

# American National Standard

## for Engineered Wood Flooring

*consensus standards organization*



American National Standards Institute  
25 West 43<sup>rd</sup> Street  
New York, NY 10036  
212/642-4900

*ANSI accredited  
standards developer*



Hardwood Plywood & Veneer Association  
1825 Michael Faraday Drive  
Reston, Virginia 20190 USA  
703/435-2900

*adopted by*



**National  
Wood Flooring  
Association**

National Wood Flooring Association  
111 Chesterfield Industrial Blvd.  
Chesterfield, MO 63005  
800/422-4556



# American National Standard For Engineered Wood Flooring

American National Standards Institute, Inc.

## Abstract

This Standard establishes nationally recognized requirements for commercially available engineered wood flooring. It is intended to provide producers, distributors, and users with a basis for common understanding of the characteristics of these products.

Requirements are given for grading, bond line, moisture content, machining, and formaldehyde emissions of engineered wood flooring. Methods for identifying products that conform to the Standard, as well as trade terms used, are included. Information on ordering, installation, re-inspection practices, and inherent characteristics of engineered wood flooring is included in the Appendix.

## A Note on the Metric System of Measurement

The 1975 Metric Conversion Act, as amended by the Omnibus Trade and Competitiveness Act of 1988, sets forth that the metric (SI) is the preferred system of measurement in the U.S. The Engineered Wood Flooring Standard contains metric units first with English (inch-pound) units in parentheses. The metric number in almost all cases is the “soft” conversion number for the accepted inch-pound system requirement. In order to make the metric number more conceptually coherent and for consistency, most conversions for less than 76 mm (3 inches) in dimension are “soft” converted to the nearest 0.1 mm. For most measurements of 76 mm (3 inches) or above, the “soft” value is converted to the nearest 1 mm. For machining and tolerances, measurements are shown to the nearest 0.01 mm.

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## Foreword

(This foreword is not a part of the American National Standard for Engineered Wood Flooring, ANSI/HPVA EF 2009).

This American National Standard for Engineered Wood Flooring, ANSI/HPVA EF 2009, is sponsored by the Hardwood Plywood & Veneer Association (formerly the Hardwood Plywood Manufacturers Association) and developed under the Procedures for Development of American National Standards. The products described in this Standard are manufactured as various widths and lengths to simulate a plank floor, in blocks, or to create a pattern. This Standard is a revision of the American National Standard for Engineered Wood Flooring, ANSI/HPVA EF 2002, formerly the American National Standard for Laminated Wood Flooring, ANSI/HPVA LF 1996, which superseded American National Standard for Laminated Hardwood Flooring, ANSI/HPMA LHF 1987 and LHF 1982, American National Standard for Laminated Hardwood Block Flooring, ANSI 010.2-1975, and the American National Standard for Laminated Hardwood Floor Tile, ANSI/HPMA-LFT-1978. The first Standard in this series was published in 1960 as Laminated Hardwood Block Flooring, CS233-60.

Suggestions for improvements of this Standard are welcome and should be sent to the American National Standards Institute, 25 West 43<sup>rd</sup> Street, New York, NY 10036.

Consensus for this standard was achieved by use of the “ANSI Essential Requirements: Due process requirements for American National Standards” and the ANSI accredited “Hardwood Plywood and Veneer Association Policy for the Development and Maintenance of Voluntary American National Standards”. The following organizations, recognized as having an interest in engineered wood flooring, were contacted prior to the approval of this Standard. Inclusion in this list does not necessarily imply that the organization concurred with the proposed Standard as submitted to ANSI.

Anderson Hardwood Floors, Inc.	Mannington Wood Floors
Arborcraft	National Wood Flooring Association
Armstrong World Industries	North Carolina State University
B R Funster	PPG Industries
Besse Forest Products	Pennsylvania State University
Composite Panel Association	Roddis Lumber Co.
California Air Resources Board	Sierra Club
Design Floors	Timber Products
Greenguard	Doug Brown, retired
Indiana University	

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## 1. PURPOSE

The purpose of this Standard is to establish nationally recognized requirements for commercially available engineered wood flooring. It is intended to provide producers, distributors, architects, designers and other users with a description of the characteristics and the basis for the manufacture, purchase criteria and sale of these products.

## 2. SCOPE AND CLASSIFICATION

**2.1 SCOPE** – This Standard covers requirements for moisture content, machining, bond line, construction, formaldehyde emissions, and finish of engineered wood flooring for interior use. Engineered wood flooring includes flooring such as multiple pieces of varying lengths and widths, to create a strip or plank appearance or multiple specific shaped pieces to fit together to form a pattern. Methods for identifying products that conform to the Standard, as well as definitions of trade terms used, are included. Information on ordering, installation, re-inspection practices and inherent characteristics is included in the Appendix.

**2.2 CLASSIFICATION** – The engineered wood flooring covered by this Standard is classified by the species, pattern, and finish of the face veneer. (See 3.3, 3.4, and 3.13).

## 3. REQUIREMENTS

**3.1 GENERAL** – All engineered wood flooring represented as complying with this Standard shall meet all of the requirements specified herein.

**3.2 ILLEGALLY LOGGED WOOD** – There shall be no wood used in the manufacture of flooring under this standard that has been taken in violation of the laws of a U.S. State, U.S. federal government, or any foreign law that protects plants or timber.

**3.3 WOOD SPECIES** – Veneers forming the engineered flooring shall be of one or more wood species. North American species commonly used for the surface (face) of engineered wood flooring are listed in Table 1.

