ANSI/HPVA EF 2020

AMERICAN NATIONAL STANDARD FOR ENGINEERED WOOD FLOORING

APPROVED AUGUST 14, 2020

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Consensus Standards Organization

Hardwood Plywood & Veneer Association
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Adopted By

American National Standard
For Engineered Wood Flooring

Abstract

This Standard establishes nationally recognized requirements for commercially available engineered wood flooring. It is intended to provide manufacturers, 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 2020).

This American National Standard for Engineered Wood Flooring, ANSI/HPVA EF 2020, is sponsored by the Hardwood Plywood & Veneer Association (HPVA®), DBA Decorative Hardwoods Association (DHA), and developed under the HPVA Policy for the Development and Maintenance of Voluntary American National Standards. The products described in this Standard are manufactured in various widths and lengths, engineered as strip, plank or block flooring products. This Standard is a revision of the American National Standard for Engineered Wood Flooring, ANSI/HPVA EF 2012, 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.

Consensus for this Standard was achieved by use of the "**ANSI Essential Requirements: Due Process Requirements for American National Standards"** and the ANSI accredited HPVA Procedures for the Development of 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.

AHF Products (formerly Armstrong Flooring Inc.)	**National Wood Flooring Association (NWFA)**
American OEM	**NC State University Dept of Forest Biomaterials**
Architectural Woodwork Institute (AWI)	**Newport Construction**
Great Lakes Veneer	**Shaw Industries Group, Inc.**
Mannington Mills, Inc.	**William Groah, Retiree**
Mohawk Industries	**Woodwork Institute of California**
National Institute of Certified Floor Covering Inspectors	

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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 manufacturers, 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 at the time of manufacture for moisture content, machining, bond line, construction, formaldehyde emissions, finish, and compliance marking 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, inherent characteristics, inspection, and certification practices and are included in the Appendix.

2.2 CLASSIFICATION

The engineered wood flooring covered by this Standard is classified by the species, grade and finish of the face veneer. (See SECTION 3.3, 3.4 and 3.11).

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 engineered flooring shall be of one or more 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 OF ENGINEERED WOOD FLOORING

Species of Surface Ply[a, b]	
Hickories	***Carya spp.***
Pecan	***Carya illinoensis***
Birch, Sweet	***Betula lenta***
Maple, Hard	***Acer. Nigrum and Acer saccharum***
Oaks, Commercial White	***Quercus alba***
Ash, White	***Fraxinus spp.***
Beech, American	***Fagus grandifolia***
Oaks, Commercial Red	***Quercus rubra***
Birch, Yellow	***Betula allegheniensis***
Walnut (Black), American	***Juglans nigra***
Cherry, Black	***Prunus serotina***
White / Yellow Pine (one or both)	***Pinus spp.***

[a] Listed in Order of Relative Hardness and Inherent Wearing Capability.
[b] Wood Handbook: Wood as an Engineering Material (2010) is available from the Forest Products Society, 2801 Marshall Court, Madison, WI 57305-2295 and online at www.fpl.fs.fed.us/products/publications. See also the current revision of ANSI/HPVA HP-1 TABLE 1, CATEGORIES OF COMMERCIAL SPECIES AND SPECIES GROUPS which lists categories of commercial species and species groups.

3.4 GRADE AND PRODUCT DESCRIPTION

When present, the veneers for crossband adjacent to the face, back and other inner plies used for engineered wood flooring shall be in compliance with the grade specifications appearing in ANSI/HPVA HP-1[1]. Splice joints shall be well made with good craftsmanship so as not to distract from the overall appearance of the board. 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 tolerances and physical requirements shall be in conformance with the minimum requirements appearing in TABLE 2. Products shall be of suitable quality to be useable for their intended purpose and application. For non-locking systems, slight contact/friction between the bottom of the tongue and top of the lower groove lip must be maintained.

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 SECTION 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 of the finished product in a given lot. For product requested for inspection, sampling levels shall be determined by the inspection agency and be representative of the entire shipment. Should the evaluation reveal the non-conformance exceeds 5 percent in the given lot or sample set, elevated re-sampling measures may be taken.

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 the current ANSI/HPVA HP-1 SECTION 3.10 and 3.10.1, CONSTRUCTION and SPECIAL CONSTRUCTION, which provide additional information on production of a balanced product.[1]

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 3 for reference). The moisture content shall be determined in accordance with SECTION 4.3 and the product shall be marked in accordance with SECTION 3.14.

