COMPOSITE PANEL ASSOCIATION

STANDARD METHOD FOR MEASUREMENT OF WARP

IN COMPOSITE PANELS

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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 and medium density fiberboard (MDF) panels[1]. It provides a common frame of reference for consistency in measuring and communicating the degree of warp present in either of 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.
- Twist - deviation from a flat plane between diagonal corners.

PROCEDURES:

1. Prior to sample collection, storage conditions including the number of and spacing of bolsters, levelness of floor, temperature and relative humidity 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.

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

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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.

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[4] 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.

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[5] (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.

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[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 insure 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] 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.

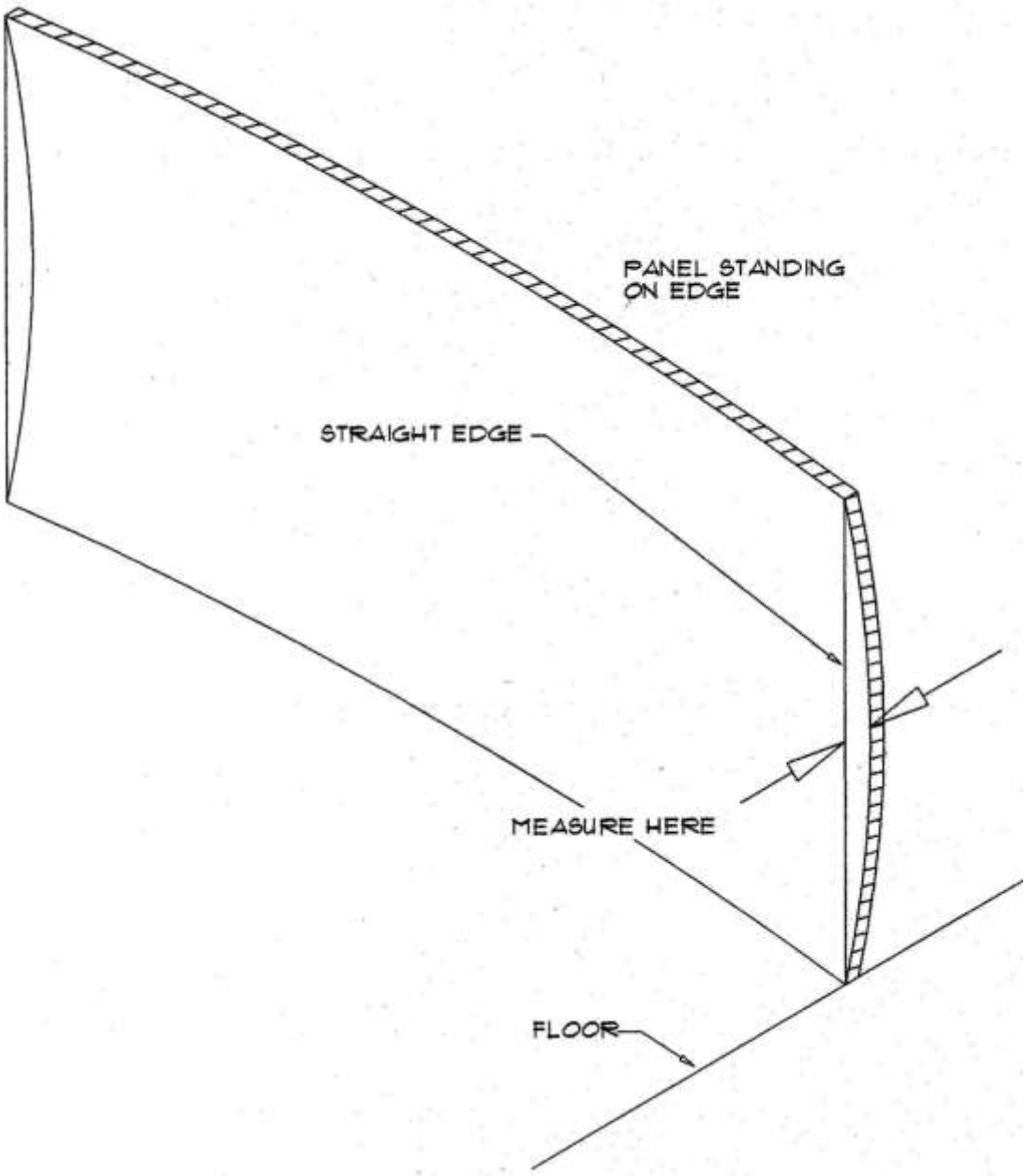

Figure 1. Example of cup measurement.

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.

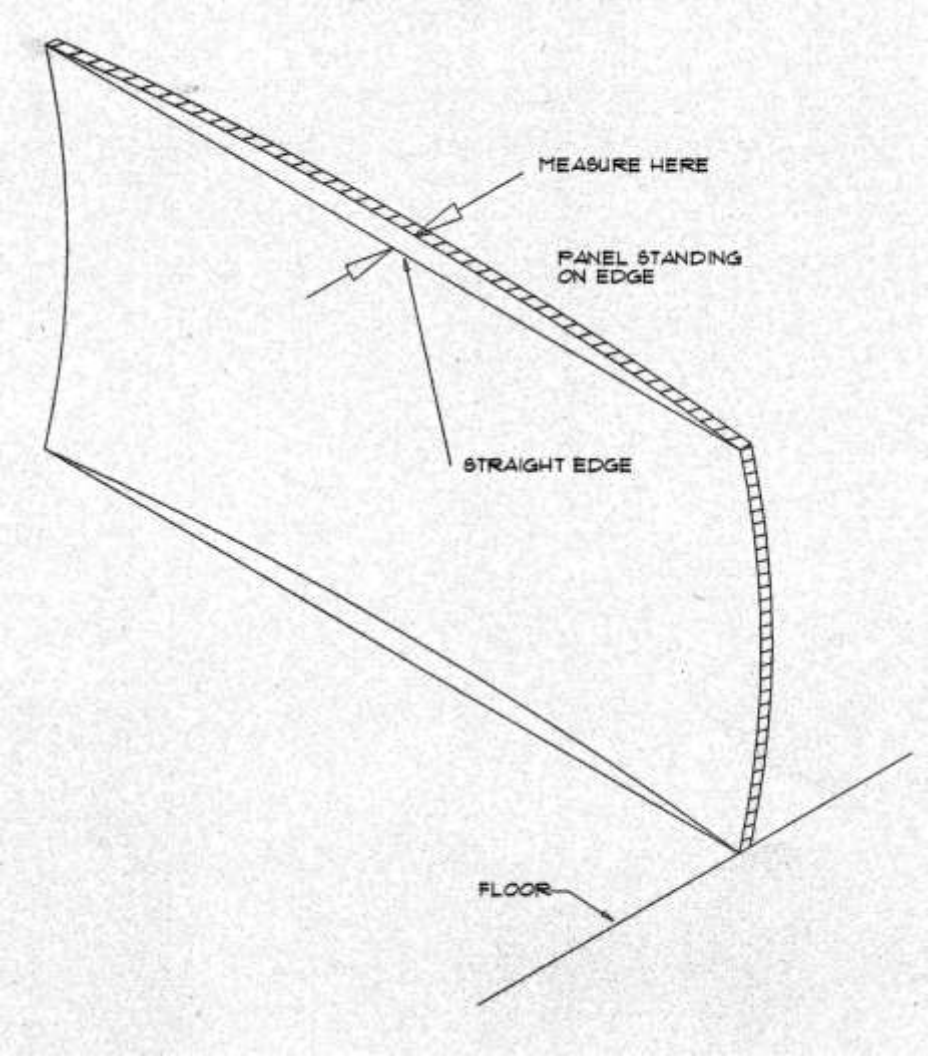

Figure 2. Example of bow measurement.