**TABLE 1**  
Various Surface (Face) Species<sup>a</sup> of Engineered Wood Flooring  
Listed in Order of Relative Hardness and Inherent  
Wearing Capability

Species of Surface Ply <sup>a</sup>
Pecan/Hickory
Hard Maple (Sugar and Black)
Oak (Red and White)
Birch (Sweet and Yellow)
Ash, White
Beech
Walnut, Black
Pine, Southern
Cherry, Black

<sup>a</sup>When other unlisted species are used, compression perpendicular to the grain (fiber stress at proportional limit) for the species as appearing in the Wood Handbook shall be equal to or in excess of black cherry. Wood Handbook: Wood as an Engineering Material (1999) is available from the Forest Products Society, 2801 Marshall Court, Madison, WI 57305-2295. See also ANSI/HPVA HP-1 -2009, Table 1, which lists categories of commercial species and species groups .

**3.4 GRADE AND PRODUCT DESCRIPTION** – The grades of the veneers for crossband adjacent to the face, back and other inner plies used for engineered wood flooring shall be in accordance with the grade descriptions appearing in ANSI/HPVA HP-1<sup>1</sup>. Splice joints shall be well made with good craftsmanship so as not to distract from the overall appearance of the panel. Face splices shall be matched for color and grain and appear parallel with the edges. Face veneer grades will be determined by the manufacturer's product samples. These grades include cutting methods such as sawn, rotary, and sliced as well as natural characteristics, texturing methods, and factory finishes.

**NOTE:** Product samples are a visual representation of a manufacturer's product. Since wood is a natural material, its appearance is influenced by many factors beyond human control. Differences in appearance can be more pronounced in some species and are not always represented in the manufacturer's product sample.

**3.5 MACHINING** – Machining shall be in conformance with the minimum requirements appearing in Table 3.

**3.6 BOND LINE** – All adjacent surfaces of each ply shall be uniformly and securely bonded. The flooring shall conform to the requirements of the bond test described in 4.2.

**3.7 GRADE, MACHINING, AND BOND LINE TOLERANCES** – Non-conformance with the requirements of this standard shall not exceed a total of 5 percent in the finished product for a given lot.

**3.8 CONSTRUCTION** – The flooring pieces shall be of a construction that limits expansion, contraction, and warping, that affect the intended use or installation of the product. Any construction with an even or odd number of plies and any combination of thicknesses that do not affect the intended use or installation of the product is permitted. See also ANSI/HPVA HP-1-2009 sections 3.10 and 3.10.1 which provide additional information on production of a balanced product.

**3.9 VENEER THICKNESS** – The veneer thickness will vary according to the design and intended use as specified by the manufacturer.

**3.10 MOISTURE CONTENT** – The average moisture content of the flooring shall be between 5 and 9 percent at the time of shipment from the manufacturer's plant unless it has been specifically designed for arid or high humidity markets. The purpose of this requirement is to provide a product which will perform satisfactorily over the typical range of humidity and temperature in an indoor environment, when installed according to the instructions of the manufacturer. (See Table 4 for requirements). The moisture content shall be determined in accordance with 4.3 and the product shall be marked in accordance with 3.15.

**3.11 FORMALDEHYDE EMISSION REQUIREMENTS** – Engineered wood flooring made from hardwood plywood, veneer or composite core panels, shall meet the formaldehyde chamber concentration requirements in Table 4 when tested in accordance with the Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products using a Large Chamber, ASTM E 1333.<sup>2</sup> Engineered wood flooring shall be placed on the floor of the large chamber intended use side up with the boards contiguous (tongues shall be inserted into grooves for products containing tongues and grooves or fitted together in case of locking joints). The loading ratio shall be calculated based on one-side exposure only. To comply with the formaldehyde emission requirements of this Standard, flooring shall be certified by an independent, accredited certification organization, approved by and issued a current accreditation by a signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement (ILAC, 2000) for ISO 65 product certification. An organization approved by a governmental organization with wood product formaldehyde emission standards, that otherwise meets all the requirements of this section (3.11 et seq.), shall meet the independent, accredited certification organization requirements of this standard.

**3.11.1 TESTING REQUIREMENTS** – To comply with the testing requirements of this standard for formaldehyde emissions, all testing shall be conducted by an ISO 17025 accredited testing laboratory whose emission testing and analysis falls under the scope of their ISO 17025 accreditation. The quality control test to be used shall be approved by the ISO 65 certification organization.

**3.11.2 MINIMUM REQUIREMENTS FOR COMPLIANCE** – The following minimum elements shall be incorporated into all testing programs.

<sup>1</sup> ANSI/HPVA HP-1-2009 is available from the Hardwood Plywood and Veneer Association, 1825 Michael Faraday Drive, Reston VA 20190-5350 USA, [www.hpva.org](http://www.hpva.org)

<sup>2</sup> The latest issue of ASTM publications shall be used provided the requirements are applicable and consistent with the issues designated. Copies of ASTM publications may be purchased from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959



**3.11.2.1** Correlation must be established between the quality control test utilized and the ASTM E1333 large chamber test. For each product type that is determined, a minimum number of five (5) tests must be run on samples utilizing the ASTM E1333 test and the test used for quality assurance. Each facility shall provide proof of an existing Quality Assurance Program along with adequate testing competency and recordkeeping as specified in the Quality Control manual.

**3.11.2.2** Quarterly review of test data for compliance shall be conducted for each facility.

**3.11.2.3** Quarterly ASTM E1333 test method tests shall be conducted for each product type. Under no circumstances would ASTM E1333 testing frequency be less than once a year for each product type to be certified. (See 3.11.2.6 below for the exceptions.)

