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SURFACE VEHICLE RECOMMENDED PRACTICE

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PEEL STRENGTH OF SOFT TRIM ADHESIVES

***Foreword*—**This Document has not changed other than to put it into the new SAE Technical Standards Board Format.

***1. Scope*—**This SAE Recommended Practice shall be used to determine the peel strength achieved by an adhesive when used to bond various decorative, flexible substrates such as cloth supported vinyl or carpet, to rigid (steel), semi-rigid (SMC plastic), or other similar substrates.

2. References

2.1 Applicable Publication—The following publication forms a part of this specification to the extent specified herein.

2.1.1 ASTM PUBLICATION—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

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

3. Definitions

3.1 Soft Trim Adhesives—These adhesives, typically solvent or water based, or hot melts, are applied to one or both of the substrates. They develop their strength with the application of heat, pressure, and/or time.

3.2 Peel Strength—Peel strength is the force required to separate bonded substrates of a predetermined width from one another at a predetermined rate of speed. The force may be applied at an angle of 90 degrees (perpendicular) or 180 degrees (parallel) to the substrates.

3.2.1 BREAKAWAY—Load required to initiate disbond.

3.2.2 AVERAGE PEEL—The peel-strength average recorded from 25 mm (1 in) into peel to termination.

3.3 Flexible Substrates—Decorative cloth, supported vinyl, and carpet materials conforming readily to rigid or semi-rigid substrate are typically used.

3.4 Semi-Rigid/Rigid Substrates—A variety of semi-rigid plastics, hardboards, and sheet metal (painted or unpainted).

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3.5 Open Time—The time between adhesive application and assembly (closing) of the bond.

3.6 Peel-Strength Average—The peel-strength average is considered to be the midline of the peel-load variations as displayed on the universal testing machine.

4. Equipment Required

4.1 Universal Testing Machine—Must meet the requirements of ASTM D 1002 (cross head speed of 50 to 500 mm/min (2 to 20 in/min), range 0 to 9.07 kg (0 to 20 lb)).

4.2 Fixture—Constant 90 degree angle frictionless peel fixture.

4.3 Roller—Able to apply a load of 0.357 kg/cm (2 lb/in) width.

4.4 Specimen Cutter—Two single-edged razor blades held in parallel planes, 25.4 mm (1.0 in) apart.

4.5 Timer—0 to 60 min.

4.6 Spray Guns

4.6.1 ATOMIZING—Manufacturer's recommendations—with assorted nozzles, air caps, needles, and pressurizing pots.

4.6.2 AIRLESS—Manufacturer's recommendations—with assorted nozzles, air caps, needles, and pressurizing pots.

5. Method A—90 degree Peel

5.1 Sample Preparation—90 degree Peel

5.1.1 Select one 100 x 300 mm (4 x 12 in) semi-rigid/rigid substrate panel for each test condition masking a 25 x 100 mm (1 x 4 in) strip along a 100 mm (4 in) panel edge.

NOTE—25 panel/strip 90 degree peel-test assemblies are required for each adhesive open time, warp, fill, and adhesive wet-film thickness condition being evaluated. In instances where only one substrate is coated with the adhesive, mask only that substrate.

5.1.2 Cut the flexible material into one 25 x 300 mm (1 x 12 in) test strip for each semi-rigid/rigid substrate panel.

NOTE—When cutting fabrics with a defined weave, cut one set parallel to the warp and one set parallel to the fill. Both sets shall be tested.

5.1.3 Apply the test adhesive for approximately 200 mm (8 in) from one end of the flexible test material strips.

NOTE—For spray-applied adhesives, mask 100 mm (4 in) from one end of the substrate aligning the test strips side by side with their intended bonded surfaces facing up. Adhesive wet-film thickness shall be per manufacturer's recommendations.

5.1.4 Immediately start the open-time timer after applying the adhesive. Carefully remove the masking material from the flexible test strip(s) before applying each strip to the center of a panel.

5.1.5 At the appropriate open time(s), apply a flexible test material strip to the center of a semi-rigid/rigid panel aligning the strip with the panels 300 mm (12 in) edges and assuring that the unbonded portion of the flexible strip is on the 100 mm (4 in) masked edge with the bonded portion of the flexible strip starting 25 mm (1 in) from the panel's edge. Immediately pressurize the full-bond area rolling it four times (two times forward and two back) using the 0.91 kg (2 lb) roller.

NOTE—Every effort to eliminate the effects of adhesive squeeze-out on the peel sample should be made.

