Fiberboard Test Procedure—SAE J315 SEP80

SAE Standard
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THIS IS A PREPRINT WHICH IS SUBJECT TO REVISIONS AND CORRECTIONS. THE FINAL VERSION WILL APPEAR IN THE 1982 EDITION OF THE SAE HANDBOOK.

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LAND SEA AIR SPACE

PREPRINT

ϕFIBERBOARD TEST PROCEDURE—SAE J315 SEP80

SAE Standard

Report of the Passenger Car Body Engineering Committee and Nonmetallic Materials Committee, approved August 1951, completely revised by the Nonmetallic Materials Committee September 1980.

1. Scope—This SAE Standard provides test methods for determining the critical characteristics of basic or finished fiberboard products. Where applicable, methods of test developed by SAE and ASTM have been referenced.

2. Fiberboard Terminology—See SAE J947.

3. Recommendations—Fiberboard fabrication and finishing techniques, such as crease bending, scoring, forming, perforating, and the application of barrier coatings or paints, will modify the characteristics of the producer's basic material. Consequently, it is recommended that separate but related specifications be established for (1) the properties of the basic product and (2) the finished processed material.

4. Conditioning—Tests for material classification and for arbitration purposes shall be made on material conditioned to a constant weight in a controlled atmosphere of 70 ± 2°F (21 ± 1°C) and 50 or 65% relative humidity. Quality control tests can be conducted on unconditioned specimens unless otherwise specified by the user.

5. Thickness—Thickness shall be measured by a micrometer having two plane, parallel faces, the smaller of which should be circular and 0.25—0.33 in^2 (161—212 mm^2) in area. When the specimen is clamped between the faces, it should be under a steady pressure of 7.0—9.0 psi (48.23—62.0 kPa). The graduations of the dial face should be such as to permit estimating the thickness to at least 0.0005 in (0.013 mm).

The sample should be comprised of at least three representative specimens, each of which should be tested in four separate places. The test should be made by placing the specimen between the jaws of the micrometer and lowering the pressure foot gently upon the surface of the specimen, taking care that the edge of the foot is at least 0.25 in (6.3 mm) from the edge of the specimen. The average thickness should be reported in decimals of an inch (millimeter) to the nearest 0.0005 in (0.013 mm) and may be supplemented by maximum and minimum readings.

Fundamental technique and apparatus used shall be similar to those of ASTM D 645.

Note: Specimens cut for dimensional stability tests are satisfactory for these measurements.

6. Weight—The weight shall be determined by weighing 1 x 1 ft (305 x 305 mm) of material to the nearest 0.10 g. Dimensions shall be measured accurately to the nearest 0.01 in (0.25 mm). Three representative specimens shall be weighed and the average computed and reported in pounds per 1000 ft^2 or grams per square meter.

7. Density—Density in pounds per cubic foot (kilograms per cubic meter) shall be computed using data obtained from the average thickness and weight report.

8. Bursting Strength—The bursting strength shall be determined using the conventional power-driven hydraulic type machine. The average value to the nearest 5 psi (34.5 kPa) obtained by making five bursts on each side of three specimens is to be reported. Fundamental technique and apparatus used shall conform to ASTM D 774, Method of Test for Bursting Strength of Paper, or ASTM D 2529, Methods of Test for Bursting Strength of Paperboard or Linerboard.

9. Cohesive Strength—This test is designed to measure the force required to rupture a sample of paperboard at the weakest layer.

9.1 Apparatus

Jumbo Mullen Tester (Fig. 1)

Brass disks, 0.063 in (1.6 mm) thick and 2.390 in (60.71 mm) diameter

Annular brass disks, 0.063 in (1.6 mm) thick, 3 in (76 mm) outer diameter, and 1.375 in (34.93 mm) inner diameter

Steel sleeve, approximately 2.75 in (69.9 mm) inside diameter, 0.5 in (13 mm) high, and 0.125 in (3.18 mm) thick

Means of cleanly cutting an annular sample of 2.390 in (60.71 mm) outer diameter and 1.375 in (34.93 mm) inner diameter

9.2 Procedure—Cut a 14 x 3 in (356 x 76 mm) sample of the board to be tested. Cover each side with a strip of 3 in (76 mm) double-face, pressure-sensitive tape or equivalent without peeling the protective liner, and die cut four annular specimens for testing. Peel one of the protective liners from each sample and press lightly to one of the solid disks; then peel the other liner and place an annular disk on the other side, using the hole in each for alignment.

