Paint Replacement Tape 5004

Surface Characterization Bulletin **August, 2008**

Introduction

Adhesion between 3M™ Paint Replacement Tape 5004 and its substrate is of elevated importance for some applications such as aircraft exteriors, high speed train exteriors, etc. Substrate composition, contamination and surface roughness are determining factors for the adhesion properties of tape. This bulletin describes the recommended procedures for surface characterization prior to application of 3M 5004 Tape. It describes the necessary steps to determine surface roughness and peel adhesion as indicators of substrate suitability for adhesion of paint replacement tape. Minimum adhesion values and the corresponding maximum surface roughness will vary depending on the specific application and final use environment. The customer is responsible for determining the acceptable adhesion values for each application.

Tools and Equipment

- Surface Roughness Gauge: Mahr Federal Products Co., Pocket Surf® Model EMD-1500 Portable Surface Roughness Gauge; Providence, RI.
- Cheesecloth or comparable lint and sizing free cloth.
- Surface Cleaner approved and intended for the application. **See Caution below.**
- Electronic Digital Scale, 1 oz (30 gm). Graduations, 10 lbs. (5 kg) minimum capacity.
- Timer readable in seconds.
- 2 ft. minimum flexible tape measure.
- Surface Thermometer: Pacific Transducer Corp., Los Angeles, CA. Model 309F or 309C or available substitute.
- 3M™ Filament Tape or equivalent.
- 1 inch x 12 inch (24 mm x 300 mm) test strips of 3M™ Paint Replacement Tape 5004, cut from tape to be used for the installation.

⚠ Caution

When handling any chemical products, read the manufacturers' container labels and the Material Safety Data Sheets (MSDS) for important health, safety and environmental information.

General Guidelines

Peel adhesion should be tested using the same 3M™ Paint Replacement Tape 5004 to be used for the installation.

Adhesion test strips can be used to evaluate the adhesion of 3M 5004 Tape.

Prepare the surface as required and recommended in the specific Installation Bulletin.

Surfaces to be tested should be within a temperature range of 60°F to 100°F (15°C to 38°C), and above the dew point.

It is recommended to measure surface roughness and peel adhesion at several sites.

Choose sites that:

- Visually or by feel, represent the extremes of surface roughness.
- Are located where the tape will be subjected to the effects of abrasion and contamination.
- Represent all substrate materials, surface variations and areas of concern.
- Provide an overall view of average surface conditions and variations in surface roughness.
- Surface preparation for surface analysis should be identical to that used for tape installation.

General Guidelines *(continued)*

Surface Roughness Measurements

1. Measure the surface roughness in the same area where the peel strips will be applied. See "Data Log Sheet" for a sample data recording log.
2. Install peel adhesion test strips per the method described below.
3. Follow the Surface Roughness Gauge procedures for calibration prior to use.
4. Locate the probe on the surface to be measured near the test strips. Avoid surface curvature that will not allow a complete uninterrupted sweep of the probe.
5. Take the surface roughness measurement making sure that the gauge is held steady during the procedure.
6. Take a minimum of 4 measurements for each site.
7. Calculate and record average values for each site. See the sample "Data Log Sheet" in this bulletin.

Note: 3M™ Paint Replacement Tape 5004 performs best when the surface roughness (R_a) is less than 60 micro-inches.

Peel Adhesion

In the following section, two methods of measuring 'Peel Adhesion' are described. **Method 1** utilizes a force gauge so that quantitative peel values can be obtained continuously along the length of a peel strip. These values allow a statistical measure of adhesion variability and a data record for future reference. **Method 2** uses preformed 3M™ Adhesion Test Strips 4881 for 3M™ Paint Replacement Tape 5004. It provides a quick and easy visual and tactile indication of whether or not adhesion on 3M 5004 Tape is above a threshold level.

Peel Adhesion Test Method 1:

This method of field testing the peel adhesion of paint replacement tape follows the general procedures of ASTM D3330 Method A. Deviations from this test method to accommodate field-testing limitations are outlined in the following section.

Surface Preparation

Follow the recommendations described in the "General Guidelines" section.

Test Strips

A metal template or a prefabricated cutter, as described in ASTM D3330, can be used to cut the test strips used with this method. Strip width is a critical parameter. We recommend ± 1/64 inch (0.5 mm) tolerance for general applications. (Ensure that the cutting method produces accurate width test strips.)

Test Strips Application and Peel Test

Peel testing using this method is easiest with two people. One person pulls the test strip at a constant rate while the other records the peel values.

1. The surface should be within a temperature range of 60°F to 100°F (15°C to 38°C), and above the dew point.
2. A surface wipe with an approved surface cleaner or Isopropyl alcohol/cheesecloth is recommended prior to applying a test strip. Make sure the surface is dry before proceeding.
3. Remove test strip liner and apply the strip to the test site using firm finger pressure or a plastic squeegee. If wrinkles or bubbles form during strip application, remove the test strip and reapply a new test strip.
4. Note and record the application time. This is used as a starting time to determine dwell time before actual peel testing. This information can be recorded directly onto the test strip for future documentation.
5. Peel testing of a test strip can be done after a minimum of 15 minutes dwell time; however, 1-2 hours provides a more reliable result. The best measure of adhesion requires dwell times of 12-24 hours.

Peel Adhesion ***(continued)***

6. After the desired dwell time has expired, attach a flexible ruler with tape to the test surface alongside and parallel to the test strip. This provides a reference to aid in pulling at the required constant rate.
7. Carefully peel back one end of the test strip approximately 1-2 inches (25-50 mm). Be careful to minimize film distortion during this operation.
8. Attach the scale to the peeled back portion of the test strip using either a piece of filament tape or a clamp that will not distort the film or allow it to slip during the test. See Figure 1.
9. Tare the scale without any applied load, and have a timer ready to monitor the rate of pull.
10. Activate the timer and begin to pull the tape with the scale parallel to the surface. Pull at a rate of 1 inch (25 mm) per 5 seconds, which is comparable to the test standard of 12 inches per minute (5 mm per second).
11. Note and record the adhesion value after each 1 inch, (25 mm) of peel. Record a minimum of 4 readings for each test strip; however, eight readings are recommended.
12. Calculate and record the average peel adhesion value for each test strip.
13. 3M™ Paint Replacement Tape 5004 performs best when the peel adhesion per this method is above 40 ounces at a surface temperature of 70°F (21°C).

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Figure 1: Adhesion scale attached to test strip.

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Surface Characterization Data Log Sheet

Vehicle/Craft ID:		Surface Description:								Site No./Location:
Test Operator:										
SURFACE ROUGHNESS		Peel Strip ID								
Reading	R_a	Surface Temp During Peel								
1		Peel Date/Time								
2										
3		Dwell Time								
4		Reading	PEEL VALUE							
5		1								
6		2								
7		3								
8		4								
9		5								
10		6								
11		7								
12		8								
AVE		AVERAGE								

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Precautionary Information

Refer to Product Label and Material Safety Data Sheet for health and safety information before using this product. For additional health and safety information, visit www 3M.com/msds or call 1-800-364-3577 or (651) 737-6501.

For Additional Information

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