



# GEOMEMBRANES PRODUCT DATA

Photograph courtesy Owens Corning

## FOR MORE INFORMATION

*Geosynthetics* magazine has provided information on the geomembrane specification charts for comparative purposes only. Designers should contact manufacturers for additional details and to discuss site-specific considerations.

Information on the use and specification of geomembranes is also available from the Geosynthetic Materials Association (GMA).

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## PUBLISHER'S NOTE

*Geosynthetics* magazine compiled all information included in the 2023 *Geosynthetics Specifier's Guide* from information submitted by firms in the geosynthetics industry. Companies provided specifications voluntarily, and specification accuracy is the responsibility of the manufacturer. The appearance of a listing in this directory is not an endorsement of the company or product by *Geosynthetics* magazine or the Advanced Textiles Association (ATA). The 2023 *Geosynthetics Specifier's Guide* is intended as a guide, and *Geosynthetics* magazine and ATA encourage readers to contact the companies listed for further information.

Manufacturers engineer these products to provide cost-effective solutions and to meet specific design requirements in fluid barrier, containment and other geotechnical applications.

Geomembranes have been used since the 1950s, and their use has steadily increased as a result of water resource concerns. It is now common to find local and state regulations calling for infrastructure designs that use geomembranes for containment, lining and capping. Whether for potable water or animal waste, these materials have become central to project acceptance and success.

Geomembranes are available in a variety of physical, mechanical and chemical resistance properties designed to meet the requirements of a wide range of applications. For example, the products can be compounded for exposure to ultraviolet light, ozone and microorganisms in soil. Different combinations of these properties exist in various geosynthetic lining materials to cover a wide spectrum of geotechnical applications and designs.

Manufacturers use several methods to bond the geosynthetic lining materials in the factory and in the field. Each material has highly developed quality control techniques that govern its manufacture and installation.

## The numbers

Companies that submitted product data chart lines were asked to provide data determined through industry-accepted testing methods. Companies were asked to sign a certificate of compliance verifying the accuracy of this data.