3.11 FINISH

3.11.1 UNFINISHED FLOORING

The unfinished flooring product shall conform to the requirements for unfinished flooring described in TABLE 2.

[1] ANSI/HPVA standards available from the Hardwood Plywood and Veneer Association (HPVA®) DBA Decorative Hardwoods Association (DHA), 42777 Trade West Drive, Sterling, VA 20166 USA, www.decorativehardwoods.org

3.11.2 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 coated (e.g. stained, finished, etc.). Appearance shall be consistent with the manufacturer's specifications for color and gloss.

3.12 PACKAGING

The engineered wood flooring shall be packaged in such a manner as to provide reasonable protection against damage in ordinary handling and transportation.

3.13 INSTALLATION INSTRUCTIONS AND WARRANTY

Installation instructions shall be provided to the user in writing or with the web link to obtain the information electronically. A manufacturer's warranty shall be included or available upon request.

3.14 MARKING

Each package of engineered wood flooring shall be marked with the name or recognized identification of the manufacturer (or private label, if produced for a downstream entity); the species; the pattern; the color or denoted unfinished; the flooring dimensions; the product coverage area (sq.m./sq.ft.); and the date of manufacture (month/year format). In instances where flooring is not sold or distributed in packaging for retail, such as palletized or bulk bundles, the marking requirement may be applied to the bundle or accompanying invoice and shipping documentation. Color may be represented by the product name or pattern of the flooring and does not specifically require a color to be identified such as brown or yellow. Products designed with moisture content specifically for arid or high humidity markets should be marked accordingly. Marking denoting conformance to this Standard shall comply with SECTION 6 IDENTIFICATION.

3.14.1 EPA TSCA TITLE VI FORMALDEHYDE LABELING

Each package of flooring must be labeled with at least the manufacturer's name, date of production (month/year format), and a statement that the flooring is TSCA Title VI compliant. Manufacturers may substitute the name of a responsible downstream fabricator, importer, distributor, or retailer for their name on the label if they obtain and maintain written consent from the downstream entity. Flooring made from panels manufactured with ultra low-emitting formaldehyde (ULEF) or no-added formaldehyde (NAF) resins may be labeled as such on their packaging.

3.14.2 CARB 93120 ATCM FORMALDEHYDE LABELING (OPTIONAL)

CARB accepts TSCA Title VI certified/compliant flooring products labeled in accordance with SECTION 3.14.1. Manufacturers wishing to dual-label according to CARB requirements shall include a marking on the flooring package denoting the product was made with hardwood plywood, particleboard, or medium density fiberboard that complies with the CARB Phase 2 emission standard, in addition to the TSCA labeling requirements in SECTION 3.14.1.

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 / THREE CYCLE SOAK TEST

Two test specimens, 50.8 mm (2 inches) wide by 127 mm (5 inches) along the grain, shall be cut from opposite sides of each flooring sample tested after all tongue and groove or other machined edge portions have been removed. The specimens shall be submerged in water at 24°C $\pm$ 3°C (75°F $\pm$ 5°F) for 4 hours $\pm$ 10 min, and then dried in a convection oven at a temperature between 49 and 52°C (120 and 125°F) for 19 hours $\pm$ 30 min, with separation between specimens to promote air circulation and drying. 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 veneer 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 ASTM International Designations ASTM D4442, Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials, and ASTM D4444, Standard Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters.[2]

4.4 FLOORING CHARACTERISTICS EVALUATION

Flooring shall be evaluated and meet the tolerance requirements for each of the characteristics detailed in TABLE 2. Manufacturers shall have a process, policy, or procedure in place to verify continued compliance with the tolerances stated in TABLE 2.

4.5 FORMALDEHYDE EMISSIONS

Hardwood plywood and other composite wood panels used in the production of engineered wood flooring shall be certified to or compliant with the California Air Resources Board Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products (CARB) and EPA TSCA Title VI 40 CFR Part 770 Formaldehyde Emission Standards for Composite Wood Products (TSCA). Flooring manufacturers that only apply face veneers to a substrate (e.g. hardwood plywood) shall comply with the TSCA requirements for "laminated product producers" and "fabricators." Flooring manufacturers that lay up their own plywood flooring (e.g. line-by-line veneer core plywood construction) shall require third party certification as a "panel manufacturer" per CARB and TSCA requirements.

