

Balance Weight Adhesion Testing on Alcoa Dura-Bright® Wheels

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Testing Conducted by Independent Automotive
Testing Experts

Introduction

Automotive wheel weights are being used to balance Alcoa aluminum truck rims with Alcoa Dura-Bright surface treatment. Wheel weights were supplied with bonding tape. Shear Adhesion was improved in laboratory testing using supplied Aculon primer wipe for Alcoa Dura-Bright surface treatments.

Tests were done in laboratory conditions that may not replicate conditions used in the field. Customers would need to validate performance in their application.

Fig. 1: Wheel rim sections and wheel weights attached with tape



Test Equipment

1. All tests were performed on an Instron Material Testing System.
2. Special fixtures were fabricated in order to conduct testing.

Test Method

A summary of the steps in sample preparation and this test are given below.

Shear Adhesion

1. Condition the tape for a minimum of 24 hours to controlled room temperature condition (23°C, 50% RH) before assembling samples.
2. Clean Alcoa wheel surface using 100% Isopropyl alcohol and a paper towel. Allow wheel surface to dry (2-3 minutes).
3. For samples where primer is used remove the Aculon Primer wipe from packaging and rub back and forth over the wheel surface. Allow the surface to dry for 3 minutes and then remove any remaining debris with a paper towel.

Fig 2: Aculon primer wipe used for Alcoa Dura-Bright surface treatment



4. Apply wheel weights to wheel surface. Place wheel weight straight so that the long edge of the wheel weight is parallel with the edge of the wheel.
5. Apply pressure to the top of the weight to allow the adhesive to wet out on the wheel surface. A 6.8 kg roller was rolled back and forth across the top of the weight.

Fig. 3: 6.8 kg roller applied to wheel weight for consistent pressure and wet-out



6. Allow the samples to dwell at room temperature condition for 72 hours before conditioning.
7. Samples are pulled at a rate of 0.5"/min, and the peak adhesion value is recorded.

Samples were conditioned with thermal shock, room temperature, and humidity. Thermal shock was performed manually by transferring samples from a freezer set at -30°C to an oven set at 80°C repeatedly over 7 days. Four thermal shocks occurred during each business day while the

samples were left in the freezer during nights and the weekend. A sample matrix is shown below in Table I.

Table I. Sample Matrix for Shear Testing Performed

	Description	Aculon Primer Used	No Primer Used
Thermal Shock	20 cycles between -30°C and 80°C	3 samples	3 samples
Humidity	7 days at 85% RH	2 samples	2 samples
Room Temperature	7 days at 23°C, 50% RH	3 samples	2 samples

Fifteen wheel weights were provided with tape pre-applied. Some sample sets only had two samples because of limited supply.

Results and Discussion Shear adhesion results reflect the peak load reached during testing. Results are expressed in kilograms-force in Table II.

Table II. Shear adhesion results of weights removed from wheels

Condition	Preparation	Average Peak Load (kgf)	Standard Deviation (kgf)
Thermal Shock	No Primer	23	4
	Aculon Primer	30	9
Humidity	No Primer	16	5
	Aculon Primer	29	0
Room Temperature	No Primer	15	4
	Aculon Primer	18	8

As illustrated by the results Aculon Primer appeared to have strengthened adhesion for each

condition compared to using no primer. The samples conditioned with humidity and thermal shock had higher shear values compared to the room temperature samples. The conditioning had a positive impact on the results for both sets of samples with and without the use of primer. The standard deviations listed in Table II have limited significance due to the sample set being so small.

The effect of using Aculon primer could be witnessed in how the samples failed in addition to the test values. The majority of all the samples that were assembled without using primer experienced failure through the weight and tape coming off from the wheel.

When the Aculon primer was used it seemed to increase adhesion to the wheel surface causing the bond between the weight and the tape to be the weaker part of the system while the tape remained bonded to the wheel surface.

Conclusions

Aculon primer does not appear to have any ill effects on the supplied weights based on the testing results above. In every sample set tested Aculon primer increased shear adhesion compared to using no primer. Temperature fluctuations and humidity did not induce any negative reaction between the primer and tape. No visual changes in the tape were apparent.

As these results were obtained in a controlled environment, it is important to note that values may vary in a real-life application. In all scenarios, correct application steps must be followed to provide optimal performance.