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Designation: ~~D5651 – 13~~ D5651 – 21

Standard Test Method for Surface Bond Strength of Wood-Base Fiber and Particle Panel Materials[1]

This standard is issued under the fixed designation D5651; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method is a measure of the cohesive bond strength of the fibers, or particles, on the surface of wood-base fiber and particle panels (for example, particleboard and medium-density fiberboard) in the direction perpendicular to the plane of the panel.

1.1.1 To determine the internal cohesive bond strength of wood-base fiber and particle panels, use Section 11 of Test Methods D1037.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This ~~test method~~ standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate ~~safety~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

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2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1037 Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process

3. Significance and Use

3.1 This test method provides a measure of the bond quality of the fibers, or particles, at the surface of wood-base fiber and particle panel materials including particleboard, medium-density fiberboard (MDF) and oriented strand board (OSB). Surface bond strength is a measure of the strength and resistance to delamination of the bond between overlay materials and panel surfaces and is an important consideration when these overlay materials, such as wood veneers, saturated papers, or plastic overlays, are to be bonded to the panel surface during secondary manufacturing.

[1] This test method is under the jurisdiction of ASTM Committee D07 on Wood and is the direct responsibility of Subcommittee D07.03 on Panel Products.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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4. Apparatus

4.1 The apparatus required for this test method is shown in Fig. 1.

4.1.1 The test cylinder shall be ~~28.7 mm (1.13 in.)~~ 28.7 mm (1.13 in.) in diameter, providing a test surface area of ~~645.2 mm~~645.2 mm^2 ~~(1 in.~~(1 in.^{2}), and the cylinder length shall be approximately ~~25 mm (1 in.).~~ 25 mm (1 in.). One face of this cylinder shall be smoothly finished for gluing, while a threaded hole shall be placed in the center of the opposite face and also aligned perpendicular to the gluing face.

4.1.2 The lower test fixture shall consist of a 6-mm (0.25- in.) steel plate mounted in a plane perpendicular to the direction of test. The mounting shall be such that this plate is held rigidly and there is at least 60-mm (2.36-in.) clearance beneath it to permit entry of the test assembly. This plate shall have a hole drilled in the center that is ~~2 mm (0.08 in.)~~ 2 mm (0.08 in.) larger than the diameter of the test cylinder.

4.1.3 The upper arm of the test machine shall have a threaded means of engaging the threaded hole in the top of the test cylinder so as to apply a force that shall move the test cylinder in a direction perpendicular to the lower test fixture and surface of the test specimen. A self-aligning joint (universal joint) is required in the upper arm of the test fixture.

4.1.3.1 Alternate connecting devices such as a swivel and hook or ball and socket, are allowed for fixing the test cylinder to the upper arm of the test machine. If alternate connecting devices are used, this shall be noted on the test report.

5. Sampling and Test Specimens

5.1 A minimum of three tests from each panel surface to be considered shall be made to determine the surface bond strength of a single panel. Panels for testing shall be selected in a manner consistent with the sampling procedures specified in Practice E122.

5.2 The test specimen shall be a minimum of ~~75 mm (3 in.)~~ 75 mm (3 in.) square. The minimum specimen thickness required for this test is ~~13 mm (0.5 in.).~~ 13 mm (0.5 in.). If necessary, laminate two or more thicknesses of the panel to build the total thickness to the minimum required.

6. Conditioning

6.1 The physical and mechanical properties of wood-base panel materials depend on the moisture content at time of test. Therefore, condition material for surface bond strength testing to constant weight and moisture content in a conditioning chamber

