Inkjet Solutions
Technical Support

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Ink Adhesion Test Procedure

Description:

This document describes the standard method for measuring Adhesion by Tape Test. This test method covers the procedure for assessing the adhesion of coating films on different substrates. The coating can be from a draw down or an ink jet printed sample. This method is used to establish whether the adhesion of a coating to a substrate is at an adequate level. It does not distinguish between higher levels of adhesion.

Affected Printers:

VUTEk h3 & h5, HS125 Pro, HS100 Pro, HSr Pro, VUTEk LX3 Pro (GS3LX), GS3250LX Pro UltraDrop, GS3250LX Pro, GS3250LX, GS3250 Pro, GS3200 Pro, GS3250, GS3200, GS3250 Pro-CP, GS3250 Pro-TF, GS2000LX Pro UltraDrop, GS2000LX Pro, GS2000LX, GS2000, GS2000 Pro, GS2000 Pro-TF, GS2000 Pro-CP, H2000 UltraDrop, QS2 Pro, QS3 Pro, QS3, QS2, GS5500LXr Pro UltraDrop, GS5250LXr Pro, GS5000r, GS3250LXr Pro, GS3250r, EFI VUTEk 5r & 5r+, EFI VUTEk 3r & 3r+, Quantum 5, Matan 5, Quantum 3, Matan 3, QuantumFlex 3, QuantumFlex 5, EFI Pro 16h, H1625 LED, H1625-RS, H1625-SD, H652, H650, H700, T1000, T660, R3225, 4950LX, 4900M-330, 4900ML, 4900M, 4900, 4830 CE, 4830, 4000 CE, 4000 Non CE, QS3250r, QS3200r, QS3220, QS3200, QS220, QS2000, PV200/600, PV200/600 +W, PV200/600 (< #1000), UltraVu II 3360, TX3250r, UltraVu II 3360 FabriVu, UltraVu II 3360 Fusion, PV320/400, UltraVu II 5330, UltraVu 150, UltraVu 2362, UltraVu 2360, PV UV 180/600

Ink Adhesion Test Procedure

Description	Time Required	Doc Number
This document describes the standard method for measuring Adhesion by Tape Test. This test method covers the procedure for assessing the adhesion of coating films on different substrates. The coating can be from a draw down or an ink jet printed sample. This method is used to establish whether the adhesion of a coating to a substrate is at an adequate level. It does not distinguish between higher levels of adhesion.	1 hour	FTP-00924, Rev. A

Required Tools, Materials and Documents

Part/Doc Number	Description	Additional Information
OMM-00047	Inkjet Solutions Safety Guide	https://inkjet.support.efi.com/doc.php?doc=683
See Equipment/Materials for a complete list of required parts and materials.		

Safety Information

	**PPE**	· Wear Gloves · Wear Goggles **Important!** Always wear PPE when handling inks, fluids and sealants!

Revision History

4/12/2017	Rev. A	First revision.

1.0 Equipment/Materials

- Adhesion testing kit Gardco PA-2000 PAT-Kit (s) including Cutting tool, 1.5 mm. set of 11 blades. Adhesion Test Tape 3M Scotch Premium Grade Transparent Cellophane Tape #610. **Caution: when ordering new Gardco PA-2000 PAT-Kits, the included tape does not correlate to the 3M 610 tape and should not be used.**
- The Temper II metal template by Gardco can be used instead of the cutting tool that comes in the Gardco PA-2000 kit (picture below)
- Lint-free wipes
- Flat stable surface for testing in a well-lit area

Figure 1: Kit (L) and template (R)

Caution! *Use caution when handling all blades.* Blades on cutter are very sharp! Take care when performing cuts, or cleaning and replacing blades.

2.0 Preventive Maintenance/Verification/Calibration:

Replacing blades *– When the cutter no longer produces 11 simultaneous cuts consistently, change the blade piece on the cutting tool.*

1. Loosen the set screws that hold the blade piece in the holder enough so blade is released but set screws are not all the way out.
2. Place new blade in holder with guide holes in blade facing set screws and line up holes with set screws.
3. Tighten set screws until blade is held firmly in place.
4. If using the Temper II, simply dispose of the old blade in a safety blade receptacle and place a new blade in the Temper II foam case.

