

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

Material: Al Takmol 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			
<b>Thickness (ASTM D 5199)</b>													
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
<b>Density (ASTM D 1505)</b>													
Density (g/cm3)	0.949	0.949	0.949								0.949	0.000	0.940 min
<b>Carbon Black Content (ASTM D 4218)</b>													
% Carbon Black	2.49	2.52									2.51	0.02	2.0 - 3.0
<b>Carbon Black Dispersion (ASTM D 5596)</b>													
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
<b>Tensile Properties (ASTM D 6693, 2 lpm strain rate)</b>													
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
<b>Puncture Resistance (ASTM D 4833)</b>													
Puncture Strength (N)	507	481	476	463	463						478	18	320 min
<b>Tear Resistance (ASTM D 1004)</b>													
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
<b>Oxidative Induction Time (ASTM D 3895)</b>													
OIT (minutes)	147	147									147	0	100 min

MD Machine Direction      TD Transverse Direction

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	1	2	3	4	5	6	7	8	9	10			
<b>High Pressure Oxidative Induction Time (ASTM D 5885)</b>													
HPOIT (minutes)	1787										1787		400 min
<b>SP-NCTL Stress Crack Resistance (ASTM D 5397, App)</b>													
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)											
x 30%	729	(x 0.30)											
x hinge thickness (in)	0.0320	(80% of thickness)											
x hinge thickness (mm)	0.8128	(80% of thickness)											
x specimen width	0.124	(0.124")											
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								
No. Hours to Failure:	>500	>500	>500	>500	>500						>500		500 min
<b>UV Resistance (ASTM D 7238 / GRI GM 13)</b>													
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.													
HPOIT (minutes) - Baseline	1787										1787		
HPOIT (minutes) - After QUV Aging	1449										1449		
Note: No surface cracking was observed.												81	50 min
<b>Oven Aging (ASTM D 5721/GRI GM 13)</b>													
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.													
OIT (minutes) - Baseline	147	147									147		
OIT (minutes) - After Oven Aging	48	46									47		
HPOIT (minutes) - Baseline	1787										1787		
HPOIT (minutes) - After QUV Aging	1615										1615		
												32	55 min
												90	80 min