GEOMEMBRANE TEST RESULTS
TRI Client: Gecat Plastic Factory
Project: MQA

Material: 2mm Double Sided Textured Geomembrane
TRI Log No.: A16-281

Sample Date(s): 23/11/2016
Test Date(s): 24-11-2016 - 30-01-2017

Sample conditioning for tests that require specific conditions

	Standard		Laboratory	
	t (°C)	RH (%)	t (°C)	RH (%)
Thickness (ASTM D 5199)	21 ± 2	60 ± 10	22	46
Thickness (ASTM D 5994)	21 ± 2	60 ± 10	22	46
Asperity Height (ASTM D 7466)	21 ± 2	60 ± 10	22	46
Tensile (ASTM D 6693)	21 ± 2	n/a	22	46
Puncture Strength (ASTM D 4833)	21 ± 2	65 ± 5	22	46
Tear Resistance (ASTM D 1004)	23 ± 2	50 ± 10	22	46

The laboratory temperature and relative humidity measurement is an average over the period during which the conditioning and testing was carried out.

All samples have been conditioned for a minimum of 24 hours unless otherwise stated.

Note
ASTM D6693-2010, Page 2 Note 5 states — *A humidity requirement has intentionally been left out of the test conditions due to the fact that polyolefins are not significantly affected by large fluctuations in humidity thereby making such a restriction unnecessary.*

Tests were performed as directed in each individual standard, unless otherwise stated.

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GEOMEMBRANE TEST RESULTS

#REF!

Project: MQA

Material: 2mm Double Sided Textured Geomembrane

TRI Log No.: A16-281

Sample Identification: 3766 DS 2/3

PARAMETER	TEST REPLICATE NUMBER										MEAN		GRI GM13
	1	2	3	4	5	6	7	8	9	10			
Thickness (ASTM D 5994)													
Thickness (mm)	1.925	1.875	1.975	1.950	1.900	1.975	1.825	1.975	1.975	2.000	**1.950**		≥1.9
											1.825	<< min	≥1.7
Equipment used: AEI TG3.										**STD. DEV.**		**0.06**	
Sample dimensions: 125mm circle.										**CV.**		**3.0%**	
Asperity Height (ASTM D 7466)													
Asperity Height (mm) - Side A	0.850	0.550	0.575	0.525	0.725	0.625	0.775	0.600	0.800	0.575	**0.650**		≥0.4
										STD. DEV.		**0.12**	
										CV.		**18.0%**	
Asperity Height (mm) - Side B	0.400	0.350	0.500	0.625	0.550	0.275	0.475	0.400	0.375	0.400	**0.425**		≥0.4
										STD. DEV.		**0.10**	
Equipment used: AEI TG3.										**CV.**		**24.2%**	
Density (ASTM D 1505 @ 23°C)													
Density (g/cm^3)	0.949	0.949	0.949								**0.949**		≥0.94
Carbon Black Content (ASTM D 4218)													
% Carbon Black	2.11	2.06									**2.09**		2 - 3
Carbon Black Dispersion (ASTM D 5596, Method: Microtome)													
													≥ 90%
Rating* - 1st field view	1	1	1	1	1								1 - 2
Rating* - 2nd field view	1	1	1	1	1								≤ 10%
* PCN: 12-0455960-38 - Carbon dispersion classification chart for geosynthetics was used to rate agglomerate size range.													3

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Tensile Properties (ASTM D 6693)									Test speed: 50 mm/min				
MD Yield Strength (N/mm)	36.9	34.9	37.9	36.2	37.9						**36.8**		≥22
										STD. DEV.		**1.26**	
TD Yield Strength (N/mm)	36.9	38.1	38.4	37.1	37.9						**37.7**		≥22
										STD. DEV.		**0.65**	
MD Break Strength (N/mm)	54.2	49.4	53.8	61.8	61.1						**56.1**		≥29
										STD. DEV.		**5.27**	
TD Break Strength (N/mm)	46.5	53.1	50.8	44.1	41.9						**47.3**		≥29
										STD. DEV.		**4.63**	
MD Yield Elongation (%)	14	15	17	16	17						**16**		≥12
TD Yield Elongation (%)	16	16	16	14	16						**16**		≥12
MD Break Elongation (%)	632	607	620	714	703						**655**		≥100
TD Break Elongation (%)	585	644	608	558	519						**583**		≥100
Puncture Resistance (ASTM D 4833)													
Puncture Strength (N)	768	767	807	804	789	808	791	799	772	811	**792**		≥534
										STD. DEV.		**17.14**	
										CV.		**2.2%**	
Tear Resistance (ASTM D 1004)									Machine Used: AEI TM2-TRI 5-Station				
MD Tear Strength (N)	300	305	300	302	296	292	297	301	310	306	**301**		≥249
										STD. DEV.		**5.16**	
TD Tear Strength (N)	299	288	298	296	313	317	299	311	299	296	**301**		≥249
										STD. DEV.		**9.11**	
Oxidative Induction Time (ASTM D 3895)													
OIT (minutes)	232	239									**235.5**		≥100
High Pressure Oxidative Induction Time (ASTM D 5885)													
HPOIT (minutes)	1299										**1299**		≥400

MD Machine Direction TD Transverse Direction

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SP-NCTL Stress Crack Resistance (ASTM D 5397, App)

SURFACTANT: CO-630 DATE TEST STARTED: 6-Jan-17

EXPOSURE PERIOD: Failure TEST TEMPERATURE: 50°C

Machine direction yield stress: 17.8 (MPa) Mechanical Advantage 5

x 30% 5.34 (x 0.30) Lever Weight 1.469 (N)

x hinge thickness (mm) 1.626 (80% of thickness) Grip Weight 0.401 (N)

x specimen width 3.15 (3.18 mm)

Load 27.38 (N)

Applied load = (Load - Lever Weight + Grip Weight)/Mechanical Advantage = 5.26 N

= 537 grams

Replicate No.:	1	2	3	4	5		
No. Hours to Failure:	>1900	>1900	>1900	>1900	>1900	**>1900**	≥500

Oven Aging (ASTM D 5721)

The geomembrane was exposed to 90 days of elevated temperature exposure in an air oven maintained at 85°C ± 0.5°C in accordance with ASTM D 5721, Standard Practice for Air-Oven Aging of Polyolefin Geomembranes. Oxidative Induction Time (OIT) was tested after exposure and compared to values generated for unexposed material. The results are provided below.

			MEAN	PERCENT RETAINED
OIT (minutes) - Baseline	157	172	**164.5**	
OIT (minutes) - After Oven Aging	90	92	**91**	55
HPOIT (minutes) - Baseline	953		**953**	
HPOIT (minutes) - After Oven Aging	919		**919**	96

Note: No surface cracking was observed.

UV Resistance (ASTM D 7238)

The resistance to degradation due to exposure to ultraviolet light and moisture was determined in accordance with GRI-GM11, Accelerated Weathering of Geomembranes Using a Fluorescent UVA Device. This standard covers the basic principles for using the QUV apparatus to accelerate the weathering of geomembranes using UVA bulbs and condensation. To comply with specification GRI GM13, the sample was exposed to 1600 hours of UV exposure composed of 80 cycles of UVA at 75°C for 20 hours followed by condensation at 60°C for 4 hours. The High Pressure Oxidative Induction Time (HPOIT) was evaluated before and after the exposure and results were as follows.

		MEAN	PERCENT RETAINED
HPOIT (minutes) - Baseline	953	**953**	
HPOIT (minutes) - After QUV Aging	950	**950**	100

Note: No surface cracking was observed.

MD Machine Direction TD Transverse Direction

End of Report

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