GEOMEMBRANE TEST RESULTS
TRI Client: Al Takmol Company - Plastic Factory

Material: Al Takamol 1.0 mm Smooth HDPE Geomembrane
Sample Identification: Sample # NL , 1.0 mm
TRI Log #: E2402-45-01

PARAMETER	TEST REPLICATE NUMBER										MEAN	STD. DEV.	GRI GM 13 Spec.
	1	2	3	4	5	6	7	8	9	10			
Thickness (ASTM D 5199)													
Thickness (mm)	1.03	1.05	1.19	1.04	0.98	1.03	1.09	1.13	1.02	0.97	**1.05**	0.07	1.0 mm
											0.97	<< min	Lowest 0.90 mm
Density (ASTM D 1505)													
Density (g/cm3)	0.949	0.949	0.949								**0.949**	0.000	0.940 min
Carbon Black Content (ASTM D 4218)													
% Carbon Black	2.49	2.52									**2.51**	0.02	2.0 - 3.0
Carbon Black Dispersion (ASTM D 5596)													
Rating - 1st field view	1	1	1	1	1								9 in cat 1 or 2
Rating - 2nd field view	1	1	1	1	1								1 in cat 3
Tensile Properties (ASTM D 6693, 2 ipm strain rate)													
MD Yield Strength (N/mm)	18.7	19.1	20.7	18.4	19.3						**19.2**	0.9	15 min
TD Yield Strength (N/mm)	22.6	22.1	20.8	20.5	21.9						**21.6**	0.9	15 min
MD Break Strength (N/mm)	38.2	39.6	42.9	29.3	40.8						**38.2**	5.3	27 min
TD Break Strength (N/mm)	40.6	37.7	34.5	37.5	40.3						**38.1**	2.5	27 min
MD Yield Elongation (%)	18	19	17	17	17						**18**	1	12 min
TD Yield Elongation (%)	14	14	16	15	14						**15**	1	12 min
MD Break Elongation (%)	795	810	801	643	804						**771**	72	700 min
TD Break Elongation (%)	824	762	742	793	809						**786**	34	700 min
Puncture Resistance (ASTM D 4833)													
Puncture Strength (N)	507	481	476	463	463						**478**	18	320 min
Tear Resistance (ASTM D 1004)													
MD Tear Strength (N)	178	177	189	173	174	176	168	180	178	178	**177**	5	125 min
TD Tear Strength (N)	187	184	173	171	172	176	175	184	166	174	**176**	7	125 min
Oxidative Induction Time (ASTM D 3895)													
OIT (minutes)	147	147									**147**	0	100 min

MD Machine Direction TD Transverse Direction

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PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD. DEV.	GRI GM 13 Spec.
High Pressure Oxidative Induction Time (ASTM D 5885)													
HPOIT (minutes)	1787										**1787**		400 min

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

SURFACTANT:	CO-630
EXPOSURE PERIOD:	**500 hrs**
DATE TEST STARTED:	**17-Nov-15**
TEST TEMPERATURE:	50C

Machine direction yield stress:	**2431**	(psi)			
Yield stress:	**16.8**	(MPa)	Mechanical Advantage	5	
x 30%	729	(x 0.30)	Lever Weight	0.33	(lbs)
x hinge thickness (in)	**0.0320**	(80% of thickness)	Lever Weight	1.4685	(N)
x hinge thickness (mm)	**0.8128**	(80% of thickness)	Grip Weight	0.09	(lbs)
x specimen width	0.124	(0.124")	Grip Weight	0.4005	(N)
x specimen width	3.15	(3.18 mm)			
Load	2.89	(lbs)			
Load	12.88	(N)			

Applied load = (Load - Lever Weight + Grip Weight)/Mechanical Advantage = 0.53 lbs = 241 grams

Replicate No.:	1	2	3	4	5	MEAN	GRI GM 13 Spec.
No. Hours to Failure:	>500	>500	>500	>500	>500	**>500**	500 min

UV Resistance (ASTM D 7238 / GRI GM 13)

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 GM17, the sample was exposed to 1600 hours of UV exposure composed of 80 cycles of UA 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	1787	**1787**	
HPOIT (minutes) - After QUV Aging	1449	**1449**	81
			50 min

Note: No surface cracking was observed.

Oven Aging (ASTM D5721/GRI GM 13)

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 5721-95, Standard Practice for Air-Oven Aging of Polyolefin Geomembranes. Oxidation Induction Time (OIT and HPOIT) was tested for after exposure and compared to values generated for unexposed material. The results are provided below.

			MEAN	PERCENT
OIT (minutes) - Baseline	147	147	**147**	
OIT (minutes) - After Oven Aging	48	46	**47**	32
				55 min
HPOIT (minutes) - Baseline	1787		**1787**	
HPOIT (minutes) - After QUV Aging	1615		**1615**	90
				80 min

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