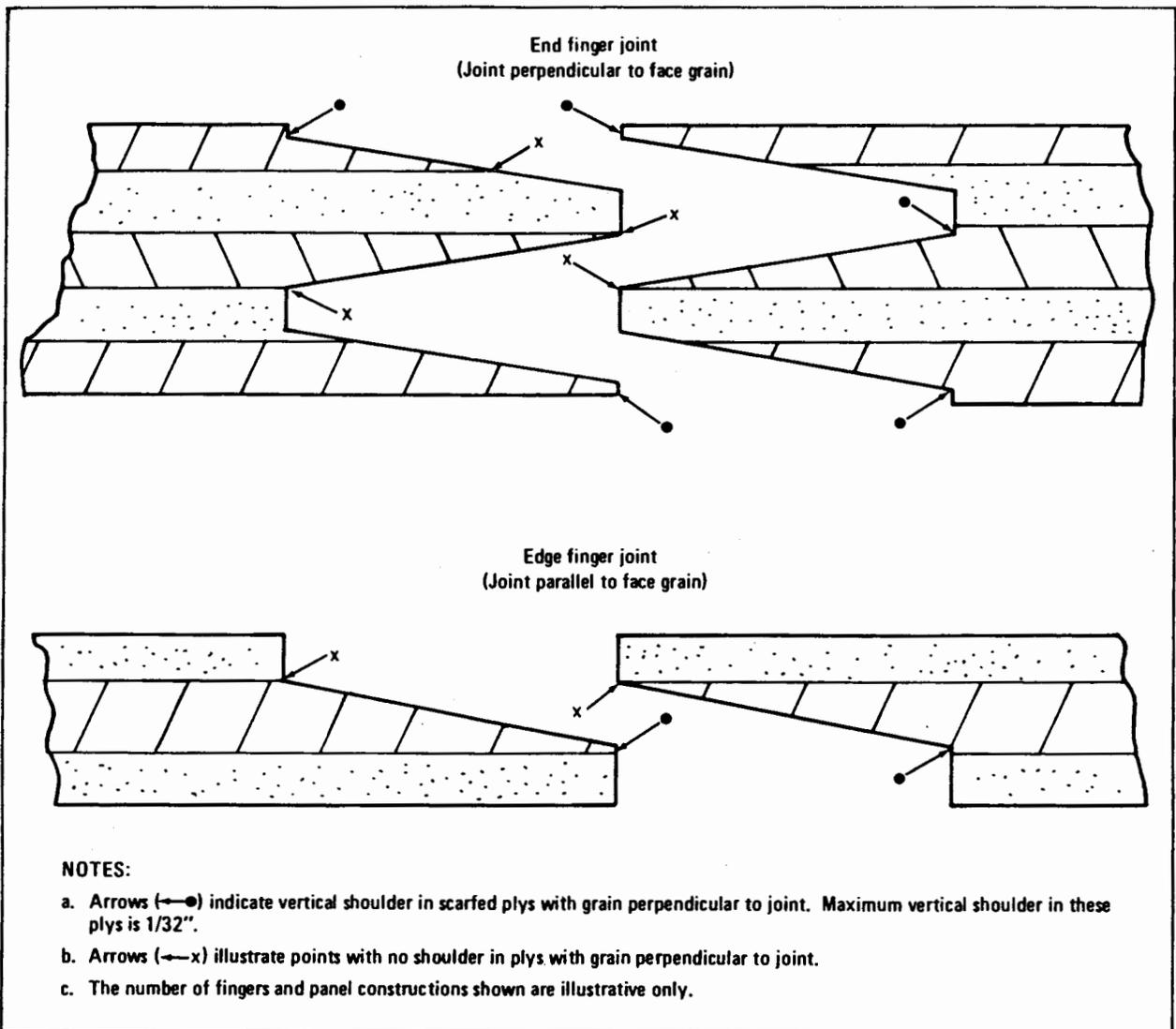


Figure 6. Cleavage test, typical test specimen

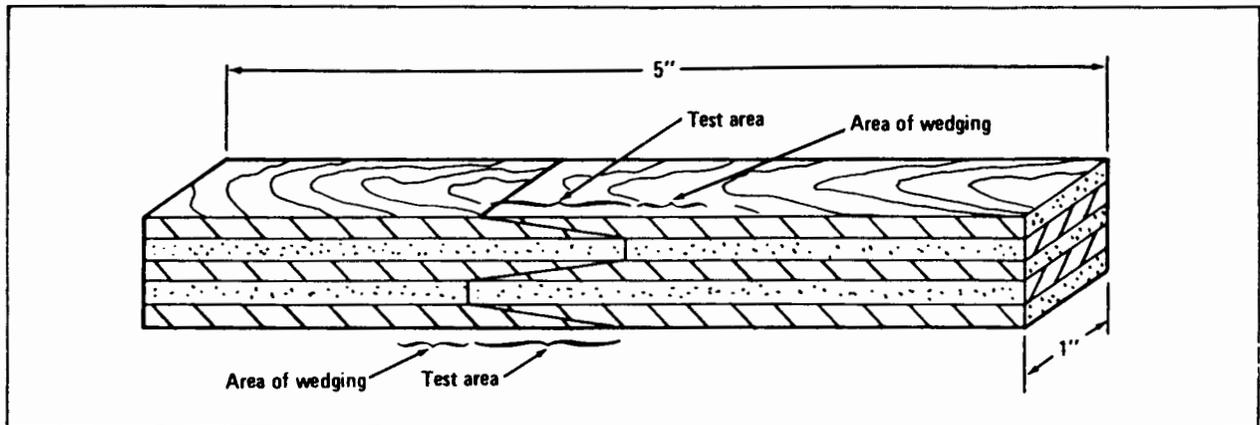
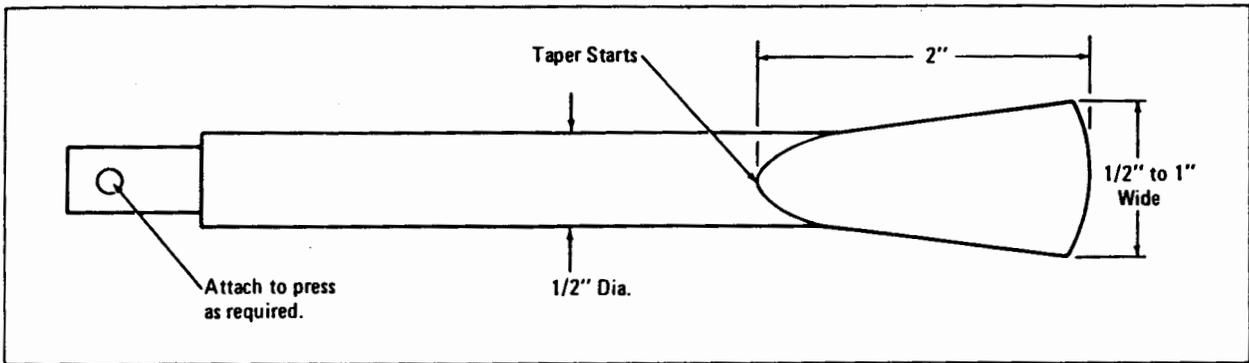


Figure 7. Wedge or chisel used for cleavage test.



5. DEFINITIONS

5.1. For the purpose of this Standard, the following definitions shall apply:

Back—

The back of a **plywood panel**; the side of a panel that is of lower veneer quality on any panel whose outer plies are of different veneer grades.

The back ply of a **plywood panel**; the outer veneer on the back side of a panel.

Borer holes — Voids made by wood-boring insects, such as grubs or worms.

Broken grain — A (leafing, shelling, grain separation) separation on veneer surface between annual rings.

Butt joint — A straight joint in which the interface is perpendicular to the panel face. An end butt joint is perpendicular to the grain.

Centers — Inner layers whose grain direction runs parallel to that of the outer plies. May be of parallel laminated plies.

Center gap — (See crossband gap)

Check — A lengthwise separation of wood fibers, usually extending across the rings of annual growth caused chiefly by strains produced in seasoning.

Class I, II — Term used to identify different species group combinations of B-B concrete form panels. (See 3.6.4.)