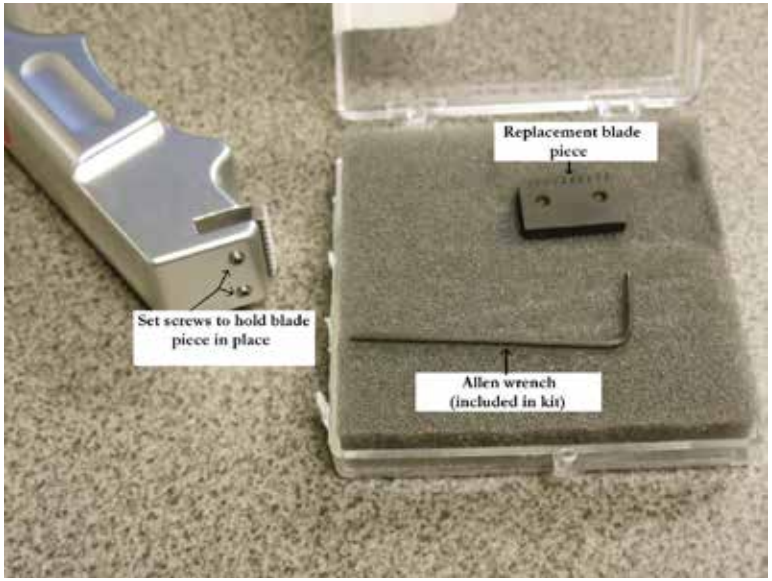


Figure 2: Foam case with blade and wrench

5. Verify all new blades by performing a cut on a printed area of substrate not important to testing. The blades should all be level with the cutting tool and free of defects. If cuts are smooth and precise then the new blades are approved for use.

3.0 Instructions

1. Select a sample area free of blemishes and minor surface imperfections.
2. Ensure the surface is clean and dry. Place on a firm base.
3. With the blade resting at a 30° angle, make a cut applying at constant speed and pressure. Blade cuts should be performed in the direction of carriage travel and 90° to the direction of carriage travel (if using a printed sample). If testing on a drawdown, simply cut in the direction of drawdown movement. Ensure that all cutting edges contact the substrate to the same degree. Using the Brush tool, brush the cutting tool to remove any debris from the blades between cuts.

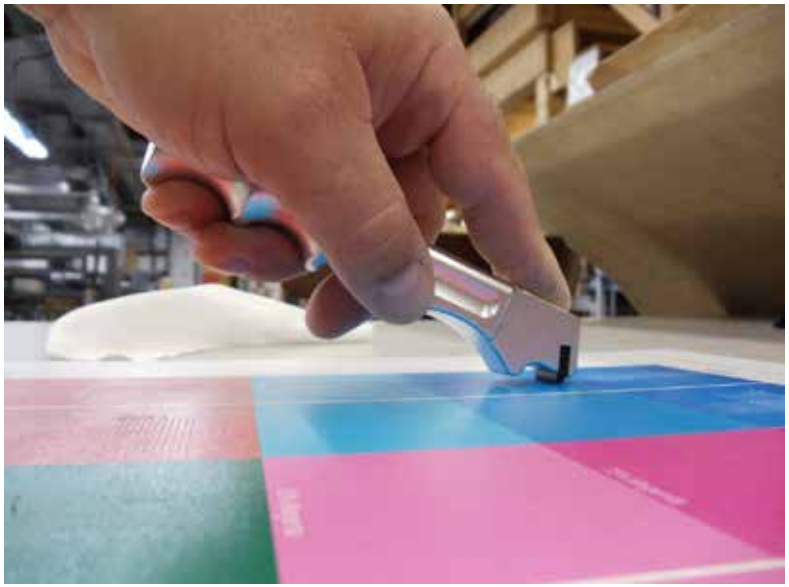


Figure 3: Cutting angle

4. If using the Temper II, place the template on the substrate in the direction of drawdown or print carriage.
5. Using the kit razor blade make 11 cuts without moving the template. There are 6 long and 5 short cuts.