**3.11.2.4** Quality control testing for each product type shall be conducted based on the following schedule:

**Table 2 Quality Control Test Sampling Frequency**

<b>Weekly HWPW Production (ft<sup>2</sup>)</b>	<b>Minimum Number of Routine Tests per Week</b>
Less than 200,000	1
200,000 – 400,000	2
Greater than 400,000	3

Production volumes determine the number of tests that are required to be conducted, and the frequency of the quality control testing is determined by the relevant production volume and not the time period. For example, if there is no production in a week, then no quality control test needs to be conducted. After the first year, the quality control testing frequency may be reduced if the manufacturing process is proven to be in control. Adequate statistical verification is required. Under no circumstance in this situation for non-exempt product types produced during a weekly period in volumes greater than 200,000 ft<sup>2</sup> shall less than one quality control once a week be conducted.

**3.11.2.5** When imported platforms are used, a quality control test should be performed on each new shipment and the results correlated to the emission limits established in Table 5.

**3.11.2.6** For ULEF and NAUF systems, ASTM E 1333 testing shall occur at least quarterly. For NAF resin systems ASTM 1333 shall occur at least once a year. The frequency of the Quality Control tests may also be reduced as determined by the independent certification organization. Significant changes in the amount of resin used by volume and weight, in press time, and in resin formulation may require additional testing as specified by the independent, third party certification organization.

**3.11.3 EXEMPTIONS FROM COMPLIANCE TESTING REQUIREMENTS** – To qualify for the ULEF, NAUF, and NAF exemptions, manufacturers shall meet the following requirements:

**3.11.3.1 ULTRA LOW EMITTING FORMALDEHYDE (ULEF) AND NO ADDED UREA FORMALDEHYDE (NAUF) EXEMPTIONS** – Provide data from six (6) months of quality control testing or 24 weeks of quality control tests, regardless of the length of time associated with collecting the data (non-consecutive weeks) in which ninety (90) percent of the test data correlates to a maximum of 0.05 mg/m<sup>3</sup> (0.04 ppm) in the ASTM E1333 test method, with the remaining ten (10) percent correlating to a maximum of 0.06 mg/m<sup>3</sup> (0.05 ppm). In addition, no test result in this six (6) month period shall exceed 0.06 mg/m<sup>3</sup> (0.05 ppm) using ASTM E1333 test method. Quarterly ASTM E1333 testing shall still be required. Routine Quality Control testing will be significantly reduced or eliminated as determined by the manufacturer and third party certification organization. Any quarterly test failure will result in revocation of this exemption and the process to re-qualify for this ULEF exemption shall start a new six (6) months qualification period.

**3.11.3.2 NO ADDED FORMALDEHYDE (NAF) EXEMPTION** – Provide data from three (3) months of quality control testing or 12 weeks of quality control tests, regardless of the length of time associated with collecting the data (non-consecutive weeks) in which ninety (90) percent of the test data correlates to a maximum of 0.05 mg/m<sup>3</sup> (0.04 ppm) in the ASTM E1333 test method, with the remaining ten (10) percent to a maximum of 0.06 mg/m<sup>3</sup> (0.05 ppm). In addition, no test result in this three (3) month period shall exceed 0.06 mg/m<sup>3</sup> (0.05 ppm) using ASTM E1333 test method. Annual ASTM E 1333 testing shall be conducted. Routine Quality Control testing will be significantly reduced or eliminated as determined by the third party certification organization and the manufacturer. Any annual test failure shall result in the revocation of this exemption and the process to re-qualify for the NAF exemption shall start a new three (3) month qualification period.

**3.11.3.3 USING A CERTIFIED COMPLIANT PLATFORM** – If a supplier provides authenticated verification that the panels purchased for the manufacture of prefinished Engineered Hardwood Flooring are certified to comply with ANSI-HP-1<sup>1</sup> formaldehyde emission requirements and the only subsequent processing of the certified panel is to stain, finish, or laminate a non-wood surface layer no additional testing is required. If any wood veneer is laminated to the platform panel, all the testing requirements of section 3.11 shall apply, unless there is no additional bond line added or if using a NAF glue, the product shall be considered compliant after 5 product sets have satisfactorily completed ASTM E 1333 tests and meet the applicable emission standard in Table 5.

## **3.12 FINISH**

**3.12.1 UNFINISHED FLOORING** – The unfinished flooring product shall conform to the requirements for unfinished flooring described in Table 2.

**3.12.2 FACTORY FINISHED FLOORING** – The factory finished flooring product shall conform to the requirements described in Table 2. The type of finish used will vary according to the design and will be suited for the intended use as specified by the manufacturer. Bevel edges shall be fully coated. Appearance shall be consistent with the manufacturer's standard for color and gloss.

**3.13 PACKAGING** – The engineered wood flooring shall be packaged in such a manner as to provide reasonable protection against damage in ordinary handling and transportation. Only flooring of the same classification (see 2.2) shall be in any one package (see 3.15) for package marking.

**3.14 INSTALLATION INSTRUCTIONS AND WARRANTY** – Installation instructions shall be provided to the user. A manufacturer's warranty shall be included or available upon request.

**3.15 MARKING** – Each package of engineered wood flooring shall be marked with the name or recognized identification of the producer; the species; the pattern; the color, or denoted unfinished; the flooring dimensions; the actual square footage (surface measure) of flooring in the package; and the date of manufacture. Products designed with moisture content specifically for arid or high humidity markets should be marked accordingly. See also section 6 below.