Construction (panel construction) — Trade term referring to detailed manner in which veneers are assembled and/or thickness of veneer used, e.g., "4-ply construction"/"3-layer construction", "1/10 inch face and back", etc.

Core — Sometimes referred to as "crossband."

Crossband — Inner layers whose grain direction runs perpendicular to that of the outer plies. May be of parallel laminated plies. Sometimes referred to as core.

Crossband gap and center gap — An open joint extending through or partially through a panel, which results when crossband or center veneers are not tightly butted.

Defects, open — Irregularities such as splits, open joints, knotholes, or loose knots, that interrupt the smooth continuity of the veneer.

Delamination — A visible separation between plies that would normally receive glue at their interface and be firmly contacted in the pressing operation. For purposes of reinspection, areas coinciding with open knotholes, pitch pockets, splits, and gaps and other voids or open characteristics permitted in the panel grade are not considered in evaluating Interior type panels for visible ply separation. Such areas are considered in evaluating Exterior type panels for ply separation, and a panel is considered delaminated if visible ply separation at a single glue line in such area exceeds 3 square inches. Wood characteristics such as checking, leafing, splitting, and broken grain are not to be construed as delamination. See corresponding definitions for those terms.

Edge splits – Wedge-shaped openings in the inner plys caused by splitting of the veneer before pressing.

Face –

The face of the plywood panel; the side of a panel that is of higher veneer quality on any panel whose outer plys are of different veneer grades; either side of a panel where the grading rules draw no distinction between faces.

The face ply of a panel; the outer veneer on the face of a panel.

Group – Term used to classify species covered by this Standard. Species covered by this Standard are classified as Groups 1, 2, 3, 4, and 5. See Table 1 for listing of species in individual groups and the reference in Section 2 for product use information.

Heartwood – Nonactive core of a log generally distinguishable from the outer portion (sapwood) by its darker color.

Identification Index – A set of numbers used in the marking of sheathing grades of plywood. (See 3.8.5.)

Inner plys – Plys other than face or back plys in a panel construction. Sub-face, sub-back, crossband and center are classed as inner plys.

Jointed inner plys – Crossband and center veneer that has had edges machine-squared to permit tightest possible layout.

Knot – Natural characteristic of wood that occurs where a branch base is embedded in the trunk of a tree. Generally the size of a knot is distinguishable by (1) a difference in color of limbwood and surrounding trunkwood; (2) abrupt change in growth ring width between knot and bordering trunkwood; and (3) diameter of circular or oval shape described by points where checks on the face of a knot that extend radially from its center to its side experience abrupt change in direction.

Knotholes – Voids produced by the dropping of knots from the wood in which they are originally embedded.

Lap – A condition where the veneers are so placed that one piece overlaps the other.

Layer – A layer is a single veneer ply or two or more plys laminated with grain direction parallel. Two or more plys laminated with grain direction parallel is a parallel laminated layer.

Lot – Any number of panels considered as a single group for evaluating conformance to this Standard.

Nominal thickness – Full “designated” thickness. For example, 1/10 inch nominal veneer is 0.10 inch thick. Nominal 1/2 inch thick panel is 0.50 inch thick. Also, commercial size designation, subject to acceptable tolerances.

Patches – Inserts of sound wood or synthetic material in veneers or panels for replacing defects. “Boat” patches are oval-shaped with sides tapering in each direction to a point or to a small rounded end; “Router” patches have parallel sides and rounded ends. “Sled” patches are rectangular with feathered ends.

Pitch pocket – A well-defined opening between rings of annual growth, usually containing, or which has contained, pitch, either solid or liquid.

Pitch streak – A localized accumulation of resin in coniferous woods which permeates the cells forming resin soaks, patches, or streaks.

Plugs – Sound wood of various shapes, including among others, circular and dog-bone, for replacing defective portions of veneers. Also synthetic plugs used to fill openings and provide a smooth, level, durable surface. Plugs usually are held in veneer by friction until veneers are bonded into plywood.

Plugged inner plys – (Also referred to as solid inner plys.) – Refers to C Plugged crossband and centers and additional limitations as given in 3.8.1.