Important! If a cut is missed a new area on the drawdown/print sample will have to be tested since it is very difficult to get the Temper II template back in the same position.

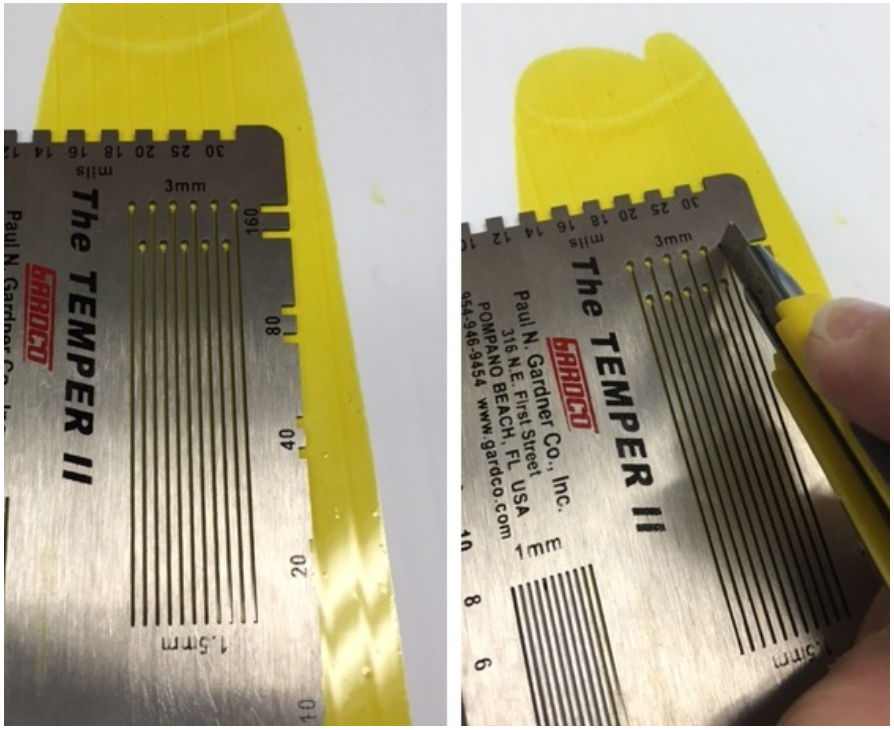


Figure 4: Cutting using template

6. Make a second set of cuts at a 90° angle from the original cuts and centered on the original cuts for each color block. This will form a 10 square by 10 square area, for a total of 100 squares.