#### 4. INSPECTION AND TEST PROCEDURES

**4.1 GENERAL** – The inspection and test procedures contained in this section are to be used to determine the conformance of products to the requirements of this Standard. Additional sampling and testing of the product, as agreed upon between purchaser and seller is not precluded by this section.

**4.2 BOND LINE TEST** – Two test specimens, 50.8 mm (2 inches) wide by 127 mm (5 inches) along the grain, shall be cut from each flooring sample tested. The specimens shall be cut from opposite sides of the flooring after all tongue and groove portions have been removed. The specimens shall be submerged in water at  $24^{\circ}\text{C} \pm 3^{\circ}\text{C}$  ( $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ) for 4 hours, and then dried at a temperature between  $49$  and  $52^{\circ}\text{C}$  ( $120$  and  $125^{\circ}\text{F}$ ) for 19 hours, with sufficient air circulation to lower the moisture content (based on oven-dry weight) of the specimens to a maximum of 8 percent. This cycle shall be repeated until all specimens fail or until three cycles have been completed, whichever occurs first. The flooring shall be considered as failing when any single delamination between two plies of either specimen is greater than 50.8 mm (2 inches) in continuous length, over 6.4 mm (1/4 inch) in depth at any point, and 0.08 mm (0.003 inch) in width as determined by a feeler gauge 0.08 mm (0.003 inch) thick and 12.7 mm (1/2 inch) wide. Specimens shall be examined for delamination at the end of each cycle. Delamination due to tape at joints of inner plies or defects allowed by the grade shall be disregarded. For performing the bond line test, flooring samples shall be selected in multiples of ten in order to provide for a sufficient number of specimens (two specimens per sample) to which the acceptance levels are applied. Ninety-five percent of test specimens shall pass the first cycle, and eighty-five percent of test specimens shall pass the third cycle.

**4.3 DETERMINATION OF MOISTURE CONTENT** – Moisture content determinations shall be made using any of the methods described in American Society for Testing and Materials (ASTM) designations D4442-07, Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials, and D4444-08, Standard Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters.<sup>3</sup>

#### 5. DEFINITIONS

The terms used in this Standard are defined as follows:

**AIR CHANGE RATE** – The amount of outside air moving into or out of a building or chamber usually expressed by the number of building or chamber volumes exchanged per hour.

**BACK** – The side opposite to the face of engineered wood flooring.

**BARK** – The tough outer covering of the woody stems and roots of trees, shrubs, and other woody plants.

**BARK POCKET** – Bark around which normal wood has grown.

**BLENDING** – Color change that is detectable at a distance of 1.8 m to 2.4 m (6 feet to 8 feet) but which does not detract from the overall appearance of the floor under normal and expected lighting conditions.

**BOW** – With the face of the engineered product up as the board lies on a flat surface, bow is a condition where the center of the board deviates from the flat plane while the ends remain in contact.

**BURL** – A swirl, twist, or distortion in the grain of the wood which usually occurs near a knot or crotch. A burl is often associated with abrupt color variation and/or a cluster of small dark piths caused by a cluster of adventitious buds.

**CHAMBER LOADING RATIO** – In context with formaldehyde large chamber testing, the total exposed surface area of the product expressed in square meters (feet) divided by the test chamber volume in cubic meters (feet).

**CHARACTER** – A unique visual or graining effect which may include burls, knots, mineral streaks, gum pockets, etc.

**CHECKS** – Small fractures running parallel to the grain of the wood caused chiefly by expansion and contraction of the wood.

<sup>3</sup> The latest issue of ASTM publications shall be used provided the requirements are applicable and consistent with the issues designated. Copies of ASTM publications may be purchased from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

**CONSTRUCTION (PRODUCT CONSTRUCTION)** – Term referring to detailed manner in which flooring components are assembled, e.g. "3-ply construction", "3.2 mm (1/8 inch) face, back and core", etc.

**CORE** – Any form of composite or wood materials used to support the face (intended use side) and back layer.

**CROOK** – A distortion perpendicular to the edge of a piece of engineered wood flooring from a straight line from end-to-end of the piece (sometimes referred to as sidebow).

**DECAY** – Decomposition of wood substance caused by action of wood-destroying fungi, resulting in softening, loss of strength and weight, and often in change of texture and color.

**DECAY, INCIPIENT** – The early stage of decay that has not proceeded far enough to soften or otherwise perceptibly impair the hardness of the wood. It may be accompanied by a slight discoloration or bleaching of the wood.

**DELAMINATION** – Separation of plies or layers of wood or other material through failure of the adhesive bond.

**DISCOLORATIONS** – Stains in wood substances. Common veneer stains are sap stains, blue stains, stain produced by chemical action caused by the iron in the cutting knife coming in contact with the tannic acid of the wood, and those resulting from exposure of natural wood extractives to oxygen and light, to chemical action of vat treatments or the adhesive components, and/or to the surface finish.

**END GAP** – Separation that occurs when two pieces of flooring are fitted together end to end such that the longitudinal axes are aligned in the same direction.

**END LIFT** – With the face of the engineered product up as the board lies on a flat surface, a condition where the ends of the board deviate from the flat plane while the center remains in contact, sometimes referred to as ski.

**ENGINEERED WOOD FLOORING** – A product composed of an assembly of layers or plies of veneer(s) in combination with lumber core, particleboard, MDF core, hardboard core, special core, or special back material joined with an adhesive. Except for special constructions, the grain of alternate plies is at right angles and the decorative face veneer made from hardwood, softwood species or woody grass.

