

Test Method Materials

Tape Adhesion Test for Paint Finishes

1 Scope

Note: Nothing in this test method supersedes applicable laws and regulations unless a specific exemption has been obtained.

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

This standard specifies the test method to be used for evaluating the adhesion properties of painted metal and plastic before and after environmental testing. This standard describes the cross hatch tape test (Method A) and X-cut tape test (Method B). Paint systems are required to meet the requirements of Method A and/or Method B. Unless otherwise specified, when dry film thickness is greater than 125 µm use X-cut tape test (Method B). If neither Method A nor Method B is usable due to size and/or shape constraints (typically found in small parts) the sense of the test shall be utilized.

2 References

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

2.1 Normative.

ASTM D3330M ASTM D3759	ASTM D3652
2.2 GM.	
GM4365M	GM9035P

3 Test Equipment

3.1 Pressure Sensitive Adhesion Tape. It is extremely important that the tape adhesive bonds to steel with a 180 degree peel strength value of at least 430 N/m. Weaker adhesives will reduce the severity of the test results. The tape backing should exhibit low elongation. The following describes the various parameters of the recommended tape:

3.1.1 Nominal Dimensions.

Width2	0	mm
Thickness, total ASTM D3652M0.1	4 r	nm

Thickness, backing ASTM D3759M.....0.08 mm

3.1.2 Properties.

Peel strength, steel ASTM D3330M 430 N/m min

Tensile strength ASTM D3759M......7kN/m nom

Elongation ASTM D3759M......5 % nom

3.1.3 Shelf Life......12 months max.

3M610, 3M670 or 3M898 have been found suitable for this purpose. Other tape sources should be compared to both the above parameters and the above tape source. GM9035P modified for infrared analysis of tape may also be used to determine the equivalency.

3.2 Sharp pointed razor knife, razor blade, or Gardco paint adhesion tester (P-A-T) cutting tool.

3.3 Rubber eraser (pencil type) or equivalent instrument for applying tape.

3.4 A cutting guide can be used for Method A, if the cutting tool is not available.

4 Test Material

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

4.2 The time recovery after exposure environmental cycle tests and before tape adhesion tests shall be 10 to 15 minutes unless otherwise specified in the appropriate specifications (Example: GM4365M or 998XXXX).

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4.3 Multiple tape adhesion tests shall be conducted (minimum of three, space permitting – larger parts will require more and should consider geometric configuration and processing characteristics, Method A or B).

5 Test Method

5.1 Summary of Test Method. Not applicable.

5.2 Test Sample Preparation. Not applicable.

5.3 Test Procedure

5.3.1 Cross Hatch Tape Test (Method A).

5.3.1.1 Visually examine the sample and record any adverse conditions such as, scratch marks, blemishes and other surface imperfections.

5.3.1.2 Oil, wax or any residue on the painted surface shall be removed prior to test with soap and water or any other cleaner not detrimental to paint.

5.3.1.3 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 other obviously defective areas as these defects should be rated separately.

5.3.1.4 Make the cross hatch cut with the sharp cutting tool. The number of lines and spacing between lines shall depend upon the coating film thickness as shown in Table 1. Make all cuts about 20 mm long. Cut through the film to the substrate 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. Make the additional number of cuts perpendicular and centered on the original cuts. Avoid cutting so deeply that the substrate is displaced.

Table 1: Cross Hatch Tape Test Cuts

Dry Film Thickness (μm)	Spacing (mm)	No. of Cuts (in each direction)
≤ 5 0	1	11
50 - 125	2	6
$\geq 125^{(Note 1)}$	-	-

Note 1: When dry film thickness of the coating is thicker than 125 μ m use X-cut tape test (Method B).

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

5.3.1.6 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 cross hatch diagonally. See Figure 1.

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

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

5.3.1.9 Rate Adhesion per Figure 2. Paint adhesion should be reviewed on both the part and the tape.

5.3.2 X-Cut Tape Test (Method B).

5.3.2.1 Visually examine the sample in the asreceived condition; record any adverse conditions such as scratch marks, etc.

5.3.2.2 Oil, wax or any residue on the surface of the paint shall be removed prior to test with soap and water or any other cleaner not detrimental to the paint.

5.3.2.3 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 other obviously defective areas as these defects should be rated separately.

5.3.2.4 With a sharp pointed razor knife cut an X (consisting of 2 bisecting lines each approximately 75 mm long through the paint film to the substrate (see Figure 3). Use sharp blades, as dull blades tend to cause lower ratings. When cutting, hold knife perpendicular to the surface and avoid any side motion. For relatively soft substrates, such as plastics, avoid cutting so deeply that the substrate is displaced.

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

5.3.2.6 Dispense or cut a strip of tape approximately 125 to 150 mm long, being careful

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not to allow the adhesive side to come in contact with anything before the test application.

5.3.2.7 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 25 degree angles. The remaining 50 to 75 mm of tape provide a loose tail on one side to grasp when removing tape.

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

5.3.2.9 After approximately 5 to 10 s, grasp tail between thumb and forefinger and pull upward with a rapid jerking motion perependicular to the paint film.

5.3.2.10 Estimate the percentage area of paint not removed by the tape test area of 20×75 mm (1500 mm²) as shown in Figure 5. Paint adhesion should be reviewed on both the part and the tape.

5.3.2.11 If the area to be tested on the painted sample is less than the standard tape test area, then utilize the sense of the test in reporting the percentage area remaining on the surface. One (1) commonly used variation is shown in Figure 4.

6 Evaluation and Rating

7 Report

7.1 Method A. Record the tape adhesion rating per Figure 2.

7.2 Method B. Record the tape adhesion rating as the percentage of area of paint remaining in the standard tape test area (see Figure 5), and the type of removal (see Figure 6).

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

7.4 Submit both painted sample and tape for review. Tape should be submitted on an overhead or on a white sheet of paper. Tape should never be placed back on the sample.

Figure 1: Cross Hatch Test (Method A)



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Figure 2: Classification of Cross Hatch Test Results



Figure 3: X-Cut Test



Figure 4: Example of X-Cut Test (Small Area)

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Figure 6: Type of Removal



A - Paint removed along knife cut evenly.

B - Paint removed in the "V" section of the knife cut.

C - Paint removed in a "Patch not Touching" knife cut.

D- Paint removed in a "Patch Touching" knife cut

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8 Safety

This method may involve hazardous materials, operations and equipment. This method does not propose to address all the safety problems associated with its use. It is the responsibility of the user of this method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

9 Coding system

This material specification shall be given in other documents, drawings, VTS, CTS etc. as follows:

Test to GM9071P

10 Release and Revisions

10.1 Release. This test method originated in 1970.

10.2 Revisions.

Rev	Date	Description (Organization)
G	JUN 2001	Reformatted Revision (GMNA)
н	AUG 2002	Correction on Figure 2 (GMNA)

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