Product Name	Base Polymer [1]	Dimensional Properties				Tensile Properties ASTM D6693			Puncture Resistance ASTM D4833 kN (lb)	Tear Resistance ASTM D1004 kN (lb)	Low Temperature Brittleness ASTM D746 °C (°F) [3]	Carbon Black Content ASTM D1603 (%)	Carbon Black Dispersion ASTM D5596 [4]	Manufacturer's Suggested Applications [5]
		Roll Width/Length m (ft)	[2] Thickness ASTM 5199 mm (mils)	[2] Thickness ASTM D5994 mm (mils)	Density ASTM D1505 (g/cm <sup>3</sup> ) <sub>s</sub>	Strength Yield kN/m (lb/in)	Strength Break kN/m (lb/in)	Elongation Yield/Break %						
<b>AGRU America Inc.</b>   www.agruamerica.com														
Agru Drain Liner®	LLDPE Structured	7.0/152.4 (23/500')	NA	1.5 (60)	0.939 max.	NA	22 (126)	NA/300	0.31 (70)	0.18 (40)	-60 (-83)	2-3	Cat 1/2	CL, SIL, LL, LC, LPL, DL
Agru Grip Liner®	LLDPE Structured	7.0/152.4 (23/500')	NA	1.5 (60)	0.939 max.	NA	22 (126)	NA/300	0.31 (70)	0.18 (40)	-60 (-83)	2-3	Cat 1/2	CL, SIL, LL, LC, LPL, DL
Agru Microspike® Liner	LLDPE-T	7.0/283.57 (23/710')	NA	1.0 (40)	0.939 max.	NA	20 (112)	NA/400	0.22 (50)	0.11 (25)	-60 (-83)	2-3	Cat 1/2	CL, LC, TL, LPL, DL
Agru Microspike® Liner	LLDPE-T	7.0/216.4 (23/505')	NA	1.5 (60)	0.939 max.	NA	29 (168)	NA/400	0.31 (70)	0.16 (36)	-60 (-83)	2-3	Cat 1/2	CL, LC, TL, LPL, DL
Agru Microspike® Liner	LLDPE-T	7.0/117.4 (23/385')	NA	2.0 (80)	0.939 max.	NA	39 (224)	NA/400	0.40 (90)	0.22 (50)	-60 (-83)	2-3	Cat 1/2	CL, LC, TL, LPL, DL
Agru Smooth® Liner	LLDPE-S	7.0/254.5 (23/835')	1.0 (40)	NA	0.939 max.	NA	28 (160)	NA/800	0.26 (60)	0.11 (25)	-60 (-83)	2-3	Cat 1/2	CL, LC, TL, LPL, DL
Agru Smooth® Liner	LLDPE-S	7.0/164.6 (23/540')	1.5 (60)	NA	0.939 max.	NA	42 (240)	NA/800	0.40 (90)	0.16 (37)	-60 (-83)	2-3	Cat 1/2	CL, LC, TL, LPL, DL
Agru Smooth® Liner	LLDPE-S	7.0/126.5 (23/415')	2.0 (80)	NA	0.939 max.	NA	56 (320)	NA/800	0.53 (120)	0.21 (48)	-60 (-83)	2-3	Cat 1/2	CL, LC, TL, LPL, DL
Agru Super Gripnet® Liner	LLDPE Structured	7.0/152.4 (23/500')	NA	1.5 (60)	0.939 max.	NA	22 (126)	NA/300	0.31 (70)	0.18 (40)	-60 (-83)	2-3	Cat 1/2	CL, SIL, LL, LC, LPL, DL
ClosureTurf®	LLDPE O/C Structured -Turf	7.0/152.4 (23/500')	NA	1.5 (60)	0.939 max.	NA	22 (126)	NA/300	0.31 (70)	0.18 (40)	-60 (-83)	2-3	Cat 1/2	CL, SIL, LL, LC, LPL, DL
<b>Atarfil S.L.</b>   www.atarfil.com														
GMB LLD smooth	LLDPE-S	width: 6.0 (19.7) / 6.3 (20.6) / 7.5 (24.6) length: 70 (229) to 280 (918)	0.75 to 3.00 mm (30 to 120 mils)	NA	< 0.940	NA	21 (119)	800	0.23 (51)	0.07 (16)	-75	2-2.5	1-2	CL, SIL, DP, RP
GMB TM/TMT® LLD asperity 0.75mm / 30mils	LLDPE CX-T	width: 6.0 (19.7) length: 90 (295) to 263 (864)	NA	1.00 to 4.0 mm (20 to 160 mils)	< 0.940	NA	12 (68)	≥300	0.26 (60)	0.10 (24)	-75	2-2.5	1-2	LC
GMB TM/TMT® LLD asperity 0.45mm / 20 mils	LLDPE CX-T	width: 6.0 (19.7) / 6.3 (20.6) / 7.5 (24.6) length: 90 (295) to 200m	NA	1.00 to 4.0 mm (20 to 160 mils)	< 0.940	NA	13 (73)	≥400	0.24 (54)	0.1 (22.5)	-75	2-2.5	1-2	LC
†Product can be manufactured with single (TM) or double (TMT) structured textured All Atarfil LLD geomembranes are available in different colors as there are conductive versions for all of them.														

- [1] CX = Coextruded
- CX-T = Coextruded, textured
- EIA = Ethylene interpolymmer alloy
- EPDM = Ethylene propylene diene monomer
- FP = Flexible polypropylene
- LLDPE = Linear low density polyethylene
- LLDPE-T = Linear low density polyethylene, textured
- O/C = Other or combination
- TPO = Thermoplastic polyolefin
- T = Textured
- S = Smooth

- [2] ASTM D 5199: Nominal thickness of geosynthetic
- ASTM D 5994: Core thickness of textured geomembrane
- [3] No failures at this temperature.
- [4] Carbon black dispersion for 10 different views:
  - minimum of 9 of 10 in categories 1 or 2
  - all 10 in categories 1, 2, or 3

- [5] CL = Canal liner
- LPL = Leach pad liner
- LC = Landfill cover
- TL = Tunnel liner
- RP = Reserve pit
- DL = Dam liner
- SIC = Surface impoundment cover
- LL = Landfill liner
- DP = Decorative pond
- SIL = Surface impoundment liner
- SC = Secondary Containment
- NP = Not provided by manufacturer
- NA = Not applicable, per manufacturer

« Geosynthetics recommends you contact the manufacturers before making any specifying/purchasing decisions »

