

## PAINT CURE

The following tests are required as part of Quality Control for cure testing of paint.

**All Non - conformance must be recorded on check sheets, including any corrective repairs done. If repairs are not documented, it will be understood that no corrective action was taken!**

When checklists are used the following information needs to be included:

- Cure oven temperature
- Dry-off temperature
- Cure oven cycle time

### **TAPE TEST (HATCH TEST) - ASTM D-3359-90**

To be done on powder and liquid paint.

1. Equipment required:
  - a. Cutting tool: Sharp razor blade, knife or hatch testing tool (2mm space between cuts)
  - b. Tape: One-inch transparent pressure-sensitive tape. (Paul N. Gardner # PA2806)
  - c. Rubber eraser or end of pencil
  - d. Illumination/magnifier tool
  - e. Ruler or straight edge to ensure straight cuts (when using a knife)
2. Test areas:
  - a. Can be performed anywhere on any painted surface.
  - b. Must only be performed on a metal substrate which is cool to the touch or tape will fail to adhere to the surface.
  - c. The area being tested will determine the equipment needed and procedure used.
    - i. Flat even surfaces: The hatch test knife is a good tool and procedure 3a should be used.
    - ii. Tight spots, corners, round surfaces and film thicknesses greater than 5 mils: A sharp knife should be used and procedure 3b followed.
3. Testing procedures:

Use one of the following two procedures:

  - a. Cross-cut using a hatch test knife/cutter  
When testing film thicknesses of 2-5 mils, there must be a 2mm space between cuts (Paul N. Gardner # PA 2056). Film thicknesses between 0-2 mils, a 1mm space between cuts are required (Paul N. Gardner # PA 2052).
    - i. Check over hatch tester blade. Replace if damaged.
    - ii. Select an area free of major blemishes and make parallel cuts as follows:

- Make all cuts about 3/4" (20mm) long. Cut through the film to the substrate in one steady motion using sufficient pressure on the cutting tool to make the cutting edge reach the substrate. When making successive single cuts with the aid of a straight edge, place the straight edge on the uncut area.
- iii. After making the required cuts brush the film lightly with a soft brush or tissue to remove any detached flakes or ribbons of coatings.
  - iv. Make the additional number of cuts at 90<sup>0</sup> to and centred on the original cuts.
  - v. Brush the area as before and inspect the incisions for reflection of light from the substrate. If the metal has not been reached make another grid in a different location. Do not attempt to deepen a previous cut as this may affect adhesion along the incision.
  - vi. Remove a length of tape about 3" (75mm) long. (If the tape is a new roll remove the first two laps and discard.)
  - vii. Place the centre of the tape over the grid and in the area of the grid, smooth into place by a finger. To ensure good contact with the film, rub the tape firmly with the eraser on the end of a pencil. The colour under the tape is a useful indication of when good contact has been made.
  - viii. Within 90 (+/-30) seconds of application, remove the tape by, seizing the free end and with a rapid, smooth motion, pulling it off at as close to an angle of 180<sup>0</sup> as possible.
  - ix. Inspect the grid area on the substrate for removal of coating from the substrate or from a previous coating using the illuminated magnifier. Rate the adhesion in accordance with the following scale. (See Figure 1 for visual classifications.)

5B the edges of the cuts are completely smooth; none of the squares of the lattice are detached.

4B Small flakes of the coating are detached at intersections; less than 5% of the area is affected.

3B Small flakes of the coating are detached along edges and at intersections of cuts. The area affected is 5 to 15% of the lattice.

2B the coating has flaked along the edges and on parts of the squares. The area affected is 15 to 35% of the lattice.

1B the coating has flaked along the edges of cuts in large ribbons and whole squares have detached. The area affected is 35 to 65% of the lattice.

0B Flaking and detachment worse than Grade 1.

**Note:** A rating of 3B or less is a non-conformance.

- b. X-cut using a sharp knife.