All engineered wood flooring products shall comply with the CARB and TSCA formaldehyde emissions limit for hardwood plywood (0.05 ppm) and shall be tested with only the decorative face surface exposed according to the ASTM E1333[2] Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products using a Large Chamber, or equivalent ASTM D6007[2] Standard Test Method for Determining Formaldehyde Concentrations in Air from Wood Products Using a Small Scale Chamber. ASTM D6007 small chamber equivalency must be demonstrated per CARB and TSCA requirements.

5 DEFINITIONS

The terms used in this Standard are defined as follows:

APPEARANCE – Face surface characteristics which assist in defining the product and its quality (appearance may be enhanced with natural character or manufactured character).

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

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

BARK POCKET – Bark around which normal wood has grown.

BEVEL (EDGE STYLE) – The slope around the perimeter of an engineered wood flooring plank or strip face. Examples of bevels or edge styles include:

square edge: edges with no bevel.
micro-bevel: small (typically < 1.6mm (1/16 inch) wide) 30-45 degree bevel edges.
pillow edge: bevel with a radius profile.
hand scrape: bevel on hand-scraped boards that varies in depth/width according to the depth of the adjacent scraped area.

BLENDING – Mixing of several cartons of engineered wood flooring in order to distribute potential color variations in product and species. Viewing should be from a distance of 1.8 m to 2.4 m (6 feet to 8 feet) under normal and expected lighting conditions.

BOW – With the face of the engineered wood flooring 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.

[2] The latest issue of ASTM publications shall be used provided the requirements are applicable and consistent with the issues designated. ASTM publications may be purchased from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959 USA, www.astm.org

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 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: See **NATURAL CHARACTER; MANUFACTURED CHARACTER**

CHECKS – Small fractures running parallel to the grain of the wood caused chiefly by veneer knife and/or expansion and contraction of the wood.

COMPOSITE – Any material composed of organic fibers, organic polymers (e.g. plastics, such as polyethylene or polyvinyl chloride) and/or inorganic matter (e.g. stone).

CONSTRUCTION (PRODUCT CONSTRUCTION) – Term referring to detailed manner in which flooring components are assembled, e.g. "2-ply face and back construction," "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.

CORK - An impermeable, buoyant material, a prime-subset of bark tissue that is harvested for commercial use primarily from *Quercus suber* (Cork Oak)**.**

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, for example, 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 or opening between two pieces of flooring fitted or installed 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 end(s) 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 or in combination with lumber, particleboard, MDF, hardboard, composite, special core or special back material joined with an adhesive. Except for special constructions, the grain of alternate plies is generally at right angles and the decorative face is veneer made from hardwood, softwood species, cork 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, WARP,** and other scenarios where distortion of a piece of flooring may occur from a smooth level plane.

GLOSS - Shine, luster or reflectance of light.

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 (RESIN) 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 (non-monocot angiosperm) trees in contrast to softwood, which is produced from (gymnosperms) 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.

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; generally involving inner-ply layers

LOADING RATIO – See **CHAMBER LOADING RATIO.**

MANUFACTURED CHARACTER – A unique visual effect created by machine or hand scraping, distressing, thermal or chemical treatment or other mechanical or chemical processes.

MANUFACTURER – A producer or private label entity who represents and sells their engineered wood flooring product under their name.

NATURAL CHARACTER – A unique visual or graining effect which may include burls, knots, mineral streaks, gum pockets, wormholes, vinemarks, and/or other naturally induced characteristics.

NO ADDED FORMALDEHYDE (NAF) – A resin formulated with no added formaldehyde as part of the resin crosslinking structure in a composite wood product that meets the emission standards in Section 770.17(c) of the EPA TSCA Title VI regulation and Section 93120.3(d) of the CARB regulation.

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

OVERWOOD – The vertical offset between two pieces of flooring properly installed or fastened per the manufacturer's recommended installation instructions. (See the requirements in TABLE 2)

PLANK – General term used to describe a single piece of engineered wood flooring which is substantially longer than it is wide.

PLANK PRODUCT – Engineered wood flooring that is generally installed in a linear pattern in which the product is 76.2 mm (3 inches) or wider.