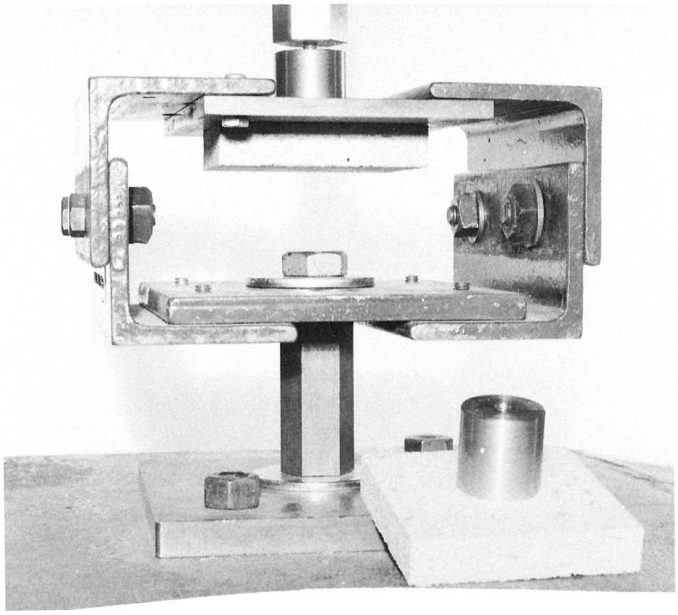

FIG. 1 Surface Strength Test Equipment and Mounting of Test Specimens

maintained at a relative humidity of ~~65 ± 5 %~~ 65 % ± 5 % and at a temperature of ~~20 ± 3°C (68 ± 6°F).~~20 °C ± 3 °C (68 °F ± 6 °F). If there is any departure from this recommended condition, state it in the report.

7. Procedure

7.1 Heat the test cylinder on a hot plate using a moderate temperature setting of ~~150 ± 10°C (300 ± 20°F).~~150 °C ± 10 °C (302 °F ± 18 °F). Use a low melting point, thermoplastic adhesive, applying just enough adhesive to spread evenly across the face of the heated test cylinder (see Note 1).

7.1.1 An amount of ~~0.30~~0.30 g ± ~~0.05 g~~ 0.05 g of adhesive is generally sufficient. Excessive adhesive may alter the surface characteristics of the sample and the resulting surface bond strength performance.

7.2 Spread the adhesive over the surface of the test cylinder using a ~~37-mm~~38-mm (1.5-in.) straight-edge putty knife. Use only enough adhesive to cover the entire surface of the test cylinder.

7.3 Remove the test cylinder from the hot plate, center the conditioned specimen on the test cylinder, and hold with a light pressure for 15 min. Remove any adhesive that overflows the contact area between the test cylinder and the test specimen.

7.4 Insert the specimen-cylinder assembly into the test apparatus as shown in Fig. 1. Carefully bring the specimen into contact with the lower surface of the steel plate. Examine the contact area to make sure that the face of the specimen is in uniform contact with the steel plate all around the perimeter of the hole.

7.5 Apply the load by separating the upper and lower heads of the test machine at a uniform rate of ~~2.5~~2.5 mm ~~mm/min~~ /min (0.1 in. ~~(0.1 in./min)~~ /min).

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NOTE 1—Hand-held electric glue dispensers have been found suitable for applying hot-melt adhesive to the surface of the test cylinder.

8. Test Data and Report

8.1 The maximum stress required to separate the test cylinder from the specimen is the surface bond strength of the specimen in Newtons (N) or pound-force (lbf).

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8.1.1 To determine the surface bond strength in N/mm^2, divide the maximum load in Newtons by the surface area of the test cylinder in square millimetres ~~(645.2 mm~~(645.2 mm^2).

8.1.2 To determine the surface bond strength in pounds per square inch (psi), divide the maximum load in pounds by the surface area of the test cylinder in square inches. Since the area of the test surface is equivalent to ~~1 in.~~1 in.^{2} (645.2 mm^2), this maximum load is also the surface bond strength expressed in pounds per square inch.

8.2 If broken joints show any glue failure between the test material and the test cylinder surface, discard the test results from that test and use an additional specimen to replace it.

8.3 Report at least the following information:

8.3.1 Actual test conditions including conditioning; test apparatus; and type of adhesive used, and

8.3.2 A description of the test panels, including number of panels tested; number of specimens tested per panel; and average surface bond strength of each panel, in Newtons per square millimetres or pounds per square inch (see Note 2).

8.3.3 If a statistical analysis is made on the test data, also report the results of this analysis.

NOTE 2—Descriptions of the surface failure, such as depth of failure and whether or not the failure included material outside the test cylinder/specimen contact area, are sometimes useful.