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

Material: Al Takamol 2.5 mm Textured HDPE Geomembrane
Sample Identification: NL - 2.5 mm
TRI Log #: E2402-44-10

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD. DEV.	PROJ. SPEC.
Thickness (ASTM D 5994)													
Thickness (mm)	2.421	2.332	2.352	2.332	2.431	2.428	2.316	2.383	2.383	2.385	**2.376** **2.316**	0.042 << min	2.375 mm 8 of 10 2.25 min Lowest 2.125
Asperity Height (ASTM D 7466)													
Asperity Height (mm) - Side A	0.48	0.46	0.48	0.36	0.28	0.48	0.36	0.48	0.48	0.41	**0.43**	0.07	0.40 min
Asperity Height (mm) - Side B	0.56	0.56	0.56	0.43	0.66	0.64	0.53	0.51	0.46	0.48	**0.54**	0.07	0.40 min
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	2.43	2.43									**2.43**	0.00	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)	43.8	43.3	42.6	43.6	42.7						**43.2**	0.5	37 min
TD Yield Strength (N/mm)	44.7	46.3	43.8	43.3	44.0						**44.4**	1.2	37 min
MD Break Strength (N/mm)	69.2	64.3	66.8	65.5	60.1						**65.2**	3.4	26 min
TD Break Strength (N/mm)	50.1	61.5	60.1	64.1	61.0						**59.4**	5.4	26 min
MD Yield Elongation (%)	17	17	18	18	16						**17**	1	12 min
TD Yield Elongation (%)	17	18	18	18	17						**18**	1	12 min
MD Break Elongation (%)	628	596	616	604	548						**598**	31	100 min
TD Break Elongation (%)	452	556	574	622	575						**556**	63	100 min
Puncture Resistance (ASTM D 4833)													
Puncture Strength (N)	921	921	899	903	886						**906**	15	667 min
Tear Resistance (ASTM D 1004)													
MD Tear Strength (N)	374	364	342	360	350	356	359	357	353	343	**356**	10	311 min
TD Tear Strength (N)	343	355	348	362	357	347	352	355	355	359	**353**	6	311 min
Oxidative Induction Time (ASTM D 3895)													
OIT (minutes)	160	159									**160**	1	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.	PROJ. SPEC.
High Pressure Oxidative Induction Time (ASTM D 5885)													
HPOIT (minutes)	1870										**1870**		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:	**2596**	(psi)			
Yield stress:	**17.9**	(MPa)	Mechanical Advantage	5	
x 30%	779	(x 0.30)	Lever Weight	0.33	(lbs)
x hinge thickness (in)	**0.0800**	(80% of thickness)	Lever Weight	1.4685	(N)
x hinge thickness (mm)	**2.0320**	(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	7.73	(lbs)			
Load	34.38	(N)			

Applied load = (Load - Lever Weight + Grip Weight)/Mechanical Advantage = 1.50 lbs = 680 grams

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

UV Resistance (ASTM D 7238 / GRI GM 11)

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	1870	**1870**	
HPOIT (minutes) - After QUV Aging	1521	**1521**	81
			50 min

Note: No surface cracking was observed.

Oven Aging (ASTM D5721)

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) was tested for after exposure and compared to values generated for unexposed material. The results are provided below.

			MEAN	PERCENT
OIT (minutes) - Baseline	160	159	**160**	
OIT (minutes) - After Oven Aging	30	33	**32**	20
				55 min
HPOIT (minutes) - Baseline	1870		**1870**	
HPOIT (minutes) - After QUV Aging	1759		**1759**	94
				50 min

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