1 Scope
This standard specifies the test method to be used to evaluate the adhesion properties of painted metal and plastic before and after environmental testing. This standard describes the cross hatch tape test using the cutting tool or cutting guide. All paint systems must meet the adhesion requirements when either 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 sense of the test shall be utilized.

Note: Nothing in the specification supersedes applicable laws and regulations unless specific exemption has been obtained.

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

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

2.1 External Standards/Specifications.
ASTM D3330M
ASTM D3759
ASTM D3652

2.2 GM Standards/Specifications.
GM4365M

3 Test Equipment
3.1 Pressure Sensitive Adhesion Tape. It is extremely important that the tape adhesively bonds to steel according to ASTM 3330M with a minimum 180 degree peel strength value of 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.
- Width = 20 mm minimum thickness, total ASTM D3652M.........> 0.14 mm.

3.1.2 Properties.
- Peel strength, steel ASTM D3330M 760 N/m min
- Elongation ASTM D3759M......................5% max.

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

3.1.4 Recommended Products….3M 8981, 3M 898

3.2 Sharp razor knife, retractable carbide cutter by Reider (Swiss) “Rico Marker”, or cutting tool by Gardco or BYK Gardner cross-cut tester.

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

3.4 Rubber eraser or equivalent instrument for applying tape.

3.5 Stiff pencil brush.

4 Test Material
The test pieces wherever possible shall be the finished part. If size, shape, etc. of the finished part is unsuitable, tests shall be conducted on specially prepared coated test panels.

5 Test Method
5.1 Summary of Test Method. 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 in the shape of a lattice pattern cut through the coating, before and after exposure to defined environmental conditions.

5.2 Test Sample Preparation.
5.2.1 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.

5.1.2 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 samples by blotting with an absorbent paper or cloth.

5.3 Test Procedure.
5.3.1 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.

5.3.2 The recovery time after exposure to environmental cycle tests and before tape adhesion test and before tape adhesion tests shall be 1 hour unless otherwise specified in the appropriate specifications (Example: GM4365M or 998XXXX).

5.3.3 Make a cross hatch cut with the sharp cutting tool. The number of lines and spacing between the lines shall depend upon the coating film thickness as shown in Appendix A Table A1. Make all cuts about 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 the similar type and number of cuts perpendicular and centered on the original cuts. Avoid cutting so deeply that the substrate is displaced.

5.3.4 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.

5.3.5 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.

5.3.6 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.

5.3.7 After 5 to 10 seconds, grasp the tail end of the tape between thumb and fore finger and pull upward with a rapid jerking motion perpendicular to the paint film.

6 Evaluation and Rating

6.1 Rate the adhesion performance per Appendix A Table A2.

6.2 Paint adhesion should be reviewed on both the part and the tape.

6.3 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.

7 Report

7.1 Record the tape adhesion rating per Appendix A Table A2.

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

7.3 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.

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 the method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

9 Notes

9.1 Glossary. Not applicable.

9.2 Acronyms, Abbreviations, and Symbols. Not applicable.

10 Coding System

This test method shall be referenced in other documents, drawings, VTS, CTS, etc. as follows: Per GMW14829-Rating 0

11 Release and Revisions

11.1 Release. This standard originated in November 2005, replacing GM9071P, GME 60401, and GMW14697. It was first approved by Paint in September 2006. It was first published in October 2006.
Appendix A

### Table A1: Cutting Guide

<table>
<thead>
<tr>
<th>Film Thickness (Microns)</th>
<th>Spacing (mm)</th>
<th>Number of cuts (In each direction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 60</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>60 to 200</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>≥ 200</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

### Table A2: Cross Hatch Classification/Rating Scale

<table>
<thead>
<tr>
<th>Surface of cross-cut area from which flaking has occurred</th>
<th>None</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Greater than 65%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating (classification)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Note:** Key for rating scale.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The edges of the cuts are completely smooth; none of the squares of the lattice is detached.</td>
</tr>
<tr>
<td>1</td>
<td>Detachment of small flakes of the coating at the intersections of the cuts. Across cut area of 5% max is affected.</td>
</tr>
<tr>
<td>2</td>
<td>The coating has flaked along the edges and/or at the intersections of the cuts. Across cut area of 5% minimum but 15% maximum.</td>
</tr>
<tr>
<td>3</td>
<td>The coating has flaked along the edges of the cuts partly or wholly in large ribbons, and/or it has flaked partly or wholly on different parts of the squares. Across cut area of 15% minimum but 35% maximum is affected.</td>
</tr>
<tr>
<td>4</td>
<td>The coating has flaked along the degrees of the cuts in large ribbons and/or some squares have detached partly of wholly. Across cut area of 35% minimum but 65% maximum is affected.</td>
</tr>
<tr>
<td>5</td>
<td>A cross-cut area of &gt; 65% is affected</td>
</tr>
</tbody>
</table>