**FACE** – The side of any engineered wood flooring that is exposed to view after installation.

**FILLINGS** – See **wood filler**

**FLATNESS** - Includes Bow, Ski, End Lift, Twist, and other scenarios where distortion of a piece of flooring may occur from a smooth level plane.

**GAP** – Open slits in the inner plies or improperly joined veneers within a piece of engineered wood flooring.

**GRAIN** – The direction, size, arrangement, and appearance of the fibers in wood or veneer.

**GUM** – A comprehensive term for nonvolatile viscous plant exudates, which neither dissolve nor swell up in contact with water.

**GUM POCKETS** – Well-defined openings between rings of annual growth, containing gum or evidence of prior gum accumulations.

**HARDWOOD** – General term used to designate lumber or veneer produced from temperate zone deciduous or tropical broad-leaved trees in contrast to softwood, which is produced from trees which are usually needle bearing or coniferous. The term does not infer hardness in its physical sense.

**HEARTWOOD** – The non-active or dormant center of a tree, generally distinguishable from the outer portion (sapwood) by its darker color.

**JOINT** – The common edge between two adjacent materials in the same plane.

**JOINT, OPEN** – A gap or space between two adjacent pieces of veneer in the same plane.

**KNOT** – Cross section of tree branch or limb with grain usually running at right angles to that of the piece of wood in which it occurs.

**KNOT, PIN** – A sound knot 6.4 mm (1/4 inch) or less in diameter containing a dark center.

**KNOT, SOUND, TIGHT** – A knot that is solid across its face and fixed by growth to retain its place.

**KNOTHOLE** – Opening produced when a knot drops from the wood in which it was originally embedded.

**LAP** – A condition where one piece of veneer in the same ply overlaps another piece.

**LOADING RATIO** – See **chamber loading ratio**.

**MANUFACTURER** – A producer of engineered wood flooring

**NO ADDED FORMALDEHYDE (NAF)** – Glue or binder system formulated without formaldehyde as part of the resin cross linking structure (See Table 4).

**NO ADDED UREA FORMALDEHYDE (NAUF)** – Glue or binder system formulated with formaldehyde based resin that does not contain urea-formaldehyde polymer (See Table 4).

**OCCASIONAL** – A small number of characteristics that are arranged somewhat diversely within the panel face.

**OVERWOOD** – The vertical offset between two properly installed pieces of flooring.

**PLANK** Product that is installed in a linear pattern in which the product is 3 inches or wider and substantially longer than it is wide.

**PLY** – A single sheet of veneer or several pieces laid with adjoining edges, which form one layer in a piece of engineered wood flooring.

**ROUGH GRAIN (ROUGH CUT)** – Irregular shaped areas of generally uneven corrugation on the surface of veneer, differing from the surrounding smooth veneer and occurring as the veneer is cut by the lathe or slicer.

**PROFILE** – Edge and end views of a piece of engineered wood flooring showing the edge (bevel or square), and tongue and groove configurations.

**PRODUCT TYPE**-means a type of wood product that differs from another based on composition, thickness, number of plies, and the resin to distinguish one composite wood product from another made by the same manufacturer.

**RUPTURED GRAIN** – A break or breaks in the grain or between springwood and summerwood caused or aggravated by excessive pressure during manufacturing or stress during seasoning and natural processes. Appears as a single or series of distinct separations in the wood such as when springwood is crushed leaving the summerwood to separate in one or more growth increments. See **shake**.

**SAPWOOD** – The lighter colored wood of the outermost growth rings of the stem of a tree which performs functions such as sap (and water) conduction and storage of reserve food.

**SHAKE** – A separation or rupture along the grain of wood in which the greater part occurs between the rings of annual growth. See **ruptured grain**.

**SIDEBOW** – See **crook**.

**SKI** – See **end lift**.

**SLIGHT** – Visible on observation, but does not interfere with the overall aesthetic appearance with consideration for the performance or intended use of the engineered wood flooring.

**SMOOTH, TIGHT CUT** – Veneer cut to minimize lathe checks.

**SOFTWOOD** – *General term* used to describe lumber or veneer produced from needle and/or cone bearing trees. See **hardwood**.

**SPECIES (COMMERCIAL GROUPS)** – Different species or genera grouped for marketing convenience and identified with a single commercial name.

**SPECIES (TREES)** – An internationally established Latin botanical classification of trees.

**SPECIFIC GRAVITY** – The ratio of the water free or oven-dry weight of a certain volume of a substance to the weight of an equal volume of water, the temperature of which is 4°C (39.2°F).

**SPLITS** – Separations of wood fiber running parallel to the grain.

**STREAKS, MINERAL** – Natural discolorations of the wood substance.

**STRIP** – Product that is installed in a linear pattern in which the product is less than 3 inches in width.

**TWIST** – A form of warp in which the four corners of a flat face are no longer in the same plane.

**ULTRA LOW EMITTING FORMALDEHYDE (ULEF)** - A product manufactured with a resin that consistently measures below the LEVEL 2 emission standards (See Table 4).

**VENEER** – A thin sheet of wood, rotary cut, sliced, or sawed from a log, bolt, or flitch. Veneer is referred to as a ply when assembled.

**WARPING** – Distortion of a piece of engineered wood flooring from a flat plane. (Also see; bow endlift, twist and crook)

**WOOD FILLER** – A material, either synthetic or an aggregate of resin and strands, shreds, or flour of wood which is used to fill openings in wood and provide a smooth, durable surface, also referred to as wood fillings.