Ply – A single veneer lamina in a glued plywood panel. (See also layer)

Plywood – Plywood is a flat panel built up of sheets of veneer called plys, united under pressure by a bonding agent to create a panel with an adhesive bond between plys as strong as or stronger than, the wood. Plywood is constructed of an odd number of layers with grain of adjacent layers perpendicular. Layers may consist of a single ply or two or more plys laminated with grain direction parallel. Outer layers and all odd numbered layers generally have the grain direction oriented parallel to the long dimension of the panel. The odd number of layers with alternating grain direction

equalizes strains, prevents splitting, and minimizes dimensional change and warping of the panel.

Repair — Any patch, plug, or shim.

Rough grain — Grain characteristics which prevent sanding to a smooth surface.

Sapwood — The living wood of lighter color occurring in the outer portion of a log. Sometimes referred to as "sap."

Shim — A long, narrow repair of wood or suitable synthetic not more than 3/16 inch wide.

Shop-cutting panel — A shop-cutting panel is one which has been rejected as not conforming to a standard grade because of deficiencies, other than adhesive bond quality, which prevents it from meeting the requirements of this Standard. Blistered panels are not considered as coming within the category of "shop-cutting" panel. Localized delamination may occur as a result of a deficiency. However, shop-cutting panels may be suitable for cut-up use where cutting removes the deficiency. Such a panel must be identified with a separate mark as specified in 6.2.1.

Split — Lengthwise separation of wood fibers completely through the veneer caused chiefly by manufacturing process or handling.

Streaks — See "Pitch streak."

Sub-face (Sub-back) — The ply adjacent to the exposed face (or back) of a parallel laminated outer layer.

Touch-sanding — A sizing operation consisting of a light surface sanding in a sander. Sander skips to any degree are admissible.

Veneer — Thin sheets of wood of which plywood is made. Also referred to as plies in the glued panel.

Waterproof adhesive — For purposes of this Standard, glue capable of bonding plywood in a manner to satisfy the exterior performance requirements given herein.

White pocket — A form of decay (*Fomes pini*) that attacks most conifers but has never been known to develop in wood in service. In plywood manufacture, routine drying of veneer effectively removes any possibility of decay surviving. (Admissible

amounts of white pocket permitted by this Standard were established through a 2-year research project at the U.S. Forest Products Laboratory.)

Light white pocket — Advanced beyond incipient or stain stage to point where pockets are present and plainly visible, mostly small and filled with white cellulose; generally distributed with no heavy concentrations; pockets for the most part separate and distinct; few to no holes through the veneer.

Heavy white pocket — May contain a great number of pockets, in dense concentrations, running together and at times appearing continuous; holes may extend through the veneer but wood between pockets appears firm. At any cross section extending across the width of the affected area, sufficient wood fiber shall be present to develop not less than 40 percent of the strength of clear veneer. Brown cubicle and similar forms of decay which have caused the wood to crumble are prohibited.

Wood failure (percent) — The area of wood fiber remaining at the glueline following completion of the specified shear test. Determination is by means of visual examination and expressed as a percent of the test area.

6. GRADEMARKING AND CERTIFICATION

6.1. Certification of shipments—In order to assure the purchaser that he is getting plywood of the grade and quality specified, the producer shall include with each shipment a Certificate of Inspection which states that the plywood conforms with this Standard. Each panel certified as being in conformance with this Standard shall bear the stamp of a Qualified Inspection and Testing Agency which (1) either inspects the manufacture (with adequate sampling, testing of glueline, and examination for quality of all veneers) or which (2) has tested a randomized sampling of the finished panels in the shipment being certified for conformance with this Standard. All plywood that is trademarked or otherwise designated as being in conformity with this Standard shall be accompanied by such Certificates of Inspection and applicable grade-trademarks of such inspection and testing agency as outlined above.