Press the sample between the disks under about 100 psi (690 kPa). This can be done using the sample clamp of the Mullen tester itself. A pile of a dozen samples may be pressed at one time.

Place one sample on the lower platen of the Mullen tester with the annular disk down and centrally located so that the hole in the disk is aligned with the hole in the platen. Place the steel sleeve upon the annular disk and clamp in place with the upper platen. Operate the tester until the expansion of the diaphragm against the solid disk ruptures the sample. Use the 0—200 psi (0—1380 kPa) scale.

Record the maximum pressure and note the location of the rupture. Failure of the tape bond invalidates a test.

Since the area of contact between diaphragm and solid disk varies according to the pressure, do not calculate the pressure per square inch of sample, but report the results as gage readings, in psi (kPa). However, the area of the sample is exactly 3 in^2 (19.4 cm^2) if the user desires to calculate psi (kPa).

10. Moisture Content—The moisture content shall be determined by observing the loss in weight of a 4 x 4 in (100 x 100 mm) specimen (the test specimen may be delaminated to facilitate moisture removal), upon drying in an air circulating oven maintained at 215 ± 5°F (102 ± 3°C) until a constant weight is obtained. The weight loss shall be expressed as percent moisture on the basis of the initial weight of the specimen. For reference purposes, see ASTM D 644, Method of Test for Moisture in Paper. In cases where appreciable volatile material other than water is known to exist, the Dean and Stark apparatus may be used. See ASTM D 95, Method of Test for Water in Petroleum Products and Other Bituminous Materials.

11. Water Absorption—The percent of water absorption shall be determined by observing the gain in weight of each of three 4 x 4 in (100 x 100 mm) specimens upon immersion in water. The test specimens shall be cut with a paper cutter or band saw to prevent delamination of the edges. The specimens shall be weighed to the nearest 0.01 g and then submerged horizontally under 1 in (25 mm) of water maintained at 70 ± 2°F (21 ± 1°C) and at a pH of 7.0 ± 0.5. After periods of 2.5 and 24 h, ±5%, the samples are removed from the water and the surplus water blotted off. The specimens shall be immediately reweighed to the nearest 0.01 g. The weight of absorbed water shall be calculated and the water absorption expressed as percent by weight based on the initial weight. The average value for each time period is reported.

12. Thickness Swell—The thickness shall be determined to the nearest 0.001 in (0.025 mm) by averaging four readings taken at the center of each side of the water absorption specimen and 1 in (25 mm) from the edge. The caliper reading shall be taken using the same apparatus as described in Section 5. The specimen shall be soaked and treated in the same manner as established in Section 11. Immediately following the tests, the specimen shall be recalipered in the same location and manner, and the average reading established for each soaked specimen. The following formula shall be used when calculating the percent of swelling:

$$S = \left[\frac{T_2 - T_1}{T_1}\right] 100$$

where:

S = swelling, %

T_1 = average thickness before soaking, in (mm)

T_2 = average thickness after soaking, in (mm)

13. Surface Water Absorption—Refer to ASTM D 2045, Test Methods for Water Absorption on Non-bibulous Paper and Paper Boards (Cobb Test).

14. Warpage—The original, wet, and dry warpage shall be determined by the following test methods:

14.1 Original Warpage—Prepare three test specimens 12 x 12 in (305 x 305 mm) from three different samples of fiberboard which are representative of a shipment.

Lay a specimen on a flat horizontal surface, and hold a straight edge so that it bridges the specimen in the area of maximum bow. Do not allow the weight of the straight edge to bear on the specimen.

Using a steel scale, graduated in 0.01 in (0.25 mm), measure the distance X at the midpoint of the straight edge bridging the bow. This distance must be measured on a perpendicular line to the straight edge. (See Fig. 2.)