## 6. IDENTIFICATION

In order that purchasers are able to identify products conforming to all requirements of this Standard, producers and distributors shall be allowed to include a statement of compliance in conjunction with their name and address on product labels, invoices, sales literature, and the like. When space is available the following statement shall appear:

This engineered wood flooring conforms to all of the requirements established in American National Standard ANSI/HPVA EF 2009. It was developed cooperatively with the industry, approved by the American National Standards Institute, Inc., and published by the Hardwood Plywood & Veneer Association. Full responsibility for the conformance of this product to the Standard is assumed by (name and address of producer or distributor).

When space is not available for the full statement, the following abbreviated statement shall appear:

*Conforms to ANSI/HPVA EF 2009 (name and address of producer or distributor).*

**FORMALDEHYDE EMISSIONS** - All engineered wood flooring represented to be conforming to the formaldehyde emission requirements of this standard shall be identified by product manufacturer, date of production and/or lot number, and statement of product emission compliance. Labels may be stamped on the product, attached or affixed as a unit label, and a written statement containing the information as described above shall be included with the shipment and/ or the accompanying invoice.

**TABLE 3**  
**Requirements and Tolerances for Engineered Wood Flooring**

	<b>Factory Finished Bevel &amp; Square Edge</b>	<b>Unfinished Bevel &amp; Square Edge</b>	<b>Character Bevel &amp; Square Edge</b>
<b>Characteristics</b>			
Plank and Block Width Tolerance	+/- 0.25 mm (+/- 0.010 inch)	+/- 0.25 mm (+/- 0.010 inch)	+/- 0.25 mm (+/- 0.010 inch)
Overwood	0.31 mm (0.012 inch)	0.38 mm (0.015 inch)	0.63 mm (0.025 inch)
Crook	0.18 mm per linear 300 mm (0.007 inch per linear foot) of length, but not to exceed 0.64 mm (0.025 inch) for any piece	0.18 mm per linear 300 mm (0.007 inch per linear foot) of length, but not to exceed 0.64 mm (0.025 inch) for any piece	0.23 mm per linear 300 mm (0.009 inch per linear foot) of length, but not to exceed 0.89 mm (0.035 inch) for any piece
End Alignment or Squareness	0.13 mm per 25 mm of width (0.005 inch per inch of width)	0.18 mm per 25 mm of width (0.007 inch per inch of width)	0.23 mm per 25 mm of width (0.009 inch per inch of width)
Flatness	Products less than 19.05mm (3/4") thick: Lift from flat surface should not exceed 1.25% of the piece's length.  Products 19.05mm (3/4") thick or greater: Lift from flat surface should not exceed 0.75% of the piece's length	Products less than 19.05mm (3/4") thick: Lift from flat surface should not exceed 1.25% of the piece's length.  Products 19.05mm (3/4") thick or greater: Lift from flat surface should not exceed 0.75% of the piece's length	Products less than 19.05mm (3/4") thick: Lift from flat surface should not exceed 1.25% of the piece's length.  Products 19.05mm (3/4") thick or greater: Lift from flat surface should not exceed 0.75% of the piece's length

Notes: These manufacturing requirements are intended to ensure that manufactured tongue and groove engineered wood flooring provides a product of high machining quality that is well-suited for installation when properly installed according to the manufacturer's installation instructions over a sufficiently smooth subfloor or substrate.

The machining requirements and tolerances apply to pre-installed or properly installed engineered wood flooring. The Appendix to this Standard provides information on installation recommendations (A2) and reinspection practices (A3).

**TABLE 4  
MOISTURE CONTENT OF WOOD AT VARIOUS TEMPERATURE AND  
RELATIVE HUMIDITY READINGS**

Temperature Fahrenheit		Expected Moisture Content of Wood (EMC)																				
		1	3	4	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10	11	12	14	15	17	19	21	24	27	
Primary Temp. Zone	30	1	3	4	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10	11	12	14	15	17	19	21	24	27	
	40	1	3	4	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10	11	12	14	15	17	19	21	24	27	
	50	1	3	4	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10	11	12	14	15	17	19	21	24	27	
	60	1	3	4	4.6	5.4	6.2	7.0	7.8	8.6	9.4	10	11	12	13	15	16	18	21	24	27	
	70	1	3	4	4.5	5.4	6.2	6.9	7.7	8.5	9.2	10	11	12	13	14	16	18	21	24	27	
	80	1	2	4	4.4	5.3	6.1	6.8	7.6	8.3	9.1	9.9	11	12	13	14	16	18	20	24	26	
	90	1	2	3	4.3	5.1	5.9	6.7	7.4	8.1	8.9	9.7	11	12	13	14	15	17	20	23	26	
	100	1	2	3	4.2	5	5.8	6.5	7.2	7.9	8.7	9.5	10	11	12	14	15	17	20	23	26	
	Relative Humidity (percent)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	98	
		Dry Zone					Primary Humidity Range					Humid Zone										
<b>Definitions:</b>	<p>Dry Zone indicates an environment in which the temperature and humidity would cause the wood to lose moisture.</p> <p>Humid Zone indicates an environment in which the temperature and humidity would cause the wood to gain moisture.</p>																					

**TABLE 5 FORMALDEHYDE EMISSIONS REQUIREMENTS FOR ENGINEERED WOOD FLOORING**

Formaldehyde Emission Classification	Loading Ratio <sup>a</sup>		Maximum Chamber Concentration <sup>b</sup>	
	m <sup>2</sup> /m <sup>3</sup>	ft <sup>2</sup> /ft <sup>3</sup>	mg/m <sup>3</sup>	ppm
LEVEL 1 <sup>c</sup>	0.43	0.13	0.10	0.08
LEVEL 2	0.43	0.13	0.06	0.05
LEVEL 2 ULEF EXEMPT	0.43	0.13	0.05/0.06	0.04/0.05
LEVEL 2 NAUF EXEMPT	0.43	0.13	0.05/0.06	0.04/0.05
LEVEL 2 NAF EXEMPT	0.43	0.13	0.05/0.06	0.04/0.05

<sup>a</sup> See Section 5 for definitions.