Product Name	Base Polymer [1]	Dimensional Properties			Density ASTM D1505 (g/cm <sup>3</sup> )s	Tensile Properties ASTM D6693			Puncture Resistance ASTM D4833 kN (lb)	Tear Resistance ASTM D1004 kN (lb)	Low Temperature Brittleness ASTM D746 °C (°F) [3]	Carbon Black Content ASTM D1603 (%)	Carbon Black Dispersion ASTM D5596 [4]	Manufacturer's Suggested Applications [5]
		Roll Width/Length m (ft)	[2] Thickness ASTM 5199 mm (mils)	[2] Thickness ASTM D5994 mm (mils)		Strength Yield kN/m (lb/in)	Strength Break kN/m (lb/in)	Elongation Yield/Break %						

**E Squared Technical Textiles** | www.e2techtexiles.com

<b>E Squared Xtrm Ply rLLDPE Smooth</b>	LLDPE	120" x 500 yards	30°, 36, 45 & 60 Mil				220°	22°	80°	70°	-25	3°		SIL, SIC, SR, SC, LC, TL
<b>E Squared Xtrm Ply rLLDPE Textured</b>	LLDPE	120" x 500 yards	30, 36°, 45 & 60 Mil				240°	22°	90°	80°	-25	3°		SIL, SIC, SR, SC, LC, TL

◇ Data listed is min. value for 30 mil products  
 ◇◇ Data listed is min. value for 36 mil products

**HUITEX** | www.huitex.com

<b>HUITEX Both OIT Series</b>	LLDPE CX	7 (23) 76 (249) ~ 420 (1378)	0.50 (20) ~ 2.50 (100)	0.50 (20) ~ 2.50 (100)	<0.939	NA	9 (52) ~ 66 (378)	NA/250 ~ 800	0.120 (26) ~ 0.620 (136)	0.050 (11) ~ 0.250 (55)		2.0~3.0	cat.1/2	all
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**Layfield Environmental Containment** | www.layfieldgroup.com

<b>Enviro Liner 6040</b>	O/C	6.8/305 (22.5/1000)	1.0 (40)	NA	≤ 0.939	NA	31 (180)	800%	0.298 (67)	NA	-70 (-90)	≥2.0	Pass	all
<b>Enviro Liner 6060</b>	O/C	6.8/158 (22.5/520)	1.50 (60)	NA	≤ 0.939	NA	44 (255)	800%	0.40 (90)	NA	-70 (-90)	≥2.0	Pass	all
<b>Geoflex 60</b>	O/C	6.8/122 (22.5/400)	1.50 (60)	NA	≤ 0.939	NA	53 (275)	800%	0.48 (94)	NA	-70 (-90)	≥2.0	Pass	all
<b>Enviro Liner 6060 Textured</b>	O/C	6.8/134 (22.5/440)	1.50 (60)	1.45 (57)	≤ 0.939	NA	20 (114)	350%	0.355 (80)	0.147 (33)	-70 (-90)	≥2.00	Pass	all
<b>HAZGARD 635FR</b>	O/C	3.14/305 (10.3/1000)	0.88 (35)	NA	NA	NA	22.8 (130)	700%	0.218 (49)	NA	-70 (-90)	Red	NA	SC (Secondary Containment)

**SKAPS Industries** | www.skaps.com

<b>SKAPS LLD - 40 Textured</b>	LLDPE	7.16 x 219.45 (23.5 x 720')	1.00 (40 mils)	1.00 (40 mils)	0.939 max	NA	11 (60)	NA/250	200 (44)	100 (22)	NP	2.0 - 3.0	9 to 10 in categories 1 or 2, max 1 in category 3	LC, TL, RP, SIC, DP
<b>SKAPS LLD - 60 Textured</b>	LLDPE	7.16 x 155.44 (23.5 x 510')	1.50 (60 mils)	1.50 (60 mils)	0.939 max	NA	16 (90)	NA/250	300 (66)	150 (33)	NP	2.0 - 3.0	9 to 10 in categories 1 or 2, max 1 in category 3	LC, TL, SIC, DP

**Solmax International Inc.** | www.solmax.com

<b>Solmax LLDPE Conductive Smooth White</b>	LLDPE-CX-S	6.86/170.7 (22.5/560)	1.5 (60)	NA	0.939	NA	44 (252)	800	0.415 (93)	0.150 (34)	<-77 (-106)	2-3	1, 2	all
<b>Solmax LLDPE Conductive Textured White</b>	LLDPE-CX-T	6.71/164.6 (22/540)	NA	1.5 (60)	0.939	NA	23 (132)	400	0.375 (84)	0.165 (37)	<-77 (-106)	2-3	1, 2	all
<b>Solmax High-Performance LL Series Smooth</b>	LLDPE-CX-S	6.86/171 (22.3/560)	1.5 (60)	NA	0.939	NA	42 (240)	900	0.444 (100)	0.150 (33)	<-77 (-106)	2-3	1, 2	all

Note: All of Solmax Geomembranes are available in a variety of thicknesses, smooth or textured, and with black, white or green surface layers.  
 Note: Textured geomembranes are available in high asperity.

