



Tape Adhesion Test for Paint Finishes

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This standard specifies the test method to be used to evaluate the adhesion properties of painted metal, plastic and sealer before and after environmental testing. This standard describes the crosshatch and the "X" cut tape adhesion tests using the cutting tools or cutting guide. All paint systems must meet the adhesion requirements when the appropriate method is used. Unless otherwise specified, the dry film thickness will determine which guide or tool is required. If either method is not usable due to size and/or shape constraints (typically found in small parts) the application of this test will be at the discretion of the responsible engineer.

1.2 Applicability. Evaluation of the adhesion properties of painted metal, plastic and sealer before and after environmental testing.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ASTM D3330M ASTM D3652M ASTM D3759M

2.2 GM Standards/Specifications.

None

3 Resources

3.1 Facilities.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Pressure Sensitive Adhesion Tape. It is extremely important that the tape adhesively bonds to steel according to ASTM D3330M with a minimum 180 degree peel strength value of 760 N/m. Weaker adhesives will reduce the severity of the test. The tape backing should exhibit low elongation. The various parameters of the recommended tape are described in 3.2.1.1 thru 3.2.1.4.

3.2.1.1 Nominal Dimensions.

- Width, 20 mm minimum
- Thickness, total ASTM D3652M, > 0.14 mm

3.2.1.2 Properties.

- Peel strength, steel ASTM D3330M, 760 N/m minimum
- Elongation ASTM D3759M, 5% maximum

3.2.1.3 Shelf Life.

- Twelve (12) months maximum.

3.2.1.4 Recommended Products.

- 3M8981
- 3M898
- Or equivalent

3.2.2 Sharp razor knife, retractable carbide cutter by Reider (Swiss) Rico Marker, cutting tool by Gardco or BYK Gardner crosscut tester.

3.2.3 Cutting guide at 1 mm, 2 mm and 3 mm.

3.2.4 Rubber eraser or equivalent instrument for applying tape.

3.2.5 Stiff pencil brush.

3.3 Test Vehicle/Test Piece.

3.3.1 Test Material. The test pieces wherever possible shall be the finished part. If size, shape, etc., of the finished part is not practical, tests shall be conducted on specially prepared coated test panels.

3.4 Test Time. Timing varies based on the specific materials and test request. See Section 4.3 for general test timing.

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Not applicable.

4 Procedure

4.1 Preparation. The adhesion of organic coatings as determined by this test method shall be defined as the tendency of the coating to become detached in the vicinity of scribed lines. Method A will be scribed in the shape of a lattice pattern and Method B will be scribed in an "X" pattern. Both methods require cutting through the coating, before and after exposure to defined environmental conditions. Use sharp blades, as dull blades tend to cause chatter and can result in lower ratings.

4.2 Conditions. Parts in the as-received conditions should be clean and dry before conducting the test. Oil, wax or any residue in the painted surface shall be removed with soap and water or any other cleaner. Dry the samples by blotting with an absorbent paper or cloth.

4.2.1 Environmental Conditions.

4.2.1.1 When specified, the coated test specimens shall be subjected to an environmental test, such as water immersion, humidity or salt spray, etc., before conducting the tape adhesion test. In this case, conduct the environmental test as required and dry samples by blotting with an absorbent paper or cloth.

4.2.1.2 Select a representative area or an area suspected of having poor film adhesion on the paint surface to be tested. Do not select sagged, solvent popped or obviously defective areas, as these defects should be rated separately.

4.2.1.3 The recovery time after exposure to environmental cycle tests and before tape adhesion tests shall be approximately 1 h unless otherwise specified.

4.2.1.4 Multiple tape adhesion tests may be required (minimum of three) depending on approval requirements and space permitting. Larger parts will require more space. Geometric configuration and processing characteristics should be considered.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions.

4.3.1 Test Procedure, Method A.

4.3.1.1 The crosshatch/cutting tool should be inspected prior to use and replaced if any damage is observed. The crosshatch/cutting tool should be replaced if any inconsistencies in the scribe installation are observed.