PLY – A single sheet of veneer or several veneer strips with adjoining edges which form one layer used in the construction 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, slicer, knife or saw.

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

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**.

SIDE GAP – Separation or opening between two pieces of flooring fitted or installed together side-to-side.

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.

SOFTWOOD – General term used to describe lumber or veneer produced from needle and/or cone bearing (gymnosperm) 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 oven-dry weight of a certain volume of a substance to the weight of an equal volume of water.

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

STREAKS, MINERAL – Natural discolorations of the wood substance.

STRIP PRODUCT – Engineered wood flooring that is generally installed in a linear pattern in which the product is less than 76.2 mm (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 resin in a composite wood product that meets the emission standards in Section 770.18(c) of the EPA TSCA Title VI regulation and Section 93120.3(c) of the CARB regulation.

VENEER – A layer of softwood, hardwood or woody grass, e.g. bamboo, which is rotary cut, sliced or sawn from a log, cant or block, commonly used in the construction of hardwood plywood and in engineered wood flooring. Veneer is referred to as a ply when assembled.

VINE MARK – Bands of irregular grain running across or diagonally to the grain which are caused by the growth of climbing vines around the tree.

VOID – Open space within an engineered wood flooring product structure.

WARPING – Distortion of a piece of engineered wood flooring from a flat plane. Also see: **BOW, END LIFT, TWIST** and **CROOK**.

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

WOODY GRASS – A fast growing member of the grass family (bambusa, dendrocalamus and allied genera, e.g. bamboo) utilized with commercial applications as a wood substitute due to its rapidly renewable properties.

WORMHOLES – Holes resulting from infestation of worms or beetles.

6 IDENTIFICATION

6.1 IDENTIFICATION OF COMPLIANCE

For products produced, tested, and evaluated in accordance with the requirements of this Standard, manufacturers may include a statement of compliance in conjunction with their name and address on product labels, invoices, sales literature and the like (see example below). Self-compliance statements must be supported by manufacturers' records of satisfactory product testing and evaluations.

Sample Compliance Statement: *This engineered wood flooring was produced and evaluated in accordance with the requirements established in American National Standard ANSI/HPVA EF 2020. Full responsibility for the conformance of this product to the Standard is assumed by: (name and address of manufacturer)*

6.2 IDENTIFICATION OF THIRD-PARTY CERTIFICATION

For purchasers to identify products third-party certified to meet all requirements of this Standard, manufacturers participating in a third-party certification program may include a statement of certification in conjunction with their name and address on product labels, invoices, sales literature and the like. All claims shall be supported by identification of an ISO/IEC 17065-accredited product certification agency.

Sample Certification Statement: *This engineered wood flooring is certified by an ISO/IEC 17065-accredited certification agency to meet all of the requirements established in American National Standard ANSI/HPVA EF 2020.*

6.2.1 CERTIFIED MARK

The logo shown below is also available for use in demonstrating third-party certification to the Standard. Approval for use of the logo shall be granted by HPVA, as the standard developer (DBA DHA), upon successful demonstration of certification by an ISO/IEC 17065-accredited product certification agency.

ANSI/HPVA EF 2020 CERTIFIED

TABLE 2. REQUIREMENTS AND TOLERANCES FOR ENGINEERED WOOD FLOORING

Requirements and Tolerances for Engineered Wood Flooring			
Characteristics	**Factory Finished Bevel & Square Edge**	**Unfinished Bevel & Square Edge**	**Manufactured Character (Factory Finished or Unfinished) Bevel & Square Edge**
Width Tolerance	**+/- 0.25 mm (+/- 0.010 inch)**		
Overwood (maximum limit)	**0.31 mm (0.012 inch)**	**0.38 mm (0.015 inch)**	**N/A***
Crook (tolerance)	**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**		
End Alignment or Squareness (tolerance)	**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)**	**Finished: 0.13 mm per 25 mm of width (0.005 inch per inch of width) Unfinished: 0.18 mm per 25 mm of width (0.007 inch per width)**
Flatness (maximum limit)	**Products less than 19.05 mm (0.75 inches) thick: lift from flat surface should not exceed 1.5% of the piece's length. Products 19.05 mm (0.75 inches) thick or greater: lift from flat surface should not exceed 0.75% of the piece's length.**		
Uniformity of Thickness	**Uniformity of thickness between boards shall be +/- 0.13 mm (+/- 0.005 inches)**		**N/A***
Product Coverage Area	**Product coverage area (sq.m./sq.ft.) marked on the package shall be the minimum contained in the package, based on the average of 5 boxes and no underage in a single box more than 3%. See Federal Trade Commission net quantity, average quantity, permitted variations (16 CFR 500.25)**		

