



Element Materials Technology
662 Cromwell Avenue
St Paul, MN
55114-1720 USA

P 651 645 3601
F 651 659 7348
T 888 786 7555
info.stpaul@element.com
element.com

ABRASION RESISTANCE OF WINDOW FILM

Name	3M Renewable Energy	Date:	July 3, 20104
Attn:	Paul Neumann	Revision Date:	February 16, 2015
Address:	3M Center, 235-3D-02	Author:	Briana Hinrichs
City, State, Zip:	St. Paul, MN 55144	Report Number:	ESP017051P-SX1
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INTRODUCTION

This report presents the results of abrasion resistance tests conducted on samples of window film. The testing was authorized by Mr. 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 reporting the results of abrasion resistance tests which were performed at another Element Lab.

OBJECTIVE

Determine abrasion resistance properties of the window films.

SAMPLE IDENTIFICATION

The sample was identified as follows;
3M™ Safety and Security Film Safety Exterior Series S40.

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

Fisher Scientific Digital Thermometer, ID PT-173-026 - Calibration Due: 9/4/2014, calibrated 8/5/14, due 8/5/15

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)
S40X-1	2.13	8.48	6.35
S40X-2	2.61	8.14	5.53
S40X-3	2.77	7.81	5.04
Average	2.50	8.14	5.64
Std. Dev.	0.33	0.34	0.66

Respectfully submitted,



Briana Hinrichs
 Advanced Materials Technician
 Product Evaluation Department

REVISION NOTES

Revision	Page #, Section, Description	Date
SX1	Separated report to be Abrasion resistance data and information only.	02-16-2015