Designation: D5656 – 10

Standard Test Method for Thick-Adherend Metal Lap-Shear Joints for Determination of the Stress-Strain Behavior of Adhesives in Shear by Tension Loading[1]

This standard is issued under the fixed designation D5656; 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 covers the preparation and testing of thick-adherend lap-shear samples for the determination of the stress-strain behavior of adhesives.

1.2 This test method covers data reduction and analysis of stress-strain curves obtained using thick-adherend lap-shear samples.

1.3 The values stated in SI units are to be regarded as the standard. The inch-pound units in parentheses are for information only.

1.4 *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 and health practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are given in 7.3.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D907 Terminology of Adhesives

D2651 Guide for Preparation of Metal Surfaces for Adhesive Bonding

D4896 Guide for Use of Adhesive-Bonded Single Lap-Joint Specimen Test Results

E4 Practices for Force Verification of Testing Machines

3. Terminology

3.1 *Definitions:*

3.1.1 Many terms in this test method are defined in Terminology D907.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *knee, n*—inflection point on a load-deflection curve; the point at which plastic yielding of the adhesive begins to dominate the deformation response of the load-deflection curve.

3.2.2 *panel, n*—two plates of a rigid material having the same dimensions that are adhesively bonded together on one face such that the thickness of the panel is approximately twice the thickness of each individual plate.

4. Summary of Test Method

4.1 This test method consists of testing thick-adherend lap-shear samples whereby a tensile load is applied to the sample but the adhesive is placed in shear. Unlike Guide D4896, the adherends used in this standard test method are thick and rigid, peel forces are minimized and the shear stress-strain properties of the adhesive are obtained. Referenced data presents a finite element analysis of the thick-adherent metal lap shear specimen and calculates the effect of varying the adherent and adhesive stiffness.[3] User of this standard is cautioned that since the stress is not totally uniform across the over-lap of the specimen, factors such as adhesive stiffness, adherent stiffness and location of shear strain measurement along the length of the bond can affect the experimentally obtained load-displacement curve.[3,4]

NOTE 1—The peel forces generated during testing are a function of the bending deformation in the adherends. Greater adherend stiffness results in less bending and smaller peel forces.

5. Significance and Use

5.1 This test method can be used to determine the stress-strain properties of an adhesive in shear and to establish the proportional-limit of the stress-stain relationship. This data may be useful for the design and analysis of adhesively bonded joints.

[1] This test method is under the jurisdiction of ASTM Committee D14 on Adhesives and is the direct responsibility of Subcommittee D14.80 on Metal Bonding Adhesives.

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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.

[3] Kassapoglou, C. and Adelmann, John C., "KGR-1 Thick Adherend Specimen Evaluation for the Determination of Adhesive Mechanical Properties ," 23rd International SAMPE Conference, Oct. 21–24, 1991.

[4] Krieger, R. B., Jr., "Stiffness Characteristics of Structural Adhesives for Stress Analysis in Hostile Environment," American Cyanamid Co., Havre de Grace, MD, 1975.

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