4.3.1.2 Make a crosshatch cut with a sharp cutting tool or guide as shown in Figure A1. The number of lines and spacing between the lines shall depend upon the coating film thickness as shown in Table A1. Make all cuts approximately 20 mm long. Cut through the film in one steady motion using just sufficient pressure on the cutting tool to have the cutting edge reach the substrate. When making successive single cuts with the aid of a guide, place the guide on the uncut area and cut through the film to the substrate. Make similar type and number of cuts perpendicular and centered on the original cuts.

4.3.1.3 After making the required cuts, brush the film lightly with a soft bristle brush or tissue to remove any detached flakes or ribbons of coating.

4.3.1.4 Dispense or cut a strip of tape approximately 75 mm long being careful not to allow the adhesive side to come in contact with anything before the test application. Place the center of the tape over the grid so that the tape covers the crosshatch diagonally.

4.3.1.5 Press the tape down firmly on the surface with sufficient rubs of the eraser to remove air bubbles and to insure good contact between the tape and paint surface.

4.3.1.6 After 5 s to 10 s, grasp the tail end of the tape between thumb and forefinger and pull upward with a rapid jerking motion perpendicular to the paint film.

4.3.1.7 Rate the adhesion performance as shown in Figure A2, and description of performance using the key in Table A2. Paint adhesion should be reviewed on both the part and the tape.

4.3.2 Test Procedure, Method B.

4.3.2.1 The scribe/cutting tool should be inspected prior to use and replaced if any damage is observed. The scribe/cutting tool should be replaced if any inconsistencies in the scribe installation are observed.

4.3.2.2 With a sharp pointed razor knife, cut an "X" consisting of two bisecting lines each approximately 75 mm long, through the paint film to the substrate as shown in Figure A3. If the area to be tested on the painted sample is less than the standard tape test area, then the application of this test will be at the discretion of the responsible engineer. Report the percentage area remaining on the surface as shown in Figure A4. When cutting, hold knife perpendicular to the surface and avoid any side motion. For relatively soft substrates, such as plastics and sealers, avoid cutting so deeply that the substrate is displaced.

4.3.2.3 After making the required cuts, brush the film lightly with a soft bristle brush or tissue to remove any detached flakes or ribbons of coating.

4.3.2.4 Dispense or cut a strip of tape approximately 125 mm to 150 mm long being careful not to allow the adhesive side to come in contact with anything before the test application.

4.3.2.5 Cover the "X" with tape so that the tape is centered over the intersection and extends for at least 38 mm on both sides of the intersection in the direction of the approximate 25 degree angles. The remaining 50 mm to 75 mm of tape provides a loose tail on one end to grasp when removing tape.

4.3.2.6 Press the tape down firmly on the surface with sufficient rubs of the eraser to remove air bubbles and to insure good contact between the tape and paint surface.

4.3.2.7 After 5 s to 10 s, grasp the tail end of the tape between thumb and forefinger and pull upward with a rapid jerking motion perpendicular to the paint film.

4.3.2.8 Estimate the percentage area of paint not removed by the tape test area of 20 mm x 75 mm (1500 mm²) as shown in Figure A5. Paint adhesion should be reviewed on both the part and the tape.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. Not applicable.

5.3 Test Documentation.

5.3.1 Report: Method A. Record the tape adhesion rating as shown in Figure A2.

5.3.1.1 Record the failure mode indicating where the failure occurred, that is, within substrate, between first coat and substrate, between first and second coat, etc.

5.3.1.2 Submit both painted sample and tape for review. Tape should be submitted on an overhead (acetate film). The tape should never be placed back on the sample.

5.3.2 Report: Method B. Record the tape adhesion rating as the percentage of area of paint remaining as shown in Figure A5, and the type of removal as shown in Figure A6.

5.3.2.1 Record the failure mode indicating where the failure occurred, that is, within substrate, between first coat and substrate, between first and second coat, etc.

5.3.2.2 Submit both painted sample and tape for review. Tape should be submitted on an overhead (acetate film). The tape should never be placed back on the sample.