



Designation: F521 – 22

# Standard Test Methods for Bond Integrity of Transparent Laminates<sup>1</sup>

This standard is issued under the fixed designation F521; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

## 1. Scope

1.1 These test methods cover determination of the bond integrity of transparent laminates. The laminates are usually made of two or more glass or hard plastic sheets held together by an elastomeric material. These test methods are intended to provide a means of determining the strength of the bond between the glass or plastic and the elastomeric interlayer under various mechanical or thermal loading conditions.

1.2 The test methods appear as follows:

| Test Methods                                 | Sections |
|----------------------------------------------|----------|
| Test Method A—Flatwise Bond Tensile Strength | 5 – 11   |
| Test Method B—Interlaminar Shear Strength    | 12 – 17  |
| Test Method C—Creep Rupture                  | 18 – 25  |
| Test Method D—Thermal Exposure               | 26 – 30  |

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:*<sup>2</sup>

**D952** Test Method for Bond or Cohesive Strength of Sheet Plastics and Electrical Insulating Materials

2.2 *ANSI Standard:*<sup>3</sup>

**B1.1** Standard for Unified Screw Threads

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee F07 on Aerospace and Aircraft and are the direct responsibility of Subcommittee F07.08 on Transparent Enclosures and Materials.

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

<sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

## 3. Terminology

3.1 *Definitions:*

3.1.1 *delamination, n*—a visible separation between two layers of bonded material.

3.1.2 *face plies, n*—transparent glass or plastic outer materials joined together with an interlayer.

3.1.3 *interlayer, n*—transparent material used as the bonding agent between two or more hard, transparent materials.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *number of plies, n*—a three-ply laminate is one having two transparent glass or plastic plies and one interlayer ply; a five-ply laminate has three glass or plastic plies and two interlayer plies.

## 4. Significance and Use

4.1 These test methods provide a means to measure quantitatively the bond integrity between the outer layers of the transparency and the interlayer, or to measure the cohesive properties of the interlayer, under various loading conditions.

4.2 These test methods provide empirical results useful for control purposes, correlation with service results, and as quality control tests for acceptance of production parts.

4.3 Test results obtained on small, laboratory-size samples shown herein are indicative of full-size part capability, but not necessarily usable for design purposes.

## TEST METHOD A—FLATWISE BOND TENSILE STRENGTH

## 5. Summary of Test Method

5.1 The bond is subjected to a mechanical load in a direction perpendicular to the plane of the bond. The adhesive or cohesive strength between the interlayer and the outer layers (flatwise tensile strength) is determined, and expressed in terms of pascals (or pounds-force per square inch).

## 6. Apparatus

6.1 *Metal Blocks*—A pair of 50 mm (2 in.) square metal blocks of 24 ST aluminum alloy, each having a maximum height of 50 mm (2 in.). Each block shall have in one end a hole (see Fig. 1) tapped 22.2 mm (7/8 in.) in accordance with ANSI B1.1, to accommodate threaded 22.2 mm (7/8-in.) studs

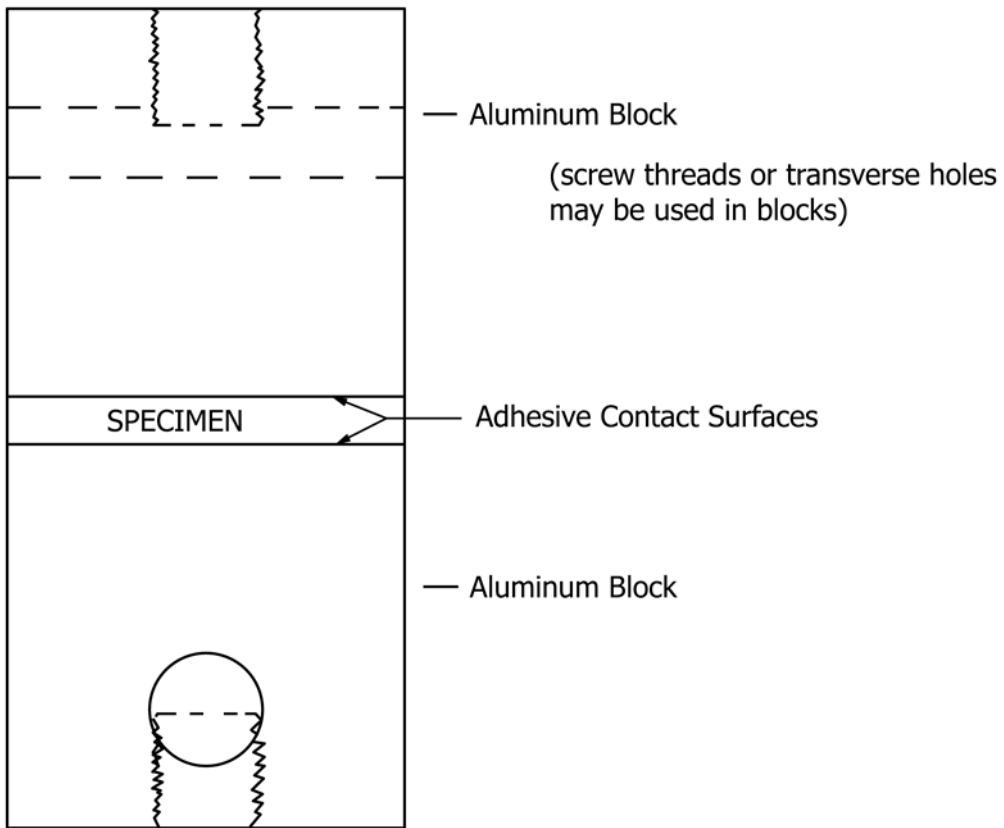
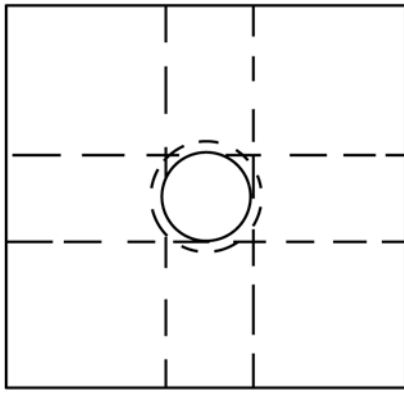


FIG. 1 Test Assembly for Flatwise Tensile Strength Test