



Designation: **D906 – 98 (Reapproved 2017) D906 – 20**

Standard Test Method for Strength Properties of Adhesives in Plywood Type Construction in Shear by Tension Loading¹

This standard is issued under the fixed designation D906; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

INTRODUCTION

The accuracy of the results of strength tests of adhesive bonds will depend on the conditions under which the bonding process is carried out. Unless otherwise agreed upon between the manufacturer and the purchaser, the bonding conditions shall be prescribed by the manufacturer of the adhesive. In order to ensure that complete information is available to the individual conducting the tests, the manufacturer of the adhesive shall furnish numerical values and other specific information for each of the following variables:

- (1) The moisture content of the wood at the time of bonding.
- (2) Complete mixing directions for the adhesive.
- (3) Conditions for application of the adhesive including the rate of spread or thickness of film, number of coats to be applied, whether more than one coat is required.
- (4) Assembly conditions before application of pressure, including the room temperature, length of time, and whether open or closed assembly is to be used.
- (5) Curing conditions, including the amount of pressure to be applied, the length of time under pressure and the temperature of the assembly when under pressure. It should be stated whether this temperature is that of the bond line, or of the atmosphere at which the assembly is to be maintained.
- (6) Conditioning procedure before testing, unless a standard procedure is specified, including the length of time, temperature, and relative humidity.

A range for any variable or combination of variables is permitted provided any arbitrarily chosen value within the range or combinations specified is acceptable to both the manufacturer and the purchaser of the adhesives.

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~~A range may be prescribed for any variable by the manufacturer of the adhesive if it can be assumed by the test operator that any arbitrarily chosen value within such a range or any combination of such values for several variables will be acceptable to both the manufacturer and the purchaser of the adhesive.~~

¹ This test method is under the jurisdiction of ASTM Committee D14 on Adhesives and is the direct responsibility of Subcommittee D14.30 on Wood Adhesives. Current edition approved Aug. 1, 2017/April 1, 2020. Published August 2017/May 2020. Originally approved in 1947. Last previous edition approved in 2014/2017 as D906 – 98 (2011)/(2017). DOI: 10.1520/D0906-98R17-10.1520/D0906-20.

1. Scope

1.1 This test method covers the determination of the comparative shear strengths of adhesives in plywood-type construction, when tested on a standard specimen and under specified conditions of preparation, conditioning, and testing. This test method is intended to be applied only to adhesives used in bonding wood to wood.

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

1.3 *This 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, health, and 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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[D907 Terminology of Adhesives](#)

[D1038 Terminology Relating to Veneer, Plywood, and Wood Structural Panels](#)

[D1432 Test Methods for Small Clear Specimens of Timber](#)
[D4442 Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials](#)

[D907D5266 Terminology of Adhesives Practice for Estimating the Percentage of Wood Failure in Adhesive Bonded Joints](#)

3. Terminology

3.1 *Definitions:*

3.1.1 Many terms in this test method are defined in Terminology [D907](#) and Terminology [D1038](#).

3.1.2 *plywood, n*—a panel generally flat built up of layers of veneer called plies, united under pressure by an adhesive to create a panel with the bond between the plies as strong as, or stronger than, the wood, and that has the following characteristics: (1) is constructed of an odd number of layers with grain of adjacent layers perpendicular, (2) with a layer consisting of either a single ply or two or more plies laminated with parallel grain direction, and (3) with outer layers and all odd numbered layers generally having the grain direction oriented parallel to the long dimension of the panel.

3.1.2.1 *Discussion*—

Generally, the grain of one or more plies is approximately at right angles to the other plies, and almost always an odd number of plies are used.

3.1.3 *shear, n*—in an adhesively bonded joint, stress, strain or failure resulting from applied forces that tend to cause adjacent planes of a body to slide parallel in opposite directions.

4. Significance and Use

4.1 The way adhesives are used in plywood makes shear strength an important performance criteria.

4.2 Shear strength measured by this test is suitable for use in adhesive development, manufacturing quality control, and in materials performance specifications.

5. Apparatus

5.1 The testing machine shall be adjusted to a loading rate of between ~~4535~~4.535 and ~~7560~~7.560 g/s (600 and 1000 lb/min). Where the testing machine is adjusted by rate of crosshead movement rather than load application rate, an appropriate head movement rate shall be selected so as to yield an average load application rate in the 4535 to 7560 g/s (600 to 1000 lb/min) range. It shall be provided with suitable grips and jaws so that the specimen can be gripped tightly and held in alignment as the load is applied. The grips and jaws shown in [Fig. 1](#) have been found satisfactory. The testing machine shall be located in an atmosphere such that the moisture content of the specimens developed under the conditions prescribed in [Section 8](#) is not noticeably altered during testing.

NOTE 1—Where the testing machine is adjusted by rate of crosshead movement rather than load application rate, an appropriate head movement rate shall be selected so as to yield an average load application rate in the 4.535 to 7.560 kg/s (600 to 1000 lb/min) range.

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.

5.2 The testing machine shall be provided with suitable grips and jaws so that the specimen can be gripped tightly and held in alignment as the load is applied.

NOTE 2—The grips and jaws shown in Fig. 1 have been found satisfactory.

5.3 The testing machine shall be located in an atmosphere such that the moisture content of the specimens developed under the conditions prescribed in Section 8 is not noticeably altered during testing.

6. Test Specimens

6.1 The test specimens shall conform to the form and dimensions shown in Fig. 2. The specimens shall be cut from test panels prepared as described in Sections 7 and 8.

6.2 At least 40 specimens, representing at least five different panels, shall be prepared, selected, and tested as prescribed in Sections 9 and 10.

7. Preparation and Test Panels

7.1 The standard substrate for this test method is ~~1.6 mm (1/16 in.)~~ 1.6 mm (1/16 in.) thick rotary-cut or sliced veneer of sweet birch (*Betula lenta*) or yellow birch (*Betula alleghaniensis*). ~~Any other thickness or species of veneer may be substituted upon~~ Upon written agreement between the party requesting this test and the manufacturer of the adhesive, any other thickness or species of veneer is permitted. Select veneer that is free of defects such as knots or distorted grain around knots, cracks, short grain (fibers out of plane), rough surfaces, or unusual discoloration that would indicate decay. Do not sand the veneer.

7.2 Cut the selected veneer into a size suitable for pressing and for cutting specimens with minimal waste. Allow at least ~~1/2 in. (13 mm)~~ 13 mm (1/2 in.) for trim around the edges.

NOTE 3—When cutting the veneer to size, ensure that the fiber direction is parallel and perpendicular to the edges. Appearances may be deceptive. If there is any question, the fiber direction should be checked with a scratch awl.

7.3 Condition the veneer to within ±1 % of the moisture content recommended by the adhesive manufacturer or the party requesting this test. In the absence of any guideline, condition the veneer to 10 to 12 % moisture content based on the oven dry weight. ~~Check moisture content of recommended samples in accordance with Sections 124 to 127 of Test Methods D143.~~

7.3.1 Check moisture content of recommended samples in accordance with Section 6 of Test Methods D4442.

7.4 Prepare the adhesive in accordance with the adhesive manufacturer’s instructions.

7.5 Apply the adhesive to each veneer in accordance with the adhesive manufacturer’s instructions. Allow the prescribed open assembly time, if any, before reassembling the veneer. Reassemble the veneer with the fiber direction of the center veneer perpendicular to the two face veneers. Allow the prescribed closed assembly time, if any, before pressing. ~~Press the assembly under the conditions prescribed by the adhesive manufacturer.~~

7.6 Press the assembly under the conditions prescribed by the adhesive manufacturer. 1141134145d/astm-d906-20

8. Conditioning of Test Panels

8.1 Upon removal from pressure, condition the panels at a relative humidity of 50 ± 2 % and at a temperature of 23 ± 1°C (73.4 ± 2°F) either for a period of 7 days, or until the specimens reach equilibrium as indicated by no progressive changes in

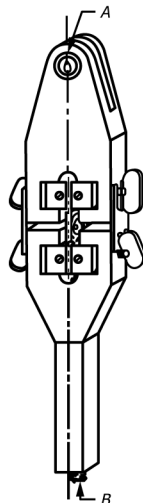


FIG. 1 Grips and Jaws