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Product Name	Base Polymer [1]	Dimensional Properties		Density ASTM D1505/D792 (min.) (g/cm <sup>3</sup> min.)	Tensile Properties ASTM D 6693 [3]				Puncture Resistance D4833 (min. avg.) kN (lb)	Tear Resistance ASTM D 1004 (min. avg.) kN (lb)	Carbon Black Content: ASTM D 1603 range (%) [4]	Carbon Black Dispersion ASTM D 5596 [5]	Stress Crack Resistance ASTM D 5397 Appendix [6]	Oxidative Induction Time (OIT) (min. avg.) [7]		Oven Aging at 85°C ASTM D 5721 [7], [8]		UV Resistance GM 11 [9]	Manufacturer's Suggested Applications [11]
		Roll Width/Length m (ft)	Thickness ASTM D5199 (smooth) ASTM D5994 (textured) min. avg. mm (mils) [2]		Strength		Elongation							Standard OIT	High Pressure OIT				
					Yield Stress kN/m (lb/in)	Break Stress kN/m (lb/in)	Yield Elongation %	Break Elongation %								ASTM D3895 % retained after 90 days	ASTM D5885 % retained after 90 days		
<b>Agru Drain Liner®</b>	HDPE Structured	7.0/152.4 (23/500)	1.5 (60)	0.94	23 (132)	23 (132)	13	300	0.42 (95)	0.18 (40)	2-3	Cat 1/2	1000	160	800	55	80	80	CL, SIL, LL, LC, LPL, DL
<b>Agru Grip Liner®</b>	HDPE Structured	7.0/152.4 (23/500)	1.5 (60)	0.94	23 (132)	23 (132)	13	300	0.42 (95)	0.18 (40)	2-3	Cat 1/2	1000	160	800	55	80	80	CL, SIL, LL, LC, LPL, DL
<b>Agru Smooth® Liner</b>	HDPE-S	7.0/317 (23/835)	1.0 (40)	0.94	15 (88)	28 (160)	13	700	0.36 (80)	0.13 (30)	2-3	Cat 1/2	1000	160	800	55	80	80	CL, SIL, SIC, LL, LC, LPL, TL, DL, DP
<b>Agru Smooth® Liner</b>	HDPE-S	7.0/164.6 (23/540)	1.5 (60)	0.94	23 (132)	42 (240)	13	700	0.53 (120)	0.20 (45)	2-3	Cat 1/2	1000	160	800	55	80	80	CL, SIL, SIC, LL, LC, LPL, TL, DL, DP
<b>Agru Smooth® Liner</b>	HDPE-S	7.0/102.1 (23/415)	2.0 (80)	0.94	31 (176)	56 (320)	13	700	0.71 (160)	0.27 (60)	2-3	Cat 1/2	1000	160	800	55	80	80	CL, SIL, SIC, LL, LC, LPL, TL, DL, DP
<b>Agru Micro Spike® Liner</b>	HDPE-T	7.0/253.4 (23/710)	1.0 (40)	0.94	15 (88)	15 (88)	13	350	0.40 (90)	0.13 (30)	2-3	Cat 1/2	1000	160	800	55	80	80	CL, SIL, SIC, LL, LC, LPL, TL, DL, DP
<b>Agru Micro Spike® Liner</b>	HDPE-T	7.0/216.4 (23/505)	1.5 (60)	0.94	23 (132)	23 (132)	13	350	0.53 (120)	0.20 (45)	2-3	Cat 1/2	1000	160	800	55	80	80	CL, SIL, SIC, LL, LC, LPL, TL, DL, DP
<b>Agru Micro Spike® Liner</b>	HDPE-T	7.0/117.4 (23/385)	20 (80)	0.94	31 (176)	31 (176)	13	350	0.66 (150)	0.27 (60)	2-3	Cat 1/2	1000	160	800	55	80	80	CL, SIL, SIC, LL, LC, LPL, TL, DL, DP
<b>Agru Super Gripnet® Liner</b>	HDPE Structured	7.0/152.4 (23/500)	1.50 (60)	0.94	23 (132)	23 (132)	13	200	0.40 (90)	0.18 (40)	2-3	Cat 1/2	1000	160	800	55	80	80	CL, SIL, LL, LC, LPL, DL