7. Twist Measurement

7.1 If desired, twist values shall be determined by stretching a calibrated straight edge[4] or a thin cord between each pair of diagonal corners on the concave side. See Figure 3 for a graphical example of twist measurement.

7.2 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 both values shall be reported to the nearest 1/64 inch (0.4 mm) as twist values for the panel.

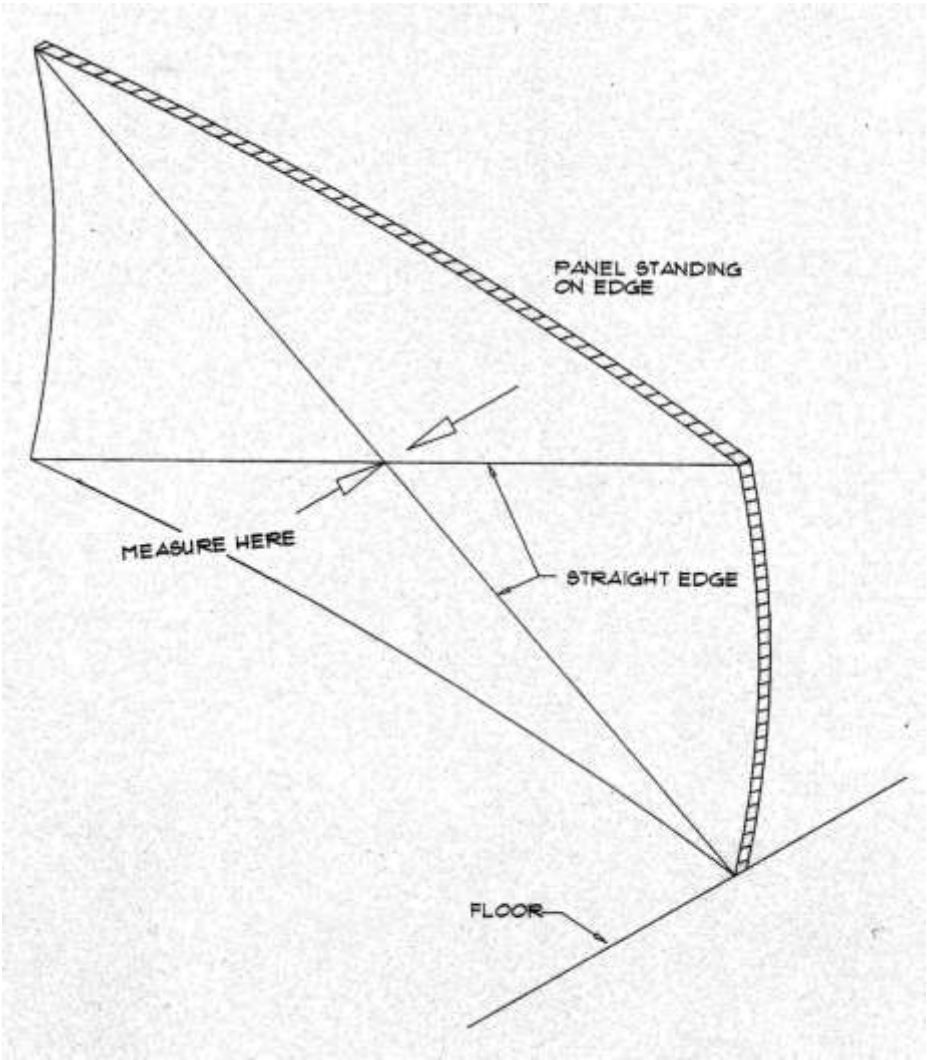

Figure 3. Example of twist measurement.

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.

Annex A
Warp Tolerances for Particleboard Interior Stair Treads[1]

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

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

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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.

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CPA also operates the International Testing and Certification Center (ITCC) 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.

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