Non-conformance with the Width Tolerance, Overwood, Crook, End Alignment, Flatness, and Uniformity of Thickness requirements of this table shall not exceed a total of 5 percent of the finished product, evaluated on a square-footage basis. The "5 percent" allowance shall not be applied to Product Coverage Area measurements.

The machining requirements and tolerances apply to individual specimens or pre-assembled engineered wood flooring samples. Refer to the manufacturer's installation instructions and requirements for specific information on properly installing engineered wood flooring. The Appendix to this Standard provides information on installation recommendations (A2) and reinspection practices (A3).

***This specification does not apply to manufactured character such as handscraped or distressed engineered wood flooring.**

TABLE 3. MOISTURE CONTENT OF WOOD AT VARIOUS TEMPERATURE AND RELATIVE HUMIDITY READINGS

Moisture Content of Wood at Various Temperature and Relative Humidity Readings

	Temperature Fahrenheit	Equilibrium Moisture Content of Wood (EMC)																			
	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
Primary Temp. Zone	**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**									

Definitions: **Dry Zone indicates an environment in which the temperature and humidity would cause the wood to lose moisture.**
Humid Zone indicates an environment in which the temperature and humidity would cause the wood to gain moisture.

APPENDIX A. ADDITIONAL INFORMATION

This Appendix of the American National Standard ANSI/HPVA EF 2020 is non-mandatory and is included for information and reference purposes only and may contain material that has not been subject to public review or a consensus process.

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 exterior openings are closed and all major construction e.g., plastering, concrete, and masonry work is finished. Manufacturers may provide more specific requirements on tolerances for moisture differentials between the engineered flooring and the substrate.

In order to obtain the maximum service and satisfaction from this type of flooring, installation should conform to the latest written recommendations of the engineered wood flooring manufacturer and of the adhesive manufacturer. In all cases, the manufacturer's installation instructions and/or technical notes and local building codes relating to the product should 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 (see SECTION 3.13). 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. (see SECTION 3.4)

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 should 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 buyer working in conjunction with the retailer and then, 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 should 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.

A3.1 OVERWOOD MEASUREMENT

For measuring OVERWOOD as defined in ANSI/HPVA EF 2020 which is the vertical offset between two properly installed pieces of flooring, the following measurement technique is suggested. Use a 0.31 mm (0.012 inch) or 0.38 mm (0.015 inch) feeler gauge, which is the maximum permitted in TABLE 2 for factory finished and unfinished engineered wood flooring, respectively, by placing the feeler gauge between the two adjacent planks. It can be determined by feel if the offset is greater than the maximum that is permitted. Another measurement option is the use of a digital gauge.

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. 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 excessive moisture, however, as may occur with flooding due to plumbing leaks, rain through open windows or doors, excessively wet concrete slabs or extreme environmental factors can result in warping, delamination, surface checks, discoloration of the wood surface and deterioration of the applied finish.

A4.3 LIGHT

Wood will change color when exposed to ultraviolet (UV) 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.

A4.5 BEVELS

Factory finished floors have bevels for aesthetics, and to help minimize the appearance of issues caused by out-of-flat subfloors, inconsistent stapling, minor board thickness and overwood variations, and slight dimensional changes due to seasonal environmental conditions (e.g. dry winter, humid summer).

A5. OTHER PROPERTIES OF ENGINEERED WOOD FLOORING

This section identifies certain properties of engineered wood flooring and the commonly referenced test methods for these properties in specific product applications. These properties vary based on specific product characteristics including the species, thickness, adhesive and finish. The property 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[1] Standard Test Method for Simulated Service Testing of Wood and Wood-Base Finish Flooring.

A5.2 WEAR RESISTANCE

ASTM D4060[1] Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser; ASTM D3359[1] Standard Test Methods for Measuring Adhesion by Tape Test.

