

**GEOMEMBRANE TEST RESULTS****TRI Client: Gecat Plastic Factory****Project: MQA****Material: 1.5mm 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**

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.



GEOMEMBRANE TEST RESULTS

TRI Client: Gecat Plastic Factory

Project: MQA

Material: 1.5mm Double Sided Textured Geomembrane

TRI Log No.: A16-281

Sample Identification: 3766 DS 1/3

PARAMETER											TEST REPLICATE NUMBER	MEAN	GRI GM13										
											1	2	3	4	5	6	7	8	9	10			
Thickness (ASTM D 5994)																							
Thickness (mm)											1.500	1.575	1.550	1.500	1.475	1.350	1.475	1.400	1.475	1.475	<div>1.475</div> <div>1.350</div>	≥1.425 ≤ min ≥1.275	
Equipment used: AEI TG3.																					STD. DEV.	<div>0.07</div>	
Sample dimensions: 125mm circle.																					CV.	<div>4.8%</div>	
Asperity Height (ASTM D 7466)																							
Asperity Height (mm) - Side A											0.625	0.600	0.700	0.700	0.700	0.575	0.675	0.650	0.525	0.675	<div>0.650</div>	≥0.4	
																					STD. DEV.	<div>0.06</div>	
																					CV.	<div>9.3%</div>	
Asperity Height (mm) - Side B											0.450	0.375	0.425	0.350	0.350	0.300	0.375	0.425	0.375	0.500	<div>0.400</div>	≥0.4	
																					STD. DEV.	<div>0.06</div>	
Equipment used: AEI TG3.																					CV.	<div>14.4%</div>	
Density (ASTM D 1505 @ 23°C)																							
Density (g/cm³)											0.949	0.949	0.949								<div>0.949</div>	≥0.94	
Carbon Black Content (ASTM D 4218)																							
% Carbon Black											2.20	2.11								<div>2.16</div>	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	
																					≤ 10%		
* PCN: 12-0455960-38 - Carbon dispersion classification chart for geosynthetics was used to rate agglomerate size range.																					3		



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ACCREDITATION NO.: 19267

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PARAMETER	TEST REPLICATE NUMBER										MEAN	GRI GM13
	1	2	3	4	5	6	7	8	9	10		
Tensile Properties (ASTM D 6693)										Test speed: 50 mm/min		
MD Yield Strength (N/mm)	27.2	27.2	27.8	26.8	26.3						27.1	≥22
											STD. DEV.	0.55
TD Yield Strength (N/mm)	27.7	29.8	29.2	29.1	27.9						28.7	≥22
											STD. DEV.	0.90
MD Break Strength (N/mm)	44.5	40.6	43.0	41.3	39.2						41.7	≥16
											STD. DEV.	2.07
TD Break Strength (N/mm)	34.8	34.7	36.5	43.1	35.0						36.8	≥16
											STD. DEV.	3.59
MD Yield Elongation (%)	13	14	14	15	15						14	≥12
TD Yield Elongation (%)	13	14	15	14	14						14	≥12
MD Break Elongation (%)	668	617	646	640	610						636	≥100
TD Break Elongation (%)	561	553	581	669	580						589	≥100
Puncture Resistance (ASTM D 4833)												
Puncture Strength (N)	682	664	645	662	644	645	639	653	619	641	649	≥400
											STD. DEV.	17.06
											CV.	2.6%
Tear Resistance (ASTM D 1004)										Machine Used: AEI TM2-TRI 5-Station		
MD Tear Strength (N)	223	236	230	219	220	222	217	219	227	229	224	≥187
											STD. DEV.	6.02
TD Tear Strength (N)	218	219	218	223	223	220	219	224	225	227	222	≥187
											STD. DEV.	3.12
Oxidative Induction Time (ASTM D 3895)												
OIT (minutes)	181	185									183	≥100
High Pressure Oxidative Induction Time (ASTM D 5885)												
HPOIT (minutes)	1185										1185	≥400

MD Machine Direction

TD Transverse Direction



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PARAMETER											TEST REPLICATE NUMBER										MEAN	GRI GM13										
											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: 6-Jan-17																				
EXPOSURE PERIOD:		Failure										TEST TEMPERATURE: 50°C																				
Machine direction yield stress:		19.3 (MPa)										Mechanical Advantage										5										
x 30%		5.79 (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		22.22 (N)																														
Applied load = (Load - Lever Weight + Grip Weight)/Mechanical Advantage = 4.23 N																																
																				= 431 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.																																
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.																																
HPOIT (minutes) - Baseline		953																				953										
HPOIT (minutes) - After QUV Aging		950																				950	100									
Note: No surface cracking was observed.																																

End of Report

Page 5 of 5

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.

TRI AUSTRALASIA PTY LTD.

UNIT 12, 45 TOWNSHIP DRIVE - BURLEIGH HEADS, QLD 4220 - AUSTRALIA | PH: +61 (7) 5535 7227