



GEOMEMBRANE TEST RESULTS

TRI Client: Gecat Plastic Factory

Project: MQA

Material: 1.5mm Smooth 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

Thickness (ASTM D 5199)

Thickness (ASTM D 5994)

Asperity Height (ASTM D 7466)

Tensile (ASTM D 6693)

Puncture Strength (ASTM D 4833)

Tear Resistance (ASTM D 1004)

Standard		Laboratory	
t (°C)	RH (%)	t (°C)	RH (%)
21 ± 2	60 ± 10	22	46
21 ± 2	60 ± 10	22	46
21 ± 2	60 ± 10	22	46
21 ± 2	n/a	22	46
21 ± 2	65 ± 5	22	46
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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Sample Identification: 3766 S 1/3

PARAMETER											TEST REPLICATE NUMBER		MEAN	GRI GM13								
											1	2	3	4	5	6	7	8	9	10		
Thickness (ASTM D 5199, Procedure B)																						
Thickness (mm)											1.54	1.54	1.54	1.48	1.50	1.52	1.52	1.58	1.50	1.52	1.52	≥1.5
											1.48	<< min		≥1.35								
Equipment used: AEI TG2, 6.35mm foot diameter, 20 kPa pressure applied.											STD. DEV.		0.03									
Sample dimensions: 125mm circle.											CV.		1.9%									
Density (ASTM D 1505 @ 23°C)																						
Density (g/cm³)											0.949	0.949	0.949	0.949		≥0.94						
Carbon Black Content (ASTM D 4218)																						
% Carbon Black											2.07	2.01	2.04		2 - 3							
Carbon Black Dispersion (ASTM D 5596, Method: Microtome)																						
Rating* - 1st field view											1	1	1	1	1	≥ 90%						
Rating* - 2nd field view											1	1	1	1	1	1 - 2						
* PCN: 12-0455960-38 - Carbon dispersion classification chart for geosynthetics was used to rate agglomerate size range.													≤ 10%									
													3									
Tensile Properties (ASTM D 6693)														Test speed: 50 mm/min								
MD Yield Strength (N/mm)											26.3	26.1	26.4	26.5	25.7	26.2		≥22				
											STD. DEV.		0.32									
TD Yield Strength (N/mm)											29.9	29.8	30.8	31.0	30.4	30.4		≥22				
											STD. DEV.		0.53									
MD Break Strength (N/mm)											48.1	50.5	49.5	47.9	49.8	49.2		≥40				
											STD. DEV.		1.12									
TD Break Strength (N/mm)											47.4	51.7	53.0	47.8	51.6	50.3		≥40				
											STD. DEV.		2.53									
MD Yield Elongation (%)											16	15	16	14	15	15		≥12				
TD Yield Elongation (%)											13	14	15	14	14	14		≥12				
MD Break Elongation (%)											699	727	705	675	712	703		≥700				
TD Break Elongation (%)											687	738	738	672	731	713		≥700				
MD Machine Direction														TD Transverse Direction								



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											1	2	3	4	5	6	7	8	9	10		
Puncture Resistance (ASTM D 4833)																						
Puncture Strength (N)	672	675	666	667	670	668	657	671	661	642	665	≥480										
											STD. DEV.	9.62										
Tear Resistance (ASTM D 1004)														Machine Used: AEI TM2-TRI 5-Station								
MD Tear Strength (N)	225	225	227	227	227	226	220	226	222	222	225	≥187										
											STD. DEV.	2.48										
TD Tear Strength (N)	218	217	216	214	215	220	215	224	223	218	218	≥187										
											STD. DEV.	3.25										
Oxidative Induction Time (ASTM D 3895)																						
OIT (minutes)	181	184									182.5	≥100										
High Pressure Oxidative Induction Time (ASTM D 5885)																						
HPOIT (minutes)	1274										1274	≥400										



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											1	2	3	4	5	6	7	8	9	10											
SP-NCTL Stress Crack Resistance (ASTM D 5397, App)																															
SURFACTANT:		CO-630										DATE TEST STARTED: 8-Dec-16																			
EXPOSURE PERIOD:		Failure										TEST TEMPERATURE: 50°C																			
Machine direction yield stress:		20.0 (MPa)										Mechanical Advantage										5									
x 30%		6.00 (x 0.30)										Lever Weight										1.469 (N)									
x hinge thickness (mm)		1.219 (80% of thickness)										Grip Weight										0.401 (N)									
x specimen width		3.15 (3.18 mm)																													
Load		23.00 (N)																													
Applied load = (Load - Lever Weight + Grip Weight)/Mechanical Advantage = 4.39 N																															
= 447 grams																															
Replicate No.:		1 2 3 4 5																													
No. Hours to Failure:		>2600 >2600 >2600 >2600 >2600																				>2600	≥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.																															
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.																															
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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The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

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