A5.3 CHEMICAL RESISTANCE

ASTM D1308[1] Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.

A5.4 FIRE PERFORMANCE

ASTM E648[1] Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; ASTM E66[1] Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

A5.5 SLIP RESISTANCE

ASTM F489[1] Standard Test Method for Using a James Machine;
ASTM D2394[1] Inclined Plane Method;
ASTM D2047 Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.

A5.6 SOUND

ASTM E90[1] Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements;
ASTM E413[1] Classifications for Rating Sound Insulation;
ASTM E492[1] IIC Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine

A5.7 THERMAL CONDUCTIVITY

ASTM C518[1] Standard Test Method for Steady-State Heat Thermal Transmissions Properties by Means of the Heat Flow Meter Apparatus.

A5.8 GLOSS

Gloss levels are commonly reported as low, medium or high gloss. Gloss is typically measured using an instrument and general measuring procedure as delineated in ASTM D1455[1] Standard Test Method for 60 Degree Specular Gloss of Emulsion Floor Polish. Gloss levels are reported based on measurements of finished product prior to service conditions. A rough guideline is high gloss has a normal range of 50 or higher, medium or mid-range gloss has a range of 15-49 and for low gloss has a normal range of less than 15.

A5.9 FINISH ADHESION

Finish adhesion is typically determined by cross hatch test, ASTM D3359[1], Standard Test Methods for Measuring Adhesion by Tape Test. A minimum of 90% performance criteria is typically recommended in the tape test. Coatings should be non-removable by normal maintenance.

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[1] The latest issue of ASTM publications shall be used provided the requirements are applicable and consistent with the issues designated. ASTM publications may be purchased from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959 USA, www.astm.org

APPENDIX B. SAMPLE THIRD PARTY CERTIFICATION CRITERIA

To comply with SECTION 6.1 of the ANSI/HPVA EF 2020 standard, manufacturers must pursue certification with an ISO/IEC 17065-accredited certification body. This appendix provides a sample testing protocol for use in operation of such a certification program.

All material submitted for evaluation for certification purposes shall be representative of general production and shipped directly from the manufacturing facility. The lot size shall be agreed upon by the manufacturer and the third-party certifier. Third party testing shall be performed at a laboratory ISO/IEC 17025-accredited to perform the specified test methods.

Each certified engineered wood flooring product type shall be tested semi-annually (twice per year) at a third-party test lab. The manufacturer shall also be responsible for performing moisture content and glue bond/three cycle soak testing on a monthly basis. Categorization of a manufacturer's flooring offerings into separate product types based on common product attributes shall be established through discussions between the manufacturer and their certification body. Product type categorization will be primarily dependent on the manufacturer's resin system(s), core platform type(s) (e.g. veneer core plywood vs HDF), core platform resin system(s) (if different from manufacturer's), and manufacturer-applied finish formulation(s) (if present).

B1. FORMALDEHYDE EMISSIONS

Engineered wood flooring shall be tested in accordance with the ASTM E1333[1] Large Chamber or equivalent ASTM D6007[1] Small Chamber test method. Products shall be tested with only their decorative face exposed in the test chamber. At a minimum, emissions testing shall be conducted by a third-party testing lab semi-annually.

Above product testing is conducted in addition to the certification requirements of EPA and CARB to ensure product compliance with the 0.05 ppm emission level. Entities claiming exemption status, including panel manufacturers, laminated product producers, or fabricators, where CARB and EPA testing requirements are exempt or deferred, may not claim to meet the emissions requirement of this standard without testing to demonstrate compliance.

B2. MOISTURE CONTENT

Product types shall be tested monthly by the manufacturer or the third-party test lab, and semi-annually by the third-party test lab; Testing performed by the third-party test lab satisfies the monthly requirement.

B3. BOND LINE / THREE CYCLE SOAK

Product types shall be tested monthly by the manufacturer or the third-party test lab, and semi-annually by the third-party test lab. Testing performed by the third-party test lab satisfies the monthly requirement.

B4. FLOORING EVALUATION

Manufacturers shall have a process, policy, or procedure to verify continued compliance with the tolerances in TABLE 2. For qualification purposes, the third-party test lab shall evaluate five (5) cartons of flooring per product type to the tolerances in TABLE 2. Upon certification, the third-party test lab shall evaluate one (1) carton of flooring per product type on a semi-annual basis.