6.1.1. Qualified inspection and testing agency—A qualified inspection and testing agency is defined to be one that:

- (a) has the facilities and trained technical personnel to verify that the grading, measuring, species, construction, sanding, bonding, workmanship, and other characteristics of the products as determined by inspection, sampling and testing comply with all applicable requirements specified herein;
- (b) has developed procedures to be followed by agency personnel in performance of the inspection and testing;
- (c) has no financial interest in, or is not financially dependent upon, any single company manufacturing the product being inspected or tested; and
- (d) is not owned, operated, or controlled by any such company.

6.2. Panel marking—All panels represented as complying with this Standard shall be identified with the mark of a qualified inspection and testing agency giving the following information:

- (a) **Species group classification**—Panels which are produced with face and back veneers of the same species group shall be identified as being of that species group. Decorative panels and sanded panels 3/8 inch or less in thickness that are manufactured with face and back plies of different species groups shall be identified by the face species group number. Decorative and sanded panels greater than 3/8 inch and touch sanded panels that are manufactured with face and back plies of different species groups shall be identified by the larger numbered species group, (e.g., Group 4 is larger numbered than Group 1). The species classification group shall be set forth in the grademark on each panel. A class number as provided in 3.6.4 shall be used in lieu of a species group number to identify concrete form panels and an Identification Index as provided for in 3.8.5, shall be used for sheathing grades. Where intermixing between species groups occurs in the faces and backs of sheathing panels, the Identification Index corresponding to the larger numbered species group shall be used to identify the panel.

(b) Either "Interior" or "Exterior"—Panels not fully satisfying exterior veneer requirements shall be identified as "Interior." However, the additional notation "exterior glue" or "intermediate (IMG)" shall be used where applicable to supplement the designation of Interior grades bonded with exterior glue or intermediate glue. Any further reference to adhesive bond, including those which imply premium performance or special warranty by the manufacturer, as well as manufacturer's proprietary designations, shall be separated from the grademarks or trademarks of the testing agency by not less than 6 inches.

(c) The grade name or the grade of face and back veneers.

(d) The symbol PS1-74 signifying conformance with this Standard.

(e) The manufactured thickness of panels if other than standard nominal thickness, except for panels meeting the requirements of 3.8.6. For standard nominal thicknesses see appendix A.1.2.

6.2.1. Voiding marks—Panels originally marked as conforming to the Standard but subsequently rejected as not conforming thereto shall have any reference to the Standard voided or obliterated by the manufacturer as follows:

Such panels shall be plainly marked by means of a 4 inch by 5 inch minimum size rectangular stamp carrying the legend, "Shop-cutting panel -- all other marks void." (See definition of shop-cutting panel.)

No reference shall be made to this Standard in the certification or grade-trademarking of panels not conforming to all provisions of the Standard.

7. EFFECTIVE DATE

The effective date of this Standard is August 1, 1974. After this date, the authority to refer to the superseded standard, PS 1-66, *Softwood Plywood, Construction and Industrial*, as a voluntary standard developed under the Department of Commerce procedures is terminated. As of the effective date, reference to PS 1-74 may be made in contracts, codes, advertising, invoices, product labels, and the

like, but no product may be advertised or represented in any manner which would imply or tend to imply approval or endorsement of that product by the National Bureau of Standards, the Department of Commerce, or by the Federal Government.

8. HISTORY OF PROJECT

On October 1, 1965, the American Plywood Association submitted to the National Bureau of Standards a draft of a proposed Commercial Standard for softwood plywood together with a request that it be processed through the Commodity Standards Procedures as a revision and consolidation of Commercial Standards CS 45-60, *Douglas Fir Plywood*, CS 122-60, *Western Softwood Plywood*, and CS 259-63, *Southern Pine Plywood*. On December 16, 1965, new procedures for the development of Voluntary Product Standards were published and this became the first Product Standard to be processed under the new procedures by the newly designated Product Standards Section (formerly Office of Commodity Standards). The proposal was reviewed by the National Bureau of Standards, the Forest Products Laboratory in Madison, Wisconsin, and by other Federal agencies with a prime interest in the product. Adjustments were made and a new draft, TS 101, was submitted on April 20, 1966, to the standing committees for the three existing standards, to Federal agencies, and to a newly appointed Standard Review Committee which embraced organizations representative of most major interests in softwood plywood.

