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Tensile Properties of Window Film

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 800T
		Client Purchase Order Number:	USMMMNY51T

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INTRODUCTION

This report presents the results of tensile/elongation tests conducted on a sample of window film. 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 tensile/elongation tests on the sample submitted and reporting the results.

OBJECTIVE

Determine tensile properties of the window film.

SAMPLE IDENTIFICATION

The sample was identified as follows;
 3M™ Scotchshield™ Safety and Security Film 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 D882	Standard Test Method for Tensile Properties of Thin Plastic Sheeting	Test Speed 2 in./min.

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

Interface Load Cell, 225 lbf capacity, S/N 677238, ID PT-163-042 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

Tensile

Sample Id	Specimen	Width, in	Thickness*, in	Peak Load, lbs	Stress at Yield, psi	Stress at Break, psi	Elongation at Yield, %	Elongation at Break, %	Modulus, ksi
Ultra 800 MD	1	1.001	0.008	234.4	15174	29267	7.89	106.72	547.6
	2	1.003	0.008	216.1	15160	26933	7.94	95.61	550.4
	3	1.002	0.008	242.6	14969	30261	7.88	116.37	533.5
	4	1.001	0.008	217.7	14991	27181	7.46	99.96	553.8
	5	1.004	0.008	233.2	15001	29036	7.80	108.97	541.8
Average		1.002	0.008	228.8	15059	28536	7.79	105.52	545.4
Standard Deviation		0.023	0.000	0.000	11.5	99	1429	0.19	8.07
Ultra 800 TD	1	1.001	0.008	214.4	****	26776	****	93.51	612.7
	2	1.003	0.008	221.5	****	27603	****	102.12	607.2
	3	1.002	0.008	221.3	****	27602	****	99.55	614.8
	4	1.003	0.008	201.3	****	25088	****	83.00	639.5
	5	1.002	0.008	203.0	****	25327	****	84.91	642.4
Average		1.002	0.008	212.3	#DIV/0!	26479	#DIV/0!	92.62	623.3
Standard Deviation		0.033	0.000	0.000	9.7	#DIV/0!	1212	#DIV/0!	8.53

* = for films tested with adhesive layer the thickness was reduce by 0.001 inch to account for the adhesive layer

Respectfully submitted,



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