TABLE 4. SAMPLE THIRD PARTY CERTIFICATION PROGRAM REQUIREMENTS

Formaldehyde Emissions	Moisture Content	Bond Line / Three Cycle Soak	TABLE 2 Evaluation
Third Party Lab: Semi-Annually (one ASTM D6007[1] small chamber or ASTM E1333[1] large chamber test, "decorative face" exposed)	In-Mill OR Third-Party Lab: Monthly (8 flooring planks, one specimen per plank, per month) Third Party Lab: Semi-Annually (8 flooring planks, one specimen per plank, per test)	In-Mill OR Third-Party Lab: Monthly (10 flooring planks, two specimens per plank, per month) Third Party Lab: Semi-Annually (10 flooring planks, two specimens per plank, per test)	In-Mill: process, policy, or procedure to verify continued compliance with tolerances stated in TABLE 2. Third Party Lab: Semi-Annually (one carton of flooring per test)

[1] The latest issue of ASTM publications shall be used provided the requirements are applicable and consistent with the issues designated. ASTM publications may be purchased from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959 USA, www.astm.org

APPENDIX C. RECOMMENDED FLOORING EVALUATION PROCEDURES

The following procedures are recommended when evaluating flooring characteristics to the tolerances stated in TABLE 2 for certification or third-party verification. Results should be compared to each respective characteristics' tolerance shown in TABLE 2. A manufacturer's internal evaluation procedures may differ from the procedures below but may be validated as effective quality control for certification purposes.

C1. PLANK WIDTH TOLERANCE

Using calipers, measure the width of the face surface at four points along the board to the nearest 0.025 mm (0.001 in.). The width measurement shall not include the tongue. Record the difference between the maximum measurement and minimum measurement. Alternatively, use a custom flooring evaluation tool which utilizes a digital indicator to measure the variation in width along each board.

C2. OVERWOOD

Assemble carton of flooring by dry-fitting and assembling on a flat table. Use a feeler gauge of the same thickness as the tolerance limit stated in TABLE 2 to check the vertical distance between flooring joints at the observed points of greatest distance. Alternatively, use a custom-made flooring tool to measure the vertical distance between joints and record the maximum overwood observed in each assembly.

C3. CROOK

Lay board on a flat table against a flat bar such that a digital indicator or caliper reads zero (or approximately zero) at both ends of the board. Move indicator/caliper down the length of the board and record the maximum deflection.

C4. SQUARENESS

Using a machinist square, check squareness by aligning the square with the board face at each board end. Use a set of feeler gauges to measure the gap between the square and board end.

C5. FLATNESS

Position board vertically on a flat table (groove-side or tongue-side down) against a flat bar such that the ends of the board touch the bar. Adjust the ends of the board until a digital indicator or caliper reads zero (or approximately zero) at both ends of the board. Move the indicator/caliper down the length of the board and record the maximum deflection.

C6. UNIFORMITY OF THICKNESS

Using calipers or a micrometer, measure the thickness at four points along each board to the nearest 0.025 mm (0.001 in.). Average the results of each board and calculate the difference between the lowest and highest individual averaged board result.

C7. PRODUCT COVERAGE AREA

Using a tape measure, measure the width and length of the face of each board to the nearest 0.79 mm (1/32 in.). Calculate the sum of the square footage of the boards and compare results to the square footage stated on the carton.

Examples of North American Surface (Wear Layer) Species Used in Engineered Wood Flooring

Pecan/Hickory

Hard Maple

Red Oak

White Oak

Birch

White Ash

Beech

Black Walnut

Black Cherry

Stains and finishes will have a material effect on the final appearance of these woods in engineered flooring.

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- Moisture Content Testing

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MATT MYERS,
MANAGER, RESEARCH & DEVELOPMENT
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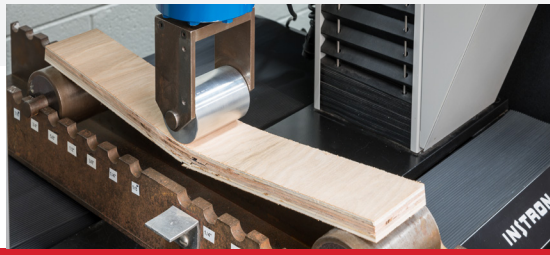

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