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Project(s): Adhesion Testing of 3M Commercial Solutions Division graphic films to Alpolic® Composite Material Panels

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I. Application Description:

Mitsubishi Plastics Composites America is a manufacturer of Alpolic® metal composite material panels for architectural applications. 3M™ graphic films have been used for years in the graphics industry for interior and exterior graphic applications. This includes signage for vehicles, walls, windows, floors and more.

II. Test Objective(s):

The purpose of this test study was to evaluate the adhesion of 3M™ Controltac™ Graphic Film with Comply™ v3 Adhesive IJ180Cv3-10 (henceforth described as IJ180Cv3) and 3M™ Controltac™ Print Film with Comply™ Adhesive 40C-10R (henceforth described as 40C) to several Alpolic® panels with common finishes and metal surfaces. 90° peel adhesion tests were performed with IJ180Cv3 and Print Film 40C applied to these substrates. The 90° peel adhesion test is one of the most common tests (others include a 180° peel adhesion test) for determining how well the graphic will bond to the substrate finish. The IJ180Cv3 and 40C evaluated in this study are 2 and 3 mils thick (0.05mm and 0.081mm) respectively.

III. Test Procedures:

Adhesion was measured using a 90° peel adhesion test based on test method ASTM D3330. 1.0" (25 mm) wide strips of graphics were used for this test. The strips of graphic were applied to the customer supplied substrates after the application surfaces were prepared utilizing the surface preparation methods listed in Section IV. Three strips of graphics were used for each different product choice. The graphics were then backed with a 2 mil (0.05 mm) thick pvc graphic film and allowed to dwell for 3 days at 70°F/50% RH conditions to allow bond strength to develop. The 90° peel adhesion tests were completed at these same environmental conditions. Laboratory retained production samples of the IJ180Cv3 and 40C were used for this study and average peel test data is reported in pounds per inch width (lbs/in).

IV. Surface Preparation:

The following surface preparation method was used in this study. First, a towel is saturated with 3M Prepsolvent 70, and then used to wipe the surface. This is followed by a dry wipe, before the solvent flashes off. Next, the same method is used with 70% Isopropyl Alcohol (with 30% water). Proper surface preparation is critical for achieving high bond strength. Kimberly-Clark WypAll X60 towels were utilized for all surface preparation techniques involving a wiping/cleaning procedure.

V. Summary of Results:

A 90-degree average peel force result of 1 lbs 0.8 oz/in is generally desired for most graphic applications. This would equate to a 180-degree average peel force of 3.0 lbs/in. Two different 3M graphic films were evaluated in this study. The attached table provides average test results for those films.

Substrate	Surface Preparation Method	Average Peel lbs/in	
	3M Prepsol 70/IPA	<i>I180Cv3</i>	<i>40C-10R</i>
High Performance Polyester: SHB Blue, GH32SHB8	3M Prepsol 70/IPA	1 lb 12.5 oz	1 lb 15.9 oz
Acrylic Primer (VLT): SHB Blue, GH32SHB8	3M Prepsol 70/IPA	2 lb 9.37 oz	2 lb 9.6 oz
Alpolic Feve: JXR Red	3M Prepsol 70/IPA	1 lb 4.2 oz	1 lb 13.57 oz
Polyester Primer: (Green on one side, White on other)	3M Prepsol 70/IPA	3 lb 2.0 oz	2 lb 15.5 oz
Alpolic: MICA MFS GREY: FR4MFS8	3M Prepsol 70/IPA	1 lb 5.3 oz	2 lb 3.23 oz

VI. Conclusion:

The 3M™ Controltac™ Graphic Film with Comply™ v3 Adhesive IJ180Cv3-10 and 3M™ Controltac™ Print Film with Comply™ Adhesive 40C-10R formed acceptable adhesive strength to all the Alpolic® composite panel substrates evaluated in this adhesion study. The different Alpolic® composite panel types and finishes showed variations in adhesion performance. The use of adhesion promoters (such as 3M Tape Primer 94, 3M Adhesion Promotor 111) could be used to build higher adhesion, if desired. To validate acceptable adhesion performance, an independent adhesion test should be conducted on all panel finishes for each project.

Please note: the adhesion results in this test report are only relevant for the specific Alpolic® composite panel finishes/types tested in this study. Alternative Alpolic® composite panel finishes/types should be tested for adhesion by 3M prior to the commencement of a graphic project.

VII. Additional Considerations- Design & Fabrication

1. Work Area & Substrate Temperatures: While surface preparation is critical to achieving good bonding performance of 3M™ graphic films, it is equally important to apply the graphic film in a work area with a temperature >50°F (ideally 60°-90°F). In addition, the bonding substrate s must be at the same temperature (thermal equilibrium). The use of an adhesion promoter could lower the installation temperature, but adhesion data will need to be checked to confirm positive results.
2. Application Pressure: It is also important to provide adequate pressure to the graphic film during the installation process. The 3M™ Controltac™ Graphic Film with Comply™ v3 Adhesive IJ180Cv3-10 and 3M™ Controltac™ Print Film with Comply™ Adhesive 40C-10R both have the Controltac™ adhesive technology, so firm installation pressure needs to be used to activate the full strength of the adhesive. If the pressure used during the installation of the graphic is not strong enough, the Controltac™ posts may not be fully crushed, leading to lower than expected adhesion. It is strongly recommended to use the 3M PA-1 Gold squeegee to achieve firm pressure.

Testing should be conducted by the customer to determine if a 3M™ graphic film will meet all the performance requirements for their application. The data reported in this document is to be used as a representation of how well the tested 3M™ graphic films listed above will bond to the specific customer-supplied substrates with the same surface preparation methods and environmental conditions. A thorough evaluation should be done by the customer to verify if a 3M™ graphic film is capable of meeting the total needs of the application, including those that were not anticipated with this testing.

The information provided in this letter related to material content represents 3M Commercial Solutions Division’s knowledge and belief as of the date it is provided.

3M Commercial Solutions Division

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