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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
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City, State, Zip:	St. Paul, MN 55144	Report Number:	ESP017051P-SX3
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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 sample was identified as follows;
3M™ Safety and Security Film Safety Exterior Series S70.

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
S70X	1	544.536
	2	565.078
	3	555.080
	4	554.683
	5	591.526
Average		562.181
Standard Deviation		17.941

Respectfully submitted,



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REVISION NOTES

Revision	Page #, Section, Description	Date
SX3	Separated report to be Puncture Resistance data and information only.	02-16-2015