



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

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## PUNCTURE TESTS OF WINDOW FILMS

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-S3
		Client Purchase Order Number:	USMMMNY51T

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## INTRODUCTION

This report presents the results of puncture 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 conducting puncture tests on the samples submitted and reporting the results.

## OBJECTIVE

Determine puncture resistance properties of the window films.

## SAMPLE IDENTIFICATION

The samples were identified as follows;  
 3M™ Safety and Security Film Safety Series S70, S80 and S140,

## 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 D4830	Standard Test Methods for Characterizing Thermoplastic Fabrics Used in Roofing and Waterproofing"	Section 7

## CALIBRATED TEST EQUIPMENT

Honeywell Temp/RH Chart Recorder, S/N 7852 243000007, ID MM190-024 calibrated 8/7/13 calibrated 8/5/14,  
 due 8/5/15

MTS Universal Test Machine, Mdl Qtest / 50LP, System #1532, ID MM210-009.3 & 6 calibrated 4/8/14 due 4/8/15

MTS Load Cell, 2250lbf Capacity, S/N 205974, ID MM210-009.1 calibrated 4/8/14 due 4/8/15

Mitutoyo Digimatic 8" Calipers, S/N 0006565, ID MM160-068 calibrated 8/8/13, calibrated 8/5/14, due 8/5/15

Mitutoyo Digimatic Indicator, Model C1012CMX, S/N 09040960, ID PT163-021 calibrated 8/8/13, calibrated 8/5/14, due 8/5/15

## TEST RESULTS

### Puncture

Sample Id	Specimen	Peak Load, N
S70	1	533.090
	2	542.031
	3	534.790
	4	527.659
	5	522.979
Average		<b>532.110</b>
Standard Deviation		<b>7.242</b>
S80	1	723.709
	2	704.762
	3	730.925
	4	733.601
	5	705.669
Average		<b>719.733</b>
Standard Deviation		<b>13.742</b>
S140	1	891.047
	2	882.463
	3	945.617
	4	950.952
	5	882.142
Average		<b>910.444</b>
Standard Deviation		<b>34.779</b>

Respectfully submitted,



Briana Hinrichs  
 Advanced Materials Technician  
 Product Evaluation Department

## REVISION NOTES

Revision	Page #, Section, Description	Date
S3	Separated report to be Puncture Resistance data and information only.	02-16-2015