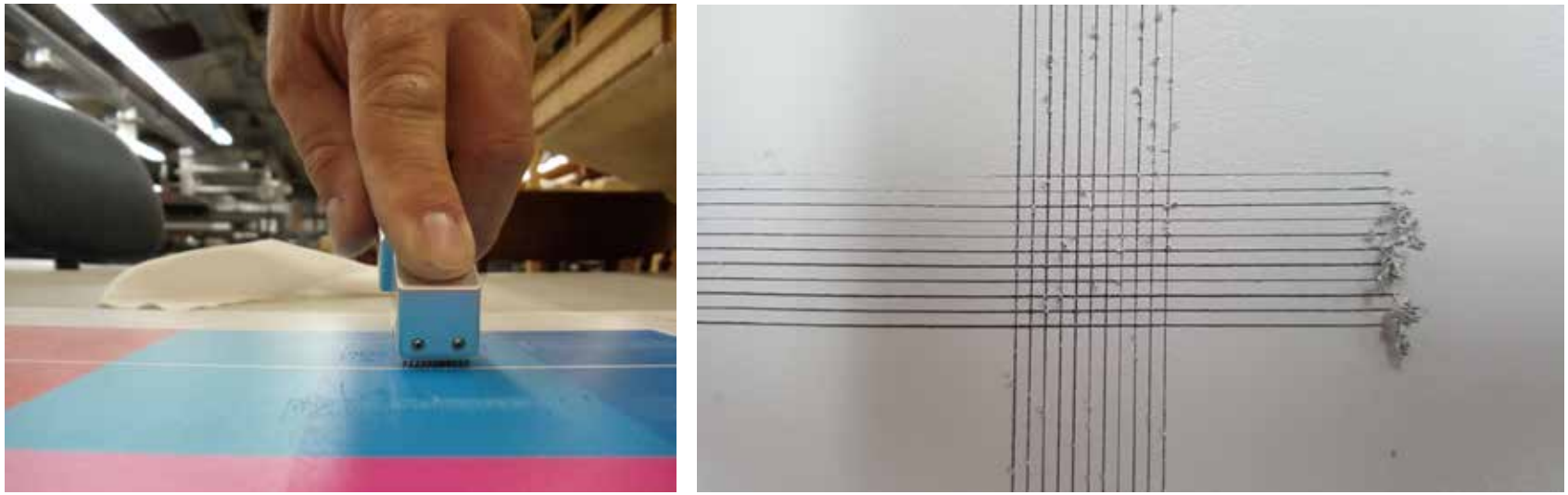


Figure 5: Cross-cutting (L) and the 100 square cross cut area, (R)

7. Brush the samples gently with a lint free wipe to remove any debris from the samples.
8. Brush the cutting tool to remove any debris from the blades.

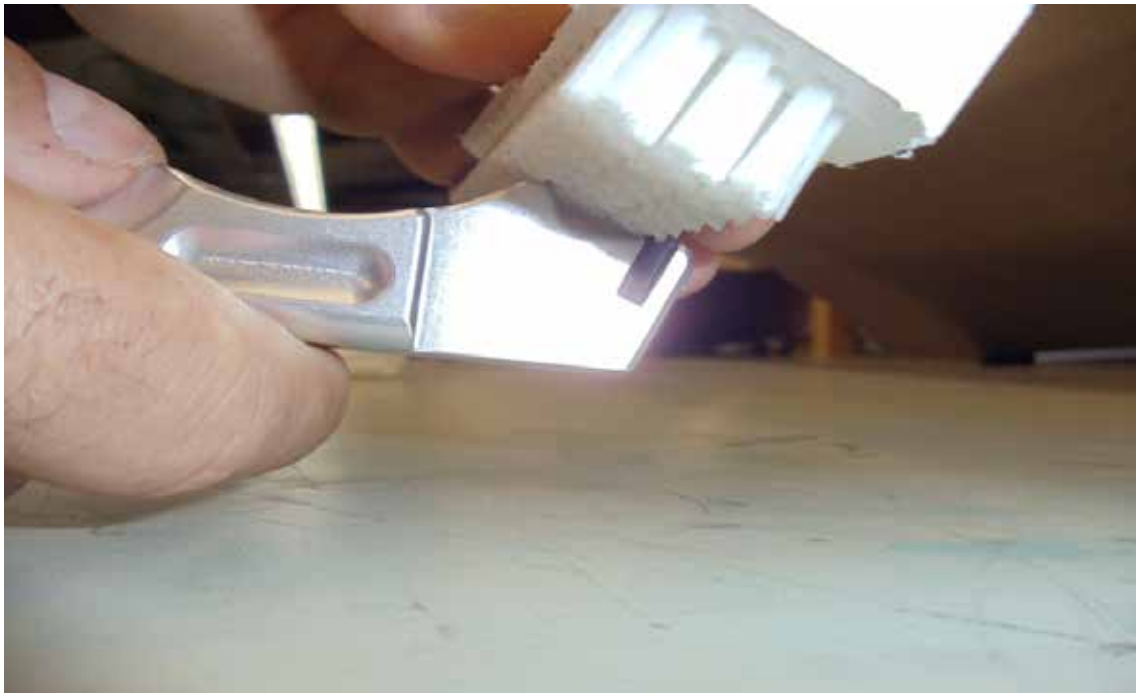


Figure 6: Cleaning cutting blade

9. Inspect the incisions for reflection of the light from the ink surface to ensure that the coating film has been penetrated. If the surface of the substrate has not been penetrated or presents damage, repeat cutting procedure on another area.