A summary of all comments received was prepared and the APA submitted a new draft, TS 101b, which reflected their responses to the suggestions made. TS 101b was unanimously approved by the Standard Review Committee. A recommended Product Standard, TS 101d, was circulated to the public for consideration and acceptance on September 1, 1966. A general press notice was released to related trade publications. Acceptances were received from producers of 85 percent of the production of softwood plywood, from many distributors, specifiers, architects, home builders, contractors, component and container manufacturers, as well as from State and Federal governmental agencies. The acceptances were considered representative of a satisfactory consensus, and there were no outstanding

substantive objections deemed valid by the Bureau. Accordingly, the successful establishment of Product Standard PS 1-66, *Softwood Plywood, Construction and Industrial*, was announced on October 18, 1966, to become effective for new production on November 1, 1966. Commercial Standards CS 45-60, CS 122-60, and CS 259-63 were superseded by PS 1-66 on December 1, 1966.

Between June 1969 and June 1970, there were six amendments issued for PS 1-66.

Current edition

In April 1972, the APA requested that the National Bureau of Standards initiate a revision of PS 1-66 under the *Procedures for the Development of Voluntary Product Standards*. A proposed revision was submitted to the Standing Committee in September 1973; the response from the Standing Committee indicated that certain changes to the standard were necessary.

A new proposal was approved by the Standing Committee in March 1974. The recommended revision was then circulated for acceptance in May 1974. The response to this circulation indicated consensus among producers, distributors, and users in accordance with the published procedures.

The new edition of the Standard was designated Voluntary Product Standard PS 1-74, *Construction and Industrial Plywood*, and became effective on August 1, 1974.

Technical Standards Coordinator:

Karl G. Newell, Jr., Office of Engineering Standards Services, National Bureau of Standards, Washington, D.C. 20234.

9. STANDING COMMITTEE

A Standing Committee has been appointed to assist in keeping this Voluntary Product Standard up to date. The names of the members of the committee are available from the Office of Engineering Standards Services, Washington, D.C. 20234, which serves as the secretariat of the committee.

APPENDIX

Based on industry practice the following information is offered plywood purchasers:

A1. Sizes and thicknesses

A1.1. Standard sizes—Plywood is generally available in panel widths of 36, 48, and 60 inches, and in panel lengths ranging from 60 inches to 144 inches in 12 inch increments. Other sizes are also available on special order. Panels 48 inches wide by 96 inches long (4 feet by 8 feet), and 48 inches wide by 120 inches long (4 feet by 10 feet) are most commonly available.

A1.2. Standard thicknesses—The standard nominal thicknesses of sanded panels range from 1/4 inch to 1-1/4 inches and greater, in 1/8 inch increments. The standard nominal thicknesses of unsanded panels range from 5/16 inch to 1-1/4 inches and greater, in increments of 1/8 inch for thicknesses over 3/8 inch. Manufactured thickness of panels other than standard nominal thickness is marked on the panel. Tolerances are as provided in 3.10.2.

A2. Overlaid plywood—The overlay face of High Density Overlay is usually produced in a natural translucent color, but certain other colors may be available. Color stability under weathering conditions is not a part of this Standard.

The overlay face of Medium Density Overlay characteristically is opaque and is produced in a natural color as well as in certain other colors.

A3. Method of ordering —

(a) The regular method of specifying sanded grades of plywood is to designate the species group, number of pieces, width, length, number of plies, type, grade, and finished thickness. Width always refers to the distance across the grain of the face plies; length refers to the distance along the grain. Width should always be specified first. If, for example, the requirement is 100 pieces of Group 2 plywood 1/4 inch thick, 48 inches wide, and 96 inches long, for interior conditions, one side of which is to be nailed against a wall where it will not show, but the other side is to be exposed to view and painted, this material should be ordered as follows:

Group 2 plywood: 100 pcs. 48 inch by 96 inch, 3-ply Interior type, A-D grade, sanded two sides to 1/4 inch thickness.

(b) **Surface finish**—For most uses, except for sheathing, sanded panels are desirable, but there are occasional uses where unsanded panels, of an A-D or other grade, are satisfactory. Such panels should be specified "unsanded," with notation made of any special patching requirements and the unsanded thickness specified.