AGRU America Inc. | www.agruamerica.com

[1] HDPE = High density polyethylene  
CX = Coextruded  
[2] Lowest individual of 10 values  
[3] Machine direction (MD) and cross machine direction (XD) average values should be on the basis of 5 test specimens each direction  
• Yield elongation calculated with a gage length of 33mm  
• Break elongation calculated with a gage length of 50mm  
[4] Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

[5] Carbon black dispersion for 10 different views:  
• minimum 9 of 10 in Categories 1 or 2  
• all 10 in Categories 1, 2, or 3  
[6] The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.  
[7] The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.  
[8] It also is recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

[9] The condition of the test should be 20 hr. UV cycle at 75 C followed by 4 hr. condensation at 60 C.  
[10] UV resistance is based on percent retained value regardless of the original HP-OIT value.  
[11] CL = Canal liner  
SIL = Surface impoundment liner  
SIC = Surface impoundment cover  
LL = Landfill liner  
DP = Decorative pond  
NP = Not provided by manufacturer  
NA = Not applicable, per manufacturer  
DL = Dam liner  
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Product Name	Base Polymer [1]	Dimensional Properties			Density ASTM D1505/D792 (min.) (g/cm <sup>3</sup> min.)	Tensile Properties ASTM D 6693 [3]				Puncture Resistance D 4833 (min. avg.) kN (lb)	Tear Resistance ASTM D 1004 (min. avg.) kN (lb)	Carbon Black Content ASTM D 1603 range (%) [4]	Carbon Black Dispersion ASTM D 5596 [5]	Stress Crack Resistance ASTM D 5397 Appendix [6]	Oxidative Induction Time (OIT) (min. avg.) [7]		Oven Aging at 85°C ASTM D 5721 [7], [8]		UV Resistance GM 11 [9]	Manufacturer's Suggested Applications [11]
		Roll Width/Length m (ft)	Thickness ASTM D5199 (smooth) ASTM D5994 (textured) min. avg. mm (mils) [2]	Strength		Elongation		Standard OIT ASTM D 3895	High Pressure OIT ASTM D 5885						ASTM D3895 % retained after 90 days	ASTM D5885 % retained after 90 days	High Pressure OIT (min. age.) % retained after 1600 hrs [10]			
				Yield Stress kN/m (lb/in)		Break Stress kN/m (lb/in)	Yield Elongation %											Break Elongation %		

Atarfil S.L. | www.atarfil.com

GMB HD smooth	HDPE CX-S	W: 6.0 / 6.3 / 7.5 (19.7 / 20.6 / 24.6) L: 202 (663)	1.5 (60)	≥ 0.942	22 (126)	40 (228)	> 13	≥ 700	0.490 (110)	0.187 (42)	2-2.5	1.2	≥ 3000 <sup>◊</sup>	120	500	55	80	75	All
GMB HD smooth	HDPE CX-S	W: 6.0 / 6.3 / 7.5 (19.7 / 20.6 / 24.6) L: 152 (498)	2.0 (80)	≥ 0.942	29 (168)	53 (304)	> 13	≥ 700	0.640 (144)	0.249 (56)	2-2.5	1.2	≥ 3000 <sup>◊</sup>	120	500	55	80	75	All
GMB TMT HD <sup>◊◊</sup> (asperity height 0.75mm / 30mil)	HDPE CX-T	W: 6.0 (19.7) L: 150 (495)	1.5 (60)	≥ 0.942	22 (126)	15 (90)	> 13	≥ 100	0.409 (92)	0.187 (42)	2-2.5	1.2	≥ 3000 <sup>◊</sup>	120	500	55	80	75	All
GMB TMT HD <sup>◊◊</sup> (asperity height 0.75mm / 30mil)	HDPE CX-T	W: 6.0 (19.7) L: 131 (432)	2.0 (80)	≥ 0.942	29 (168)	21 (120)	> 13	≥ 100	0.556 (125)	0.249 (56)	2-2.5	1.2	≥ 3000 <sup>◊</sup>	120	500	55	80	75	All
GMB TMT HD <sup>◊◊</sup> (asperity height 0.45mm / 20mil)	HDPE CX-T	W: 6.0 / 6.3 / 7.5 (19.7 / 20.6 / 24.6) L: 100 (328)	1.5 (60)	≥ 0.942	22 (126)	22 (125)	> 13	≥ 400	0.450 (101)	0.187 (42)	2-2.5	1.2	≥ 3000 <sup>◊</sup>	120	500	55	80	75	All
GMB TMT HD <sup>◊◊</sup> (asperity height 0.45mm / 20mil)	HDPE CX-T	W: 6.0 / 6.3 / 7.5 (19.7 / 20.6 / 24.6) L: 80 (262)	2.0 (80)	≥ 0.942	29 (168)	30 (171)	> 13	≥ 400	0.570 (128)	0.249 (56)	2-2.5	1.2	≥ 3000 <sup>◊</sup>	120	500	55	80	75	All
GMB HD EVO smooth	HDPE CX-S	W: 6.0 / 6.3 / 7.5 (19.7 / 20.6 / 24.6) L: 202 (663)	1.5 (60)	≥ 0.942	22 (126)	40 (228)	> 13	≥ 700	0.490 (110)	0.187 (42)	2-2.5	1.2	≥ 3000 <sup>◊</sup>	120	500	55 <sup>◊◊◊</sup>	80 <sup>◊◊◊</sup>	75	High demanding applications
GMB HD EVO smooth	HDPE CX-S	W: 6.0 / 6.3 / 7.5 (19.7 / 20.6 / 24.6) L: 152 (498)	2.0 (80)	≥ 0.942	29 (168)	53 (304)	> 13	≥ 700	0.640 (144)	0.249 (56)	2-2.5	1.2	≥ 3000 <sup>◊</sup>	120	500	55 <sup>◊◊◊</sup>	80 <sup>◊◊◊</sup>	75	High demanding applications
GMB TMT HD EVO <sup>◊◊</sup> (asperity height 0.7mm / 30mil)	HDPE CX-T	W: 6.0 (19.7) L: 150 (495)	1.5 (60)	≥ 0.942	22 (126)	15 (90)	> 13	≥ 300	0.409 (92)	0.187 (42)	2-2.5	1.2	≥ 3000 <sup>◊</sup>	120	500	55 <sup>◊◊◊</sup>	80 <sup>◊◊◊</sup>	75	High demanding applications

◊ Additional information regarding correlation between Test Methods ISO 18488 (Strain hardening) and ASTM D 5397 (Stress Crack Resistance) available upon request. Test conducted on representative smooth membrane samples.  
 ◊◊ Product can be manufactured with single (TM) or double (TMT) structured textured.  
 ◊◊◊ Product retained both Standard OIT (55%) and HP OIT (80%) after 90 days Oven Aging at 80 C ASTM D 5721  
 All Atarfil geomembranes are available in different thicknesses (from 0.75 to 4.00mm) and colors. Also an electrically conductive layer can be added upon request.

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- [2] Lowest individual of 10 values
- [3] Machine direction (MD) and cross machine direction (XD) average values should be on the basis of 5 test specimens each direction  
• Yield elongation calculated with a gage length of 33mm  
• Break elongation calculated with a gage length of 50mm
- [4] Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
- [5] Carbon black dispersion for 10 different views:  
• minimum 9 of 10 in Categories 1 or 2  
• all 10 in Categories 1, 2, or 3
- [6] The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
- [7] The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
- [8] It also is recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
- [9] The condition of the test should be 20 hr. UV cycle at 75 C followed by 4 hr. condensation at 60 C.
- [10] UV resistance is based on percent retained value regardless of the original HP-OIT value.
- [11] CL = Canal liner DL = Dam liner  
SIL = Surface impoundment liner LPL = Leach pad liner  
SIC = Surface impoundment cover LC = Landfill cover  
LL = Landfill liner TL = Tunnel liner  
DP = Decorative pond NP = Not provided by manufacturer  
NA = Not applicable, per manufacturer

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Product Name	Base Polymer [1]	Dimensional Properties		Density ASTM D1505/D792 (min.) (g/cm <sup>3</sup> min.)	Tensile Properties ASTM D 6693 [3]				Puncture Resistance D 4833 (min. avg.) kN (lb)	Tear Resistance ASTM D 1004 (min. avg.) kN (lb)	Carbon Black Content: ASTM D 1603 range (%) [4]	Carbon Black Dispersion ASTM D 5596 [5]	Stress Crack Resistance ASTM D 5397 Appendix [6]	Oxidative Induction Time (OIT) (min. avg.) [7]		