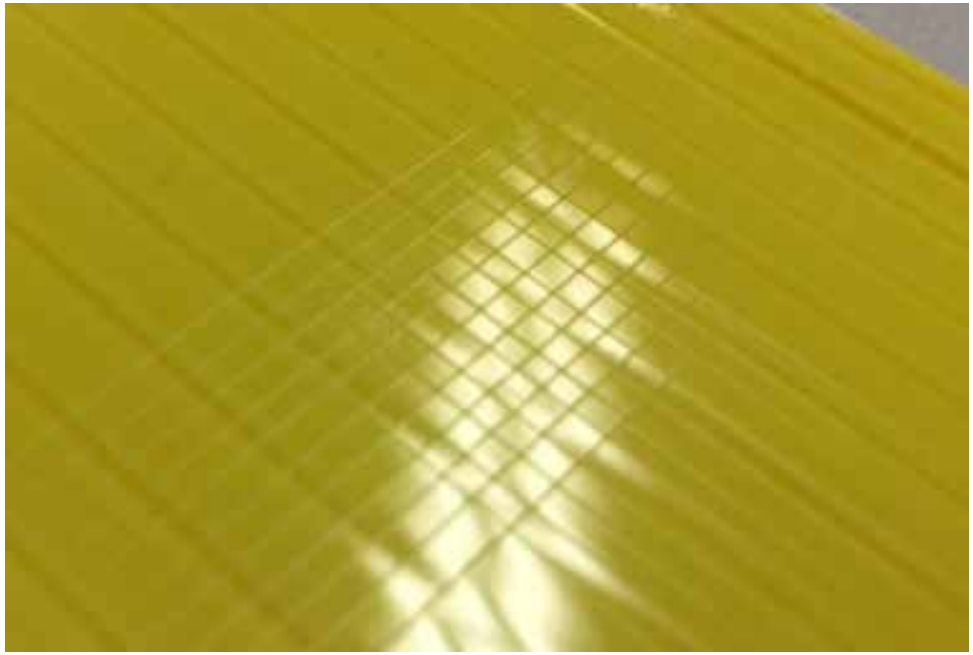


Figure 7: Cut section

10. If the test tape has not been used recently, remove two complete laps of the pressure sensitive tape from the roll and discard.
11. Use 2 to 3 inch lengths of tape for each color block.

12. Place the center of the tape at the intersection of the cuts with the tape running in the same direction as the 45° angle between cuts.
13. Smooth the tape into place by rubbing it firmly with a pencil eraser or thumb. The color under the transparent tape is a useful indicator of when good contact has been made, as is the absence of air bubbles, debris, etc. Putting a crease in the tape outside the crosshatch square will make pulling the tape easier. The example below shows that more pressure is necessary to make good contact across the entire crosshatch area.