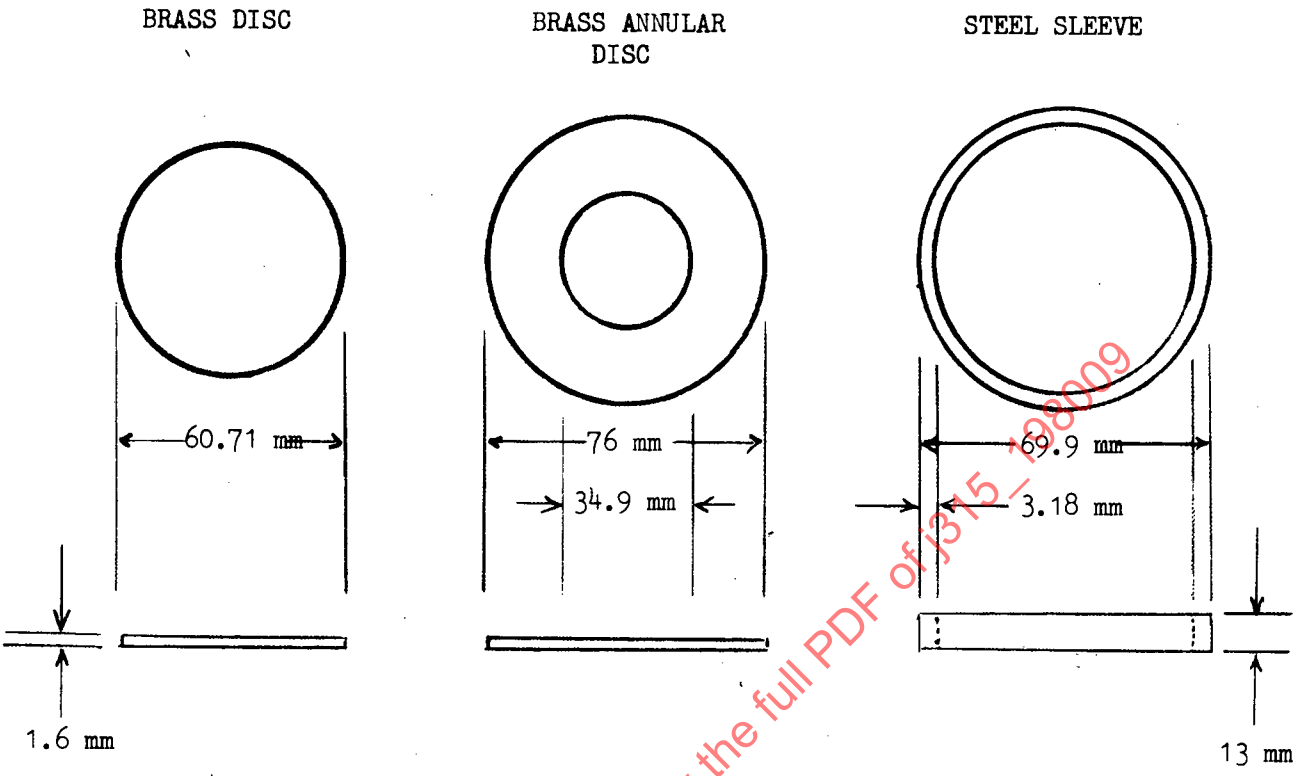
Calculate the original warpage by substituting in the following equation:

$$\frac{2X}{Y} \times 100 = \%\ \text{warpage}$$

where: X = the dimensions in inches (millimeters) as measured previously

Y = the dimensions in inches (millimeters) of the specimen before warpage

The ϕ symbol is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.