(c) **Special types of service**—Special features may be desirable in plywood panels, such as extra thick faces for certain architectural treatments, etc. In such cases, the special treatment or feature should be stated after the standard specification.

For example, if special features are desired in Group 3 Exterior type, A-A grade panels of 3/8 inch thickness, the order should read:

"Group 3 plywood: 100 pcs., 48 inch by 96 inch, 3-ply Exterior type, A-A grade, sanded two sides to 3/8 inch thickness (add further special requirements)."

(d) **Overlaid plywood**—When ordering overlaid plywood, the basic description should be specified such as "High Density Overlay" (HDO), "Medium Density Overlay" (MDO), or "B-B High Density Concrete Form." The number of pieces, size, and thickness should be noted in the same way as for other kinds of plywood. Special requirements, such as "High Density A-A," "Medium Density B Inner Plys," "Surfaced one side only," or special weights of surfacing material include "High Density 60-60" (standard weight), and other variations such as 90-60, 90-90, 120-60, 120-120.

(e) **Unsanded plywood sheathing**—The method of specifying plywood sheathing (C-D, C-C, and Structural C-D) is to designate the grade, Identification Index (see 3.8.5 and appendix A1), number of pieces, width, length, number of plies, and thickness.

If, for example, the requirement is 100 pieces of C-D, 48 inches wide by 96 inches long to be used for roof sheathing over rafters spaced 24 inches on center, this may be ordered as follows:

"C-D, 24/0 100 pcs., 48 inches by 96 inches, (3- or 5-ply), 3/8 inch thickness."
(If exterior glue bond is desired note "exterior glue.")

- (f) Concrete form plywood—The method of specifying concrete form plywood is to designate the Class (I or II, see 3.6.4), number of pieces, width, length, thickness and grade. Concrete form panels are mill-oiled, unless otherwise specified.

If the requirement is 100 pieces of Class I Concrete Form plywood, 48 inches wide by 96 inches long by 5/8 inches thick, this may be ordered as follows:

"Concrete Form, Class I, 100 pcs., 48 in. by 96 in. by 5/8 in. thickness, B-B Exterior type."

A4. Shipment reinspection practices.

A4.1. General—Any request by the buyer for the reinspection of any item or lot, of plywood certified as conforming to this Standard shall be directed to the seller. Lacking agreement of the buyer and seller as to the settlement of a complaint, the purchase, sale, or shipment of plywood certified as conforming to this Standard shall be construed as involving agreement to submit such plywood to reinspection by the qualified inspection agency whose grademark was used.

A4.2. Responsibility of the buyer—A request for reinspection may be made to the seller:

- (a) for panel grade—within 15 days⁵ from the date of receipt if the grade of any item, as invoiced, is in doubt;
- (b) for glue bond quality of Exterior type panels—when delamination is visibly evident;
- (c) for glue bond quality of Interior type panels—within 15 days⁵ of receipt by the first buyer if delamination is visibly evident.

5. For unitized shipments, the 15-day limit will be extended to include the period dating from receipt of shipment to breaking of the first bundle, but not exceeding 6 months provided the requirement for keeping the disputed plywood intact is observed and the plywood in question is held for at least 30 days following the request for reinspection.

All plywood of disputed grade and Interior type plywood of disputed glue bond quality must be kept intact and properly protected from damage or deterioration which could interfere with the making of a fair inspection. All plywood in question shall be held for a period not to exceed 30 days after the date of request for reinspection. Use by the buyer of any or all of the disputed stock within the 30 day period shall constitute an acceptance of the portion used.

A4.3. Responsibility of the seller—A request for reinspection shall be acknowledged by the seller promptly following its receipt.

A4.4. Cost and assistance—The expense of reinspection shall be borne by the seller if the item, lot, or shipment in dispute fails to pass the reinspection as provided for in A4.5. If the reinspection passes, said expenses shall be borne by the buyer. The buyer shall lend all reasonable assistance to facilitate the reinspection.

A4.5. Reinspection procedures and settlement.