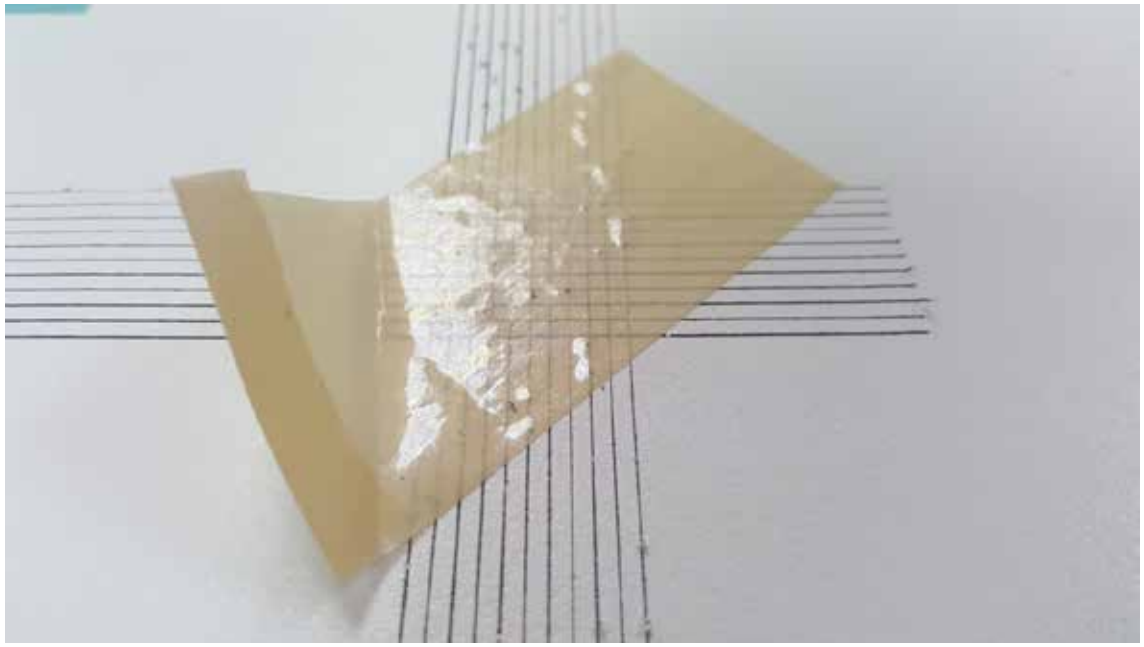


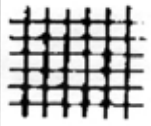
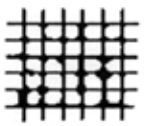
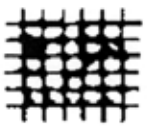
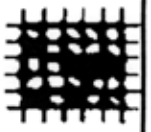
Figure 8: Close-up of tape

14. After 60 seconds of time from the last tape application, remove the tape pieces by seizing the free end and pulling off rapidly back upon itself at as close to an angle of 180° as possible.

15. Inspect the grid area for removal of sample from the substrate and rate the adhesion in accordance with the Adhesion Scale.

D 3359, method B.

CLASSIFICATION CHART

Surface of cross-cut area from which flaking has occurred. (Example for 6 parallel cuts)	None					Greater than 65%
Classification	**5**	**4**	**3**	**2**	**1**	**0**

The tool is also suitable for testing coats of paint that already have been exposed to weather or aged, and for scoring paint films prior to deep drawing.

Note: Scoring is based on percentage of the total crosshatch area affected. Refer to Adhesion Scale.

4.0 Adhesion Scale

Rating	Example	Description
5		The edges of the cuts are completely smooth; no part of the crosshatch area is affected.
4		Less than 5% of the area is affected
3		The area affected is 5 to 15% of the lattice.

2		The area affected is 15 to 35% of the lattice.
1		The area affected is 35 to 65% of the lattice.
0		The area affected is greater than 65% of the lattice.

5.0 Report

1. Report the substrate tested, the type of coating, the method of cure and the number result of test. If several tests were made, note the mean and range.
2. Note that in multicoated systems, or more than one color of ink layering, adhesion failure may occur between coats, so that the adhesion of the coating system to the substrate is not determined.
3. In this case, add M (multilayer) to the number result using the same criteria as above. Also, if there is removal of ink outside the crosshatch square, this can be indicated by adding a minus (-) to the score (ex. 4- would indicate less than 5 % of the total of the area in the crosshatch was affected but there was removal of ink outside of the crosshatch grid.
4. The accuracy and precision depend largely upon the skill of the operator and the operator's ability to perform the test in a consistent manner. Important steps that directly reflect the importance of operator skill include the angle and strength applied to the cutting tool and the rate of tape removal and the visual assessment of the tested sample. It is not unexpected that different operators might obtain different results.
5. For difficult substrates such as 3M 180-10 PSA, Arlon DPF2000 PSA and Coroplast, a smaller 9 line x 9 line cross-hatch area (81 total lines) is acceptable but percentages must be adjusted to compensate for this situation.