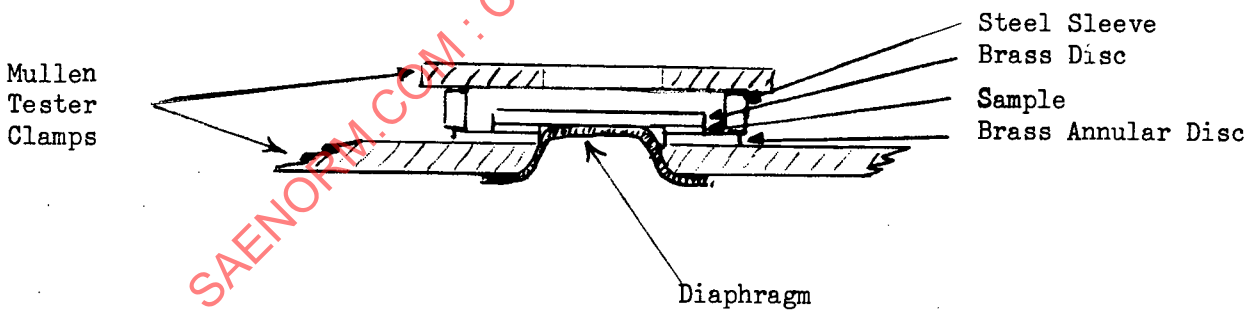
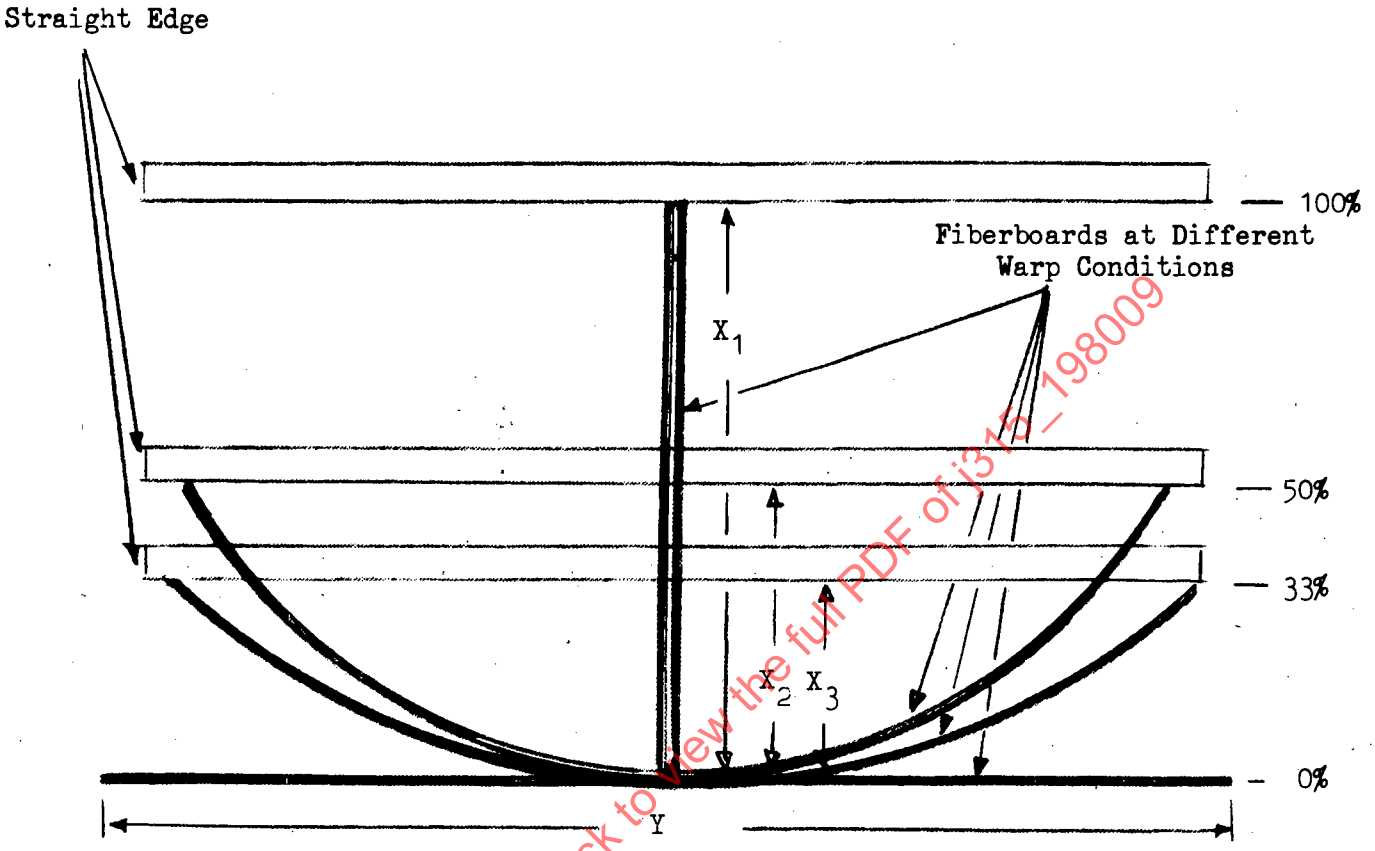


FIG. 1



Method of Measuring Fiberboard Warpage

Formula: $\frac{2X}{Y} \times 100 =$ % Warpage

X Should be Measured at the Center of the Straight Edge

FIG. 2