5.1.6 Repeat the same procedure for the balance of conditions or until all samples are assembled. Remove any masking from the semi-rigid/rigid panels.

5.1.7 On the back of each panel describe the adhesive open time, warp and fill direction, adhesive film thickness, and number the test assembly.

5.1.8 Condition the panel/strip test assemblies for 24 h at 24 °C ± 2 °C (75 °F ± 3 °F) (or manufacturer's recommendations).

5.2 Peel Procedure—90 degrees

5.2.1 Mount the 90-degree peel fixture in the universal tester.

5.2.2 Install a test assembly in the 90-degree peel fixture aligning the flexible test strip with the universal testers jaw to assure a 90-degree orientation before securing the assembly in the peel fixture and the flexible strip in the jaw.

NOTE—After securing the test assembly, assure the peel fixture continues to move freely.

5.2.3 Activate the universal-testing machine to peel the strip from the panel at arate of 304.8 mm/min (12 in/min) for a minimum of 152 mm (6 in).

NOTE—Pay particular attention that the 90-degree peel fixture continues to move easily maintaining a perpendicular alignment during the peel process. If alignment along this axis exceeds ± 10 degrees, that portion of the test-strip sample should be disregarded.

5.2.4 Record the breakaway and average peel value for each test assembly.

5.3 Report Requirements—90-degree Peel

5.3.1 Report the test method number and any deviations from the recommended test method.

5.3.2 Report complete identification of samples (open time, warp or fill, adhesive wet-film thickness), adhesive type, as well as conditioning time, temperature, and humidity prior to aging and testing.

5.3.3 Report the average of the breakaway and average peel values for the samples (in kilograms per centimeter [kg/cm] width or ounces per inch [oz/in] width).

5.3.4 Report any inconsistencies or irregularities (substrate elongation, deformation, etc.) noted during the test.

6. Method B—180-degree Peel

6.1 Sample Preparation—180-degree Peel

6.1.1 Select one 100 x 300 mm (4 x 12 in) semi-rigid/rigid substrate panel for each test assembly masking a 25 x 100 mm (1 x 4 in) strip along a 100 mm (4 in) panel edge.

NOTE—25 panel/strip 180-degree peel test assemblies are required for each adhesive open time, warp, fill, and adhesive wet-film thickness condition being evaluated. In instances where only one substrate is coated with the adhesive, mask only that substrate.

6.1.2 Cut the flexible test material into one 25 x 500 mm (1 x 20 in) test strip for each semi-rigid/rigid substrate panel.

NOTE—When cutting fabrics with a defined weave, cut one set parallel to the warp and one set parallel to the fill. Both sets shall be tested.

6.1.3 Apply the test adhesive for approximately 200 mm (8 in) from one end of the flexible test material strips.

NOTE—For spray-applied adhesives, mask 300 mm (12 in) from one end of the flexible substrate aligning the test strips side by side with their intended bonded surfaces facing up. Adhesive wet-film thickness shall be per manufacturer's recommendations.

6.1.4 Immediately start the open-time timer after applying the adhesive. Carefully remove the masking material from the flexible test strip(s) before applying each strip to the center of a panel.

6.1.5 At the appropriate open time(s), apply a flexible test material strip to the center of a semi-rigid/rigid panel aligning the strip with the panel's 300 mm (12 in) edges and assuring that the unbonded portion of the flexible strip is on the 10 cm (4 in) masked edge with the bonded portion of the flexible strip starting 2.5 cm (1 in) from the panel's edge.

6.1.6 Immediately upon application, roll the entire bonded area of the flexible strip four times (two times forward and two back) using the two-pound roller.

NOTE—Every effort to eliminate the effects of adhesive squeeze-out on the peel sample should be made.

6.1.7 Repeat the same procedure for the balance of conditions or until all samples are assembled.

6.1.8 Condition the panel/strip test assemblies for 24 h at 24 °C ± 2 °C (75 °F ± 3 °F) (or manufacturer's recommendations).

6.2 Peel Procedure—180 degrees

6.2.1 Insert the 100 mm (4 in) adhesive free edge of the semi-rigid/rigid panel into one of the universal tester jaws. Double back the loose 300 mm (12 in) of unbonded flexible strip aligning it between the universal testing machine jaws. Secure both the panel and the aligned flexible strip in the jaws.

6.2.2 Activate the universal tester to peel the flexible strip completely from the panel at a rate of 304 mm/min (12 in/min)

6.2.3 Peel for a minimum of 152 mm (6 in) recording the breakaway value and average peel value for each test assembly.