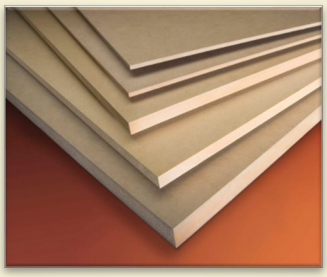
COMPOSITE PANEL ASSOCIATION



STANDARD METHOD FOR MEASUREMENT OF WARP

IN COMPOSITE PANELS

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19465 Deerfield Avenue
Suite 306
Leesburg, VA 20176

703-724-1128
CompositePanel.org

STANDARD METHOD FOR MEASUREMENT OF WARP IN COMPOSITE PANELS

PURPOSE: This document is intended to provide a standardized methodology for the measurement of warp in particleboard[1], medium density fiberboard (MDF) and laminated panels. It provides a common frame of reference for consistency in measuring and communicating the degree of warp present in these products[2].

DEFINITIONS: Warp has been defined as the deviation of the geometry of a panel from an initial state of flatness[3]. Other terms that are important include cup, bow, and twist. These terms refer to specific types of warp in a panel as follows:

- Cup - deviation from flatness in a plane oriented along the short dimension or width of a panel.
- Bow - deviation from flatness along the long dimension (length) of a panel.

PROCEDURES:

1. Prior to sample collection, storage conditions including the number of and spacing of bolsters, levelness of floor, temperature and relative humidity, complete or partial vapor barrier and age of unit shall be noted.

2. Sample Selection. Samples shall be collected from a unit of panels and the following information recorded: panel's position within the unit (e.g., third panel from top of unit), thickness, width, and length. Avoid the top and bottom 4" of the bundle for sample selection. This ensures the panel warp is from internal warp stresses and not warping from absorbing moisture from the air on only one surface.

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[1] For particleboard used as "Interior Stair Tread," refer to the Use of Materials Bulletin No. 70b *HUD building product standards and certification program for particleboard interior stair treads* by the U.S. Department of Housing and Urban Development (HUD).

[2] Causes for warp are not included in the scope of this document. Information regarding some of the causes for warp may be found in the CPA Technical Bulletin, "Minimizing Warp in Laminated Particleboard and Medium Density Fiberboard.," Copyright 1998

[3] Suchsland, Otto and J.D. McNatt, 1985. On the Warping of Laminated Wood Panels. Michigan State University, East Lansing, MI.

3. Panel orientation for measurement. Proper measurement for warp must be determined with the panel standing in a vertical position (+/- 5°).

4. The panel should be checked for freedom of movement on the floor to ensure that friction between the floor or any flat surface and the panel edge is not binding the panel and inducing or preventing warp.

   (*Note: Due to the flexibility of thinner panels, significant error in measurement of warp values may be introduced in panels of thickness less than or equal to 3/8 inch (10 mm), especially in lengths greater than 8 feet (2438 mm)*. *For thin panels, or where panel weight may induce warp, a panel may be suspended in the air by clamps that do not restrict movement.*)

5. Cup Measurement

5.1. A calibrated straight edge or a thin cord shall be stretched vertically on the concave side at each end (corner to corner) and at the midpoint of the panel (edge to edge). See Figure 1 for a graphical example of cup measurement. The type of straight edge used should be included in the report. Straightness of straight edges should be checked using a taut cord (string) to ensure that the device has not been physically damaged. When a cord (string) is stretched tight from end to end along the edge, no measurable deviation should be apparent between the straight edge and the cord. For bar-type straight edges, the cord should be offset slightly from the bar's surface to ensure that the path of the cord is not affected by the edge of the bar.

5.2. Measurement of the maximum deviation between the panel and the panel side surface of the straight edge or taut cord shall be made with a suitable instrument (e.g., indicator or caliper) at each location and all three values shall be reported to the nearest 1/64 inch (0.4 mm) as cup values for the panel. The type of instrument used should be included in the report. Accuracy of the measurement will depend on the instrument used. Indicators or calipers with appropriate inside jaws, taper gages, machinist's rules, and feeler gages have been used with success for this measurement. Another device which has earned acceptance is a straight edge of a given length (e.g., 2 feet, 4 feet, etc.) with adjustable footing on each end and a dial indicator at the midpoint. Measurements made

with this type of device may be adjusted to full panel dimension by the following formula:

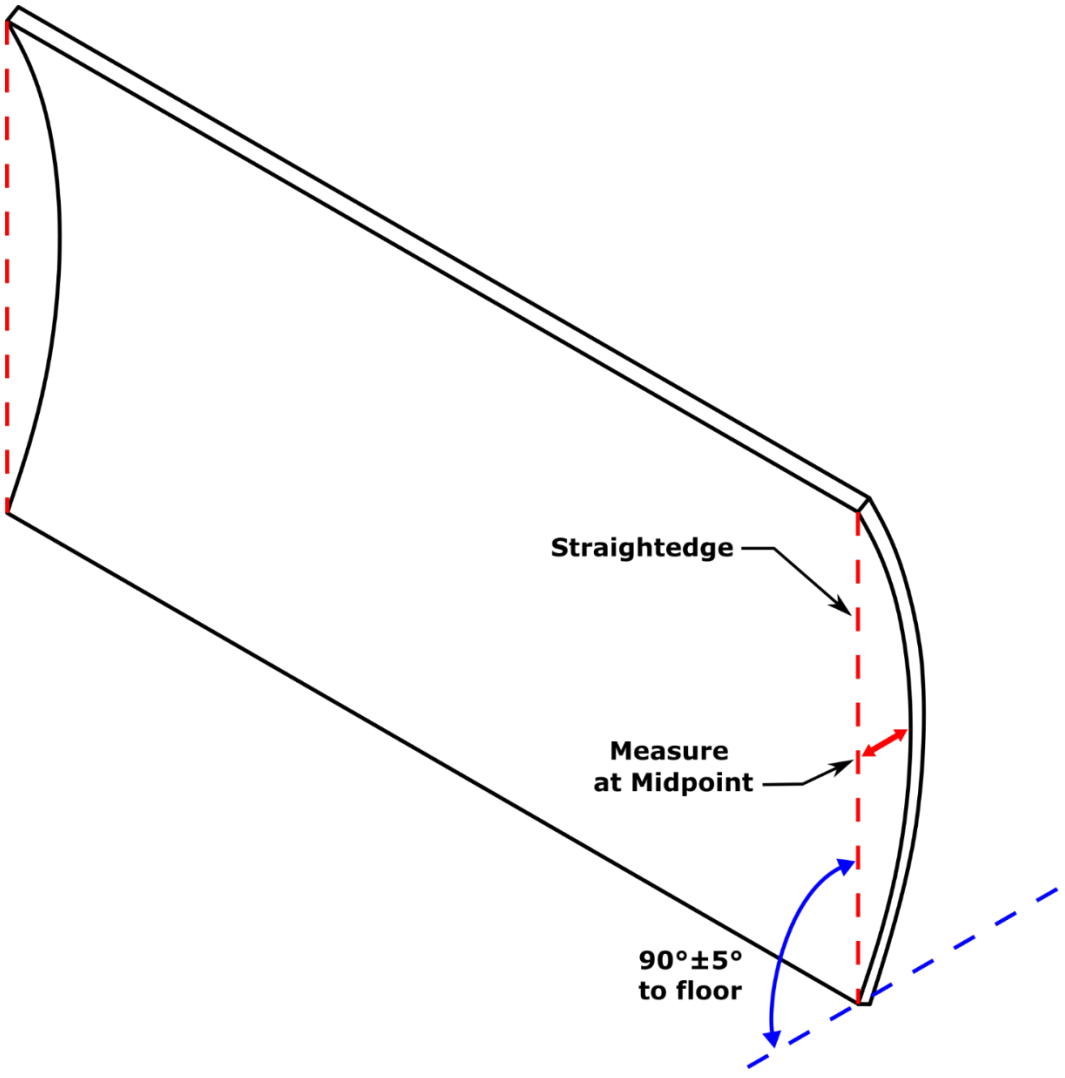
$d_2 = d_1 * (L/S)^2$, where

d_2 = extrapolated warp at full panel width or length (L) and

d_1 = measured warp over span (S) of measuring device.

All L, S, d_1, and d_2 values shall be reported if this type of device is used.

Figure 1. Example of cup measurement.