A4.5.1. Condition of plywood—All plywood designated as complying with this Standard shall be subject to reinspection in the white (unfinished) only; except that, concrete-form material may have a priming coat of oil or other clear preparation, before inspection. The above requirement does not apply to Exterior type plywood when tested for glue bond quality.

A4.5.2. Sampling for panel grade reinspections—At buyer's or seller's option, grade reinspections may include all panels of an item whose grade is in dispute. However, buyer and seller may agree on a reduced basis for sampling provided at least 20 percent or 300 panels, whichever is smaller, and which represents only those items as invoiced which are in dispute are inspected for conformance to grade. For reduced sampling, the quantity of panels selected from each disputed item shall be prorated according to the number of panels included in each item as invoiced. Panels found to be below grade shall have improper grademarks obliterated and shall be remarked for appropriate classification with a special inspection mark registered by the qualified agency conducting the reinspection and applied by that agency's authorized representative.

A4.5.3. Plywood panel grade reinspections—If reinspection establishes that a disputed item is more than 5 percent below grade according to the grade description as invoiced, that item fails to pass the reinspection. The below grade panels need not be accepted, however, all other panels shall be accepted as invoiced. If reinspection establishes that a disputed item is 5 percent or less below grade, it passes the reinspection and the buyer pays for them as invoiced. In addition to the above 5 percent grade tolerance, a 5 percent tolerance shall apply separately to the inner ply gap limitations, including the limitations applicable to the plugged crossband and jointed crossband, as set forth in 3.8.1.

A4.5.4. Sampling for glue bond reinspections—For test purposes, twenty panels, or 5 percent of the panels, whichever is less, shall be selected at random from the item, lot, or shipment which is in dispute. The number of panels required is calculated by applying the "percent panels" to the lot size and converting part panels to whole panels by using a rounding procedure where 0.01 to 0.49 parts are considered to be the smaller whole number, while 0.50 to 0.99 parts are considered to be the larger whole number. These panels shall be selected from locations distributed as widely as practicable throughout the material being sampled. When an item, lot, or shipment involves panels with different adhesive bond requirements as provided for in 3.7, testing and evaluation shall apply separately to each category. Sampling shall include no less than 20 panels of Interior type Underlayment, C-D Plugged, and C-D. Sampling of Interior type (including the different adhesive qualities) or Exterior type shall be prorated on the basis of ratio of their volume to total volume (i.e., for shipment containing 50 percent Exterior, 10 Exterior panels shall be selected), but in no case shall less than 10 panels of each type or adhesive quality be selected. Shipments of Interior type plywood bonded with exterior glue shall be sampled in the same manner as Exterior plywood.

From five of the panels selected, excluding Interior type panels bonded with interior glue, and five of

overlaid panels selected, a 5-1/2 inch by 8 inch specimen shall be cut and tested as described in 4.5.4.

A4.5.5. Plywood glue bond quality reinspections—Reinspection of the unused panels in the disputed item, lot, or shipment shall be carried out following the procedures set forth, in section 4, "Specimen Preparation and Testing," and A4.5.4 above. If the reinspection tests establish that the glue bond quality does not meet the requirements of 3.7, as applicable, the item, lot, or shipment fails to pass the reinspection and may be rejected by the buyer. If the glue bond quality requirements are met, the item, lot, or shipment passes the reinspection and the buyer must accept the item, lot, or shipment as invoiced, except that he need not accept any delaminated Exterior type or overlaid panels.

A5. Metric conversion factors—The conversion factors and units contained in this appendix are in accordance with the International System of Units (abbreviated SI for Systeme International d'Unites). The SI was defined and given official status by the 11th General Conference on Weights and Measures which met in Paris in October 1960. For assistance in converting U.S. customary units to SI units, see ASTM E 380, *ASTM Standard Metric Practice Guide*, available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103. The conversion factors for the units found in this Standard are as follows:

1 inch = 25.4 millimeters

1 foot = 0.3048 meter

1 pound per square inch =

6.894 757 x 10³ pascals

1 pound force = 4.448 222 newtons

$t_C = (t_F - 32)/1.8$

where:

t_C = temperature in degrees Celsius

t_F = temperature in degrees Fahrenheit