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## Abrasion Properties of Window Films

Name	3M Renewable Energy	Date:	July 3, 20104
Attn:	Paul Neumann	Revision Date:	September 18, 2014
Address:	3M Center, 235-3D-02	Author:	William Stegeman
City, State, Zip:	St. Paul, MN 55144	Report Number:	ESP017051P-Ultra Abr
		Client Purchase Order Number:	USMMMNY51T

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## INTRODUCTION

This report presents the results of abrasion resistance tests conducted on samples of window films. The testing was authorized by Paul Neumann of 3M Renewable Energy on June 12, 2014. The testing and data analysis were completed on September 18, 2014.

The scope of our work was limited to conducting abrasion resistance (done at another Element Lab) tests on the samples submitted and reporting the results.

## OBJECTIVE

Determine abrasion properties of the window films.

## SAMPLE IDENTIFICATION

The samples were identified as 3M™ Scotchshield™ Safety and Security Film Ultra 600, and Ultra 800

## TEST METHOD

The specimens were allowed to condition at standard laboratory conditions of  $72 \pm 4^\circ\text{F}$  and  $50 \pm 5\%$  relative humidity for at least 40 hours prior to testing. Testing was done according to ASTM Standards detailed below, with notes of parameters and/or deviations.

Test Method	Test Method Title	Parameters and/or Deviations from Method
ASTM D1044	Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion	Wheels: CS10F Weight: 500 g Cycles: 100

## CALIBRATED TEST EQUIPMENT

Byk Gardner Haze-Gard Plus, PT-173-021, Calibration Due: Per Use

Haze standard, ID PT-173-022 - Calibration Due: 10/10/2014

Tabor Abrader, ID PT-173-024 - Calibration Due: 02/05/2015

Temp/Humidity PT-172-074 – Calibration Due: 1/31/2015

## TEST RESULTS

### Abrasion

Sample #	Haze %: Original	Haze %: Abraded	Change in Haze (% ABRASION)
600-1	3.69	6.89	3.20
600-2	4.92	7.58	2.66
600-3	3.59	6.73	3.17
Average	<b>4.07</b>	<b>7.07</b>	<b>3.01</b>
Std. Dev.	<b>0.74</b>	<b>0.45</b>	<b>0.30</b>
800-1	4.99	7.33	2.34
800-2	4.97	7.91	2.94
800-3	4.24	77.60	3.36
Average	<b>4.73</b>	<b>30.95</b>	<b>2.88</b>
Std. Dev.	<b>0.43</b>	<b>40.40</b>	<b>0.51</b>

Respectfully submitted,



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