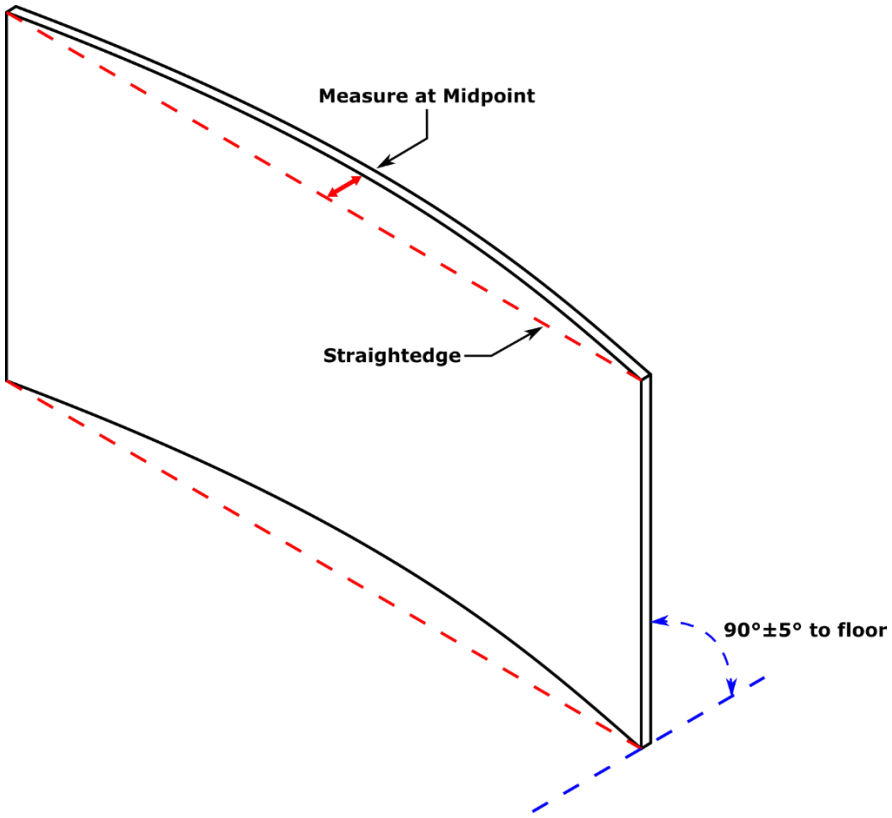


6. Bow Measurement

6.1. A calibrated straight edge[4] or a thin cord shall be stretched horizontally along the length of the panel on the concave side and stretched between each set of opposing corners and the midpoint of each vertical edge. See Figure 2 for a graphical example of bow measurement.

6.2. Measurement of the maximum deviation between the panel and the panel side surface of the straight edge or taut cord shall be made with a suitable instrument[5] at each location and all three values shall be reported to the nearest 1/64 inch (0.4 mm) as bow values for the panel.

Figure 2. Example of bow measurement.



[4] The type of straight edge used should be included in the report. Straightness of straight edges should be checked using a taut cord (string) to ensure that the device has not been physically damaged. When a cord (string) is stretched tight from end to end along the edge, no measurable deviation should be apparent between the straight edge and the cord. For bar-type straight edges, the cord should be offset slightly from the bar's surface to ensure that the path of the cord is not affected by the edge of the bar.

ADDITIONAL RESOURCES:

Composite Panel Association (CPA). 2005. Minimizing Warp in Laminated Particleboard and Medium Density Fiberboard. CPA Technical Bulletin.

National Particleboard Association (NPA). 1990. Particleboard and Medium Density Fiberboard Manufacturing Operations as They Relate to Panel Warp.

Suchsland, O., Feng, Y and D. Xiu. 1993. The Warping of Laminated Particleboard. 27 p.

Suchsland, O. and J.D. McNatt. 1986. Computer simulation of laminated wood panel warping. For. Prod. J. 36(11/12): 16-23.

Zhiyong, C. 2004. Evaluating the warping of laminated particleboard panels. 7th Pacific Rim Bio-Based Composites Symposium: proceedings, Vol. II, Nanjing, China, October 31-November 2, 2004. Pages 69-79.

Industry Technical Bulletins

CPA publishes the most definitive technical bulletins on wood-based composite panels produced in North America. CPA members may access all technical bulletins on the association's website free of charge as a benefit of membership. CPA technical bulletins are available for purchase to non-member companies.

www.CompositePanel.org

CPA's website is the most comprehensive online resource of industry information and association initiatives. The site offers an interactive publication store, searchable member database and product locator tool.

Annex A
Warp Tolerances for Particleboard Interior Stair Treads[5]

Cup	-	1/8 inch (3.2 mm)
Bow and Twist	-	1/32 inch per lineal foot (0.8 mm per 30 cm)

Definition of Twist - deviation from a flat plane between diagonal corners.

Note: measurements for bow, cup and twist shall be made to the nearest 1/64 inch (0.4 mm).

Date Published: August 18, 2022

This August 2022 test method supersedes the July 2016 version.

[5] For particleboard used as "Interior Stair Tread," refer to the Use of Materials Bulletin No. 70b *HUD building product standards and certification program for particleboard interior stair treads* by the U.S. Department of Housing and Urban Development (HUD).

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The Composite Panel Association (CPA), founded in 1960, represents the North American wood-based composite panel and decorative surfacing industries on technical, public policy, quality assurance and product acceptance issues. CPA General Members include the leading manufacturers of particleboard, medium density fiberboard (MDF), engineered wood siding and trim and hardboard in North America, representing more than 90% of industry manufacturing capacity.

CPA Associate Members include manufacturers of decorative surfaces, furniture, cabinets, mouldings, doors and equipment, along with laminators, distributors, industry media and adhesive suppliers committed to product advancement and industry competitiveness.

CPA is a vital resource for specifiers, manufacturers and users of industry products. The association provides leadership on federal, state and provincial regulatory and legislative matters of interest to industry. As an internationally recognized and accredited standards developer, CPA writes, publishes and maintains the industry's definitive ANSI product standards.

CPA also operates the International Testing Center (ITC) and manages the Grademark Certification Program, the largest and most stringent testing and certification program of its kind for North American composite panel products. CPA developed the Eco-Certified Composite (ECC) Sustainability Standard, a voluntary industry standard for composite wood panels and finished products made with particleboard, MDF, hardboard and engineered wood siding and trim.

Innovative Products for a Sustainable Future