<sup>b</sup> Emissions are based on standardizing observed formaldehyde concentrations in the ASTM E1333 large chamber to a temperature of 25°C (77°F) and a relative humidity of 50 %.

<sup>c</sup> This formaldehyde emission classification for Engineered Wood Flooring with a veneer core shall expire after December 31, 2009. Engineered Wood Flooring with a particleboard or MDF core shall expire on June 30, 2012.



## APPENDIX

***This Appendix is not a part of the American National Standard ANSI/HPVA EF 2009, but is included for information purposes only.***

**A1. ORDERING INFORMATION** – Purchasers should specify the face wood species, profile, construction, dimensions, whether finished or unfinished flooring is required, and the pattern or color of the flooring.

**A2. INSTALLATION RECOMMENDATIONS** – Engineered wood flooring will give the best service if its moisture content, when laid, is close to that which it will ultimately obtain in service. Consequently, engineered wood flooring should not be laid until all plastering, concrete, and masonry work is completely dry and until all exterior openings are closed.

In order to obtain the maximum service and satisfaction from this type of flooring, installation should conform to the latest written recommendations and specification data of the manufacturers of the flooring and the flooring adhesive. In all cases, the manufacturer's printed installation instructions and/or technical notes and local building codes relating to the product shall be used in both the selection of job conditions compatible with the flooring product and in the installation of the flooring product. Refer to manufacturer's instruction sheets to determine if the engineered wood flooring product can be installed below grade or if only on or above grade. Engineered wood flooring can be used over sound deadening material provided the sound deadening material offers sufficient support to the finished flooring without breakage, indentation, or equivalent damage. Contact manufacturer for information on sound deadening material and on installation.

**A3. RE-INSPECTION PRACTICES** – The following, based on general industry practices, is offered only for the information of purchasers of engineered wood flooring. This information does not affect the requirements of this Standard or take precedence over purchasing agreements.

Because the provisions of this Standard apply to each and every item represented as conforming to the Standard and because some tests for determining conformance destroy the item, provisions for sampling during re-inspection to determine conformance of shipments with purchase agreements should be included in the original purchase agreement.

All complaints regarding the quality or non-conformance with the Standard of any shipment shall be made within 15 days from receipt thereof.

If the grade, machining, and/or bond line integrity of any shipment is in dispute and a re-inspection is requested, the re-inspection should first be made by the retailer, and if necessary, by the distributor or manufacturer of the product. The cost of such re-inspection should be borne by the seller if the shipment is more than 5 percent below grade. The buyer need not accept those pieces established as a result of re-inspection as being below grade or not complying with the machining, bond line, or any other requirement of this Standard, but should accept the balance of the shipment as invoiced.

If the re-inspection establishes that the shipment is within the 5 percent tolerance, the buyer should pay for the shipment as invoiced, as well as the cost of re-inspection.

If the re-inspection involves the installed flooring, the re-inspection shall consider the engineered wood flooring, the installation, and the subfloor and/or substrate. If the re-inspection determines that the deficiency is due to flooring not in compliance with this Standard, the cost shall be borne by the manufacturer. The manufacturer shall select the means for correcting out-of-compliance engineered wood flooring after installation: repair, replacement of individual flooring pieces, or replacement of the flooring in the specific area(s) where out-of-compliance occurs.

**A4. INHERENT CHARACTERISTICS OF ENGINEERED WOOD FLOORING** – This section is provided as explanatory information for linking various inherent characteristics of wood to grades and to the performance and intended use of engineered wood flooring.

**A4.1 NATURAL CHARACTERISTICS** – Wood is a natural material. Thus, its appearance is influenced by a number of factors uncontrolled by man. In temperate zones, the primary growing seasons affect the formation of springwood and summerwood which can result in wood with different density and appearance as it is formed during the spring and summer seasons. These differences can be pronounced in some species. The presence of adventitious buds and limbs that are pruned by nature are responsible for the formation of small pin knots and some larger knots. Minerals and other soil factors can affect color variation in wood. Insects, vines, other living things, and variants of nature can interact with the living tree causing colorations and wounds which are healed by the living tree. These natural processes are, in part, responsible for the inherent natural visual characteristics or imprints in wood. These factors often act differently in different species.

**A4.2 FLOORING AND MOISTURE** – The species listed in the Engineered Wood Flooring Standard have been shown to exhibit properties that result in wood floor installations that can perform well for many years and last as long as the structure. Certain practices are necessary, however, to assure that wood materials will provide for a long-lasting and satisfactory floor installation. The cross-ply construction used in the manufacture of engineered wood flooring results in a product where changes in dimensions of a piece of engineered wood flooring are minimized with changes in interior moisture conditions. Subjecting this product or other wood flooring products to water, however, as may occur with flooding due to plumbing leaks, rain through open windows or doors, or excessively wet concrete slabs can result in surface checks or, at extreme conditions, discoloration of the wood surface and deterioration of the applied finish.”

**A4.3 LIGHT** – Wood will change color when exposed to the ultra-violet (UV) component of light. This change in color, when it occurs over the entire floor, often results as a mellowing of the original color. When the installation is characterized by uneven exposure to light such as when some room areas are heavily shaded while other areas are in natural light, some differences in color change can occur.

**A4.4 HARDNESS AND INDENTATION** – Some of the woods used for engineered wood flooring are among the hardest available. Nevertheless, no wood flooring can withstand extremely high compression stresses without marking or marring. High compression stresses are created by such things as women's stiletto heels or when heavy items of furniture or appliances have legs whose ends have small surface areas which concentrate force. The use of wide bearing, non-scratching protective feet or castors can minimize potential surface damage.

**A5. OTHER PROPERTIES OF ENGINEERED WOOD FLOORING** – This section identifies certain properties of engineered wood flooring and the usually referenced test methods for determining compliance with requirements for these properties in specific product applications. These properties vary based on specific product characteristics including the species, thickness, adhesive, and finish. The properties requirements vary depending on the intended building use and area of installation. When information on these product properties is required, the manufacturer of the product being specified should be consulted.

**A5.1 GENERAL**

ASTM D2394 Standard Test Method for Simulated Service Testing of Wood and Wood-Base Finish Flooring

**A5.2 WEAR RESISTANCE**

ASTM D4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser  
STM D3359 Standard Test Methods for Measuring Adhesion by Tape Test

**A5.3 CHEMICAL RESISTANCE**

ASTM D1308 Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes

**A5.4 FIRE PERFORMANCE**

ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials

**A5.5 SLIP RESISTANCE**

ASTM F 489 Standard Test Method for Using a James Machine

ASTM D2394 Inclined Plane Method

**A5.6 SOUND**

ASTM E 90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

ASTM E 413 Classifications for Rating Sound Insulation

ASTM E 492 IIC Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine

**A5.7 THERMAL CONDUCTIVITY**

ASTM C 518 Standard Test Method for Steady-State Heat Thermal Transmissions Properties by Means of the Heat Flow Meter Apparatus

# HPVA LABORATORY CERTIFICATION, TESTING, AND TECHNICAL SERVICES



The Hardwood Plywood & Veneer Association is the trade association representing North American manufacturers of hardwood plywood and veneer, including prefinishers of hardwood wall paneling and suppliers to the industry. One of the objectives of the Association has been to engage in product testing and to provide cost competitive testing, inspection and certification services.

The HPVA Laboratory performs tests to determine conformance to commercial and product standards, federal and military specifications, and state and local code regulations. Certification programs, inspection services, and specific laboratory test procedures are accredited by the **International Accreditation Service, Inc. (IAS)**.

- **ISO/IEC Guide 65 - General requirement for bodies operating product certification systems**
- **ISO/IEC Standard 17020 - General criteria for the operation of various types of bodies performing inspection**
- **ISO/IEC Standard 17025 - General criteria for the competence of testing and calibration laboratories**
- **California EPA - Air Resource Board (CARB) Approved Third Party Certifier (TPC-8)**
- **International Code Council (ICC) - Testing requirements of the International Building Codes**

## Laboratory & Technical Services

**Flame Spread and Smoke Testing** - The laboratory fire testing capability is based on ASTM test standards. Specialized testing services include general flammability, smoke, and gas analysis. Products tested include wood, paper, plastics, metal, textiles, masonry, and many other composite materials.

- **ASTM E 84 25 - Foot Tunnel Furnace**
- **ASTM E 162 - Radiant Panel**
- **ASTM E 648 - Flooring Radiant Panel**
- **ASTM F 814 - Smoke Density**
- **ASTM E 662 - Smoke Density Chamber**
- **FMVSS DOT 302 - Flammability**
- **FAR 25.853 - Vertical Flammability**
- **ASTM E 906 - Rate of Heat Release**

**Formaldehyde Testing** – HPVA is a leader in formaldehyde testing, standardized test method development and recognized third party certification agency. Our services include product emission and occupational exposure measurements.

- **ASTM E 1333 - Large Chamber**
- **ASTM D 5582 - Two-Hour Desiccator Test**
- **ASTM D 6007 - Small Chamber**
- **3M Dosimeter Service for Occupational Exposure**

**Wood Products Testing** – HPVA has the resources and expertise to perform product evaluations and specialized testing services on engineered wood flooring, plywood, and other related wood products.

- **Moisture Content**
- **Linear Expansion**
- **Special Product Evaluations to HPVA Standards**
- **Glue Bond Integrity – Type I and Type II Testing**
- **Specific Gravity**

## HPVA Testing & In-Plant Certification Programs

As part of an industry testing, inspection, and product certification program, HPVA's field inspectors visit plants throughout North America to verify formaldehyde emissions, flame spread performance, and structural properties of hardwood plywood panels. Products that conform to requirements **can earn HPVA's nationally recognized verification stamp**.

**The HPVA laboratory has the unique capabilities to conduct testing for certification, compliance, and research and development for clients in industry, government, and for other laboratories.** In operation since 1954, the 6,000 square foot laboratory now located in Reston, Virginia was established for determining important performance properties of hardwood plywood and other materials. Throughout the years, HPVA has been instrumental in developing ASTM fire, formaldehyde and other test methods used to evaluate product performance. HPVA's professional staff actively participates in ASTM Committees on Fire, Combustion Products, Surface Burning, Formaldehyde, Air Quality, Indoor Air, Wood, Building Performance and others including representation on various subcommittees.

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