Select an area free of blemishes and make intersecting cuts as follows: Make two cuts in the film, each about 1.5" (40mm) long that intersect near their middle with a smaller angle of between 30° and 45°. When making the incisions, use the straight edge and cut through the coating to the substrate in one steady motion.

- i. Inspect the incisions for reflection of light from the metal substrate to establish that the coating film has been penetrated. If the substrate has not been reached make another X in a different location. Do not attempt to deepen a previous cut as this may affect adhesion along the incision.
- ii. Remove a length of tape about 3" (75mm) long. (If the tape is a new roll remove the first two laps and discard.)
- iii. Place the centre of the tape at the intersection of the cuts, with the tape running in the same direction as the smaller angles. Smooth the tape into place by finger in the area of the incisions and then rub firmly with the eraser on the end of a pencil. The colour under the transparent tape is a useful indication of when good contact has been made.
- iv. Within 90 (+/-30) seconds of application, remove the tape by seizing the free end and pulling it off rapidly (not jerked) back upon itself at as close to an angle of 180° as possible.
- v. Inspect the X-cut area for removal of coating from the substrate or previous coating and rate the adhesion in accordance with the following scale:

5A No peeling or removal.

4A Trace peeling or removal along incisions or at their intersection.

3A Jagged removal along incisions up to 1/16" (1.6mm) on either side.

2A Jagged removal along most of incisions up to 1/8" (3.2mm) on either side.

1A Removal from most of the area of the X under the tape.

0A Removal beyond the area of the X.

- vi. Repeat the test in two other locations on each test panel. For large structures make sufficient tests to ensure that the adhesion evaluation is representative of the whole surface.
- vii. After making several cuts examine the cutting edge and replace it if dull or damaged. Discard cutting tools that develop nicks or other defects that tear the film.

#### 4. Reporting classifications and quality assurance.

- Scratching the crosshatch area rather than applying the tape is not sufficient. If you like scratching the cross hatch do so after the tape has been used, however the classification recorded is to be based on the tape system with an added note if scratching demonstrated a lesser cure.
- Record the classification on the appropriate report (see Figure 1 for classification visuals).
- A classification of 3 or less must be reported as a non-conformance, the cause

of failure determined and appropriate corrective action taken. If corrective action cannot be taken the Paint Production Supervisor must determine whether or not it will go into production.

- All hatch marks should be sanded smooth prior to touch up, especially areas that get a decal affixed on top of the hatch marks. Touch up with liquid paint (mixed 5:1 with catalyst).

Classification of Adhesion Test Results

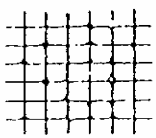
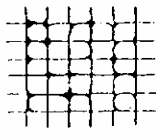

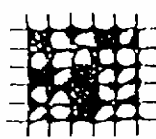
Classification	Surface of cross-cut area from which flaking has occurred. (Example for six parallel cuts)
5B	None
4B	
3B	
2B	
1B	
0B	Greater than 65%

FIG. 1 Classification of Adhesion Test Results

**MEK SOLVENT RUB CURE TEST (POWDER COATING INSTITUTE)**  
To be done on powder paint only.

1. Equipment required:
  - a. Reagent B (a solution mix of 10% MEK and 90% Xylene by volume). Store solution in a MEK squeeze bottle (make sure it is properly labelled).
  - b. 2 lb. ball peen hammer.
  - c. Soft cloth or folded into a 3" x 3" pad, 1/2" thick.
  - d. Fastening device to attach pad to ball end of hammer.
  
2. Procedure:
  - a. Fold the cloth into a 3" x 3" approximately 1/2" thick. (Approximately 4 - 6 layers of folded cloth.)
  - b. Attach the 3" x 3" cloth to the ball end of the ball peen hammer using an O-ring or wire to secure it.
    - this cloth should be changed with each test, as paint build-up will affect the test
  - c. Saturate the pad in Reagent B.  
**Caution:** Reagent B is flammable - use with adequate ventilation.
  - d. Select a test area that is flat and free of blemishes.
  - e. Holding the handle of the hammer parallel to the test piece, stroke/slide the saturated pad approximately 1 1/2" on the test piece using only the weight of the hammer as pressure. Look for obvious signs of fatigue. Do 100 double rubs (i.e.: forward and back equals 1 rub).  
**Warning:** Do not rub too hard or too quickly as this will result in an inaccurate rub.
  
3. Interpretation:
  - a. Results of this test must be compared with your previous observation of test results on parts from the system under evaluation.
  - b. Rating as follows:
    - 1 - Dissolve to metal: No cure. (NC)
    - 3 - Some film removal and softening: Partial cure. (PC)
    - 5 - Gloss reduction only with no or minimal effect on the paint: Cure. (C)  
(As per known cure sample)
  - c. A rating of anything less than "Cure" requires a non-conformance and the appropriate corrective action taken. All parts must "Cure" before being released into production.
  
4. Touch up the rub mark with liquid paint (mixed 5:1 with catalyst).

### **IMPACT ((Company) TESTING)**

1. Equipment required:
  - a. 2 lb ball peen hammer.
  - b. Illuminated magnifying glass.
  
2. Procedure:
  - a. Using the ball end of the hammer, hit the surface of the paint with moderate force.
  - b. Inspect the damaged area for shattering or breaking of paint.

3. Interpretation:
  - a. Interpretation as follows:
    - Cure: No shattering or breaking of paint - a simple divot.
    - Part cure: Some shattering or splitting of paint.
    - No cure: Breaking away of paint exposing metal.
  - b. A rating of anything less than "Cure" requires a non-conformance and the appropriate corrective action taken. All parts must "Cure" before being released into production.

## **VISUAL INSPECTIONS**

### **Solvent Popping (Liquid Paint):**

-this is a visual judgement call based on the following scales:

- 5: Perfect - 0 pinholes
  - 4: Excellent; very little pin holing - 0-10% of surface.
  - 3: Good - 10-30% of surface has pinholes.
  - 2: Fair - 30-60% of surface has pinholes.
  - 1: Poor - 60-100% of surface has pinholes.
- This rating is evaluated by inspecting the overall part.

### **Pinholes (Powder):**

-this is a visual judgement call based on the following scales:

- 4: Excellent; very little pin holing - 0-25% of surface.
  - 3: Good - 25-50% of surface has pinholes.
  - 2: Fair - 50-75% of surface has pinholes.
  - 1: Poor - 75-100% of surface has pinholes.
- This rating is evaluated by inspecting the overall part.

### **Distinction of image/Over-bake:**

Based on the following guide a general visual inspection is to be done:

- 5: Perfect - very shiny; great reflection
- 3: Some reduction in shine but still good reflection
- 1: Reject - little to no reflection

### **Gloss**

It is extremely difficult to visually inspect for gloss on a part, as the paint may appear shiny and reflective (good distinction of image) but have very low gloss; or it may appear matte and dull but have high gloss (80 units plus on a gloss meter). If there is any question as to the appearance of the coating, call Maintenance and/or your Supervisor.

Also note any hazing or blooming on painted parts.

### **Miscellaneous:**

-note any defects, contamination, rusting etc.

## **DATA PAQ**

This method of testing is used to confirm that the metal temperature is reaching "x" temperature for "y" amount of time. Thereby confirming a cure for that particular piece or location of probes.

Maintenance is responsible for performing these tests and a copy will be distributed to the Supervisor and engineering.

### **Documentation - Paint Cure**

1. Select the correct drawing for the part you are inspecting.
2. Perform all required Q.A. tests as per procedure.
3. Complete tests in all required areas on the drawing. Indicate hatch and MEK test areas on the diagram.
4. When complete, file the drawings in the Test Results Binder.
5. For parts that have no drawings, complete the Test Results - Paint Cure log sheet in the binder with all required information.
6. If any non-conformance is discovered, document the information on the drawing or log sheet and report it to your Supervisor immediately.

