SURFACE VEHICLE RECOMMENDED PRACTICE

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Lap Shear Test for Automotive-Type Adhesives for Fiber Reinforced Plastic (FRP) Bonding

RATIONALE

This document covers technology, products, or processes for which technical expertise no longer resides in the owning committee.

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1. SCOPE

This SAE Recommended Practice describes a lap shear test method for use in measuring the bonding characteristics of automotive-type adhesives for joining fiber reinforced plastics (FRPs) to themselves and to metals.

2. REFERENCES

2.1 Applicable Document

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 ASTM Publication

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D 1002 Test Method for Strength Properties of Adhesives in Shear by Tension Loading (Metal-to-Metal)

ASTM D 2093 Practice for Preparation of Surfaces of Plastics Prior to Adhesive Bonding

ASTM D 4896 Guide for Use of Adhesive-Bonded Single Lap-Joint Specimens

ASTM D 5573 Practice for Classifying Failure Modes in Fiber-Reinforced-Plastic (FRP) Joints

3. TEST SUBSTRATE

3.1 Substrates

3.1.1 Fiber reinforced plastic as specified.

3.1.2 Metal composition and roughness as specified.

3.2 Dimensions

Cut fiber reinforced plastic parts into flat coupons 25 mm x 100 mm (1.0 inch x 4.0 inch) (see Figure 1) at a nominal thickness of 2.5 mm (0.10 inch). In the case of FRP to metal bonding, metal thickness is nominally 1.5 mm (0.060 inch).

3.3 Surface Preparation

Surface preparation of FRP is in accordance with adhesive manufacturer's recommendations. Surface roughening, solvent cleaning, and surface primers are acceptable provided they do not reduce FRP bulk properties. See ASTM D2093 for additional surface preparation information. Any surface preparation shall be adaptable to actual production situations. Machine metals to eliminate burrs or bevels. Metal shall be clean and dry, or surface treated prior to bonding according to procedures prescribed by the adhesive manufacturer.

4. PREPARATION OF TEST JOINTS

4.1 Application of Adhesive

Apply adhesive in accordance with adhesive manufacturer's recommendations. In the case of two-part adhesives, mixing shall be in accordance with manufacturer's recommended procedures.

4.2 Adhesive Cure

Cure adhesive at room temperature or elevated temperature using prescribed conditions determined by adhesive manufacturer, provided the conditions can be reasonably adapted to production situations.

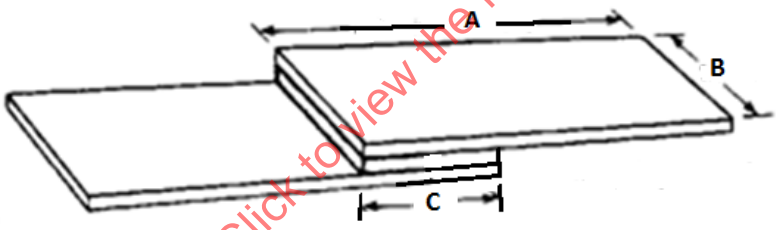

Figure 1

A = 100 mm (4.0 in); B = 25 mm (1.0 in); C = 25 mm (1.0 in); Bonded area is 25 mm x 25 mm (1.0 in x 1.0 in).

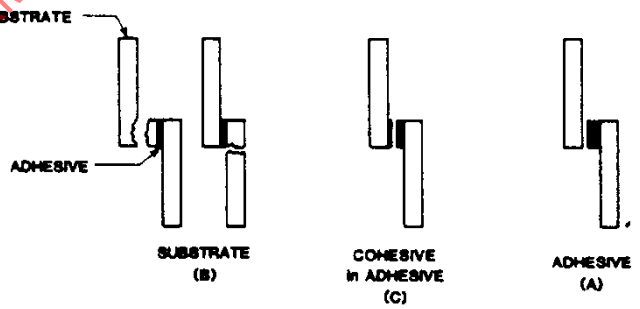

Figure 2

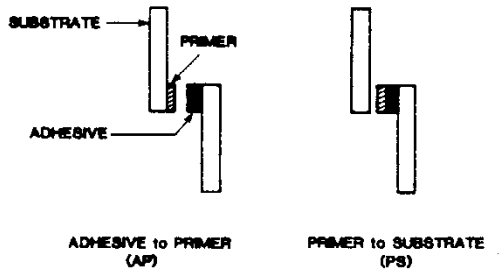

Figure 3

4.3 Joint Geometry

Joint geometry is shown in Figure 1. Control joint geometry by appropriate fixturing using glass beads or other suitable means to maintain a 0.76 mm (0.030 inch) adhesive bondline thickness. Use the minimum number of glass beads needed to maintain bondline thickness. Fixturing pressure is allowed. Bond length is 25 mm (1.0 inch) (see Figure 1).

4.4 Excess Adhesive

Carefully remove excess adhesive (squeeze out) from bonded lap shear prior to testing.

4.5 Conditioning

Allow bonded parts to return to ambient temperature for at least 1 hour if elevated temperature cures are employed. If adhesive is room temperature cured, use full cure time plus 10% prior to testing.

5. TESTING

5.1 Apparatus

Use a universal tensile testing machine conforming to the requirements and capabilities of the machine prescribed in ASTM D1002.

Use a suitable pair of grips to hold test samples without allowing slip. Initial grip separation is 100 mm (4.0 inch) with 25 mm (1.0 inch) minimum of each sample firmly held.

5.2 Test Rate

Load fixture consistently, with a rate of 13 mm (0.5 inch)/min preferred.

5.3 Test Samples

Prepare a minimum of five lap shear samples for each material (adhesive, substrate, or both) tested.

6. REPORT

6.1 Complete identification of the adhesive tested, including type and manufacturer's code number.

6.2 Complete identification of the substrates used and method of surface preparation prior to bonding.

6.3 Cure schedule, time, and temperature for bonding sample.

6.4 Individual peak load values (psi or kPa) and averages. See ASTM D4896 for additional information regarding the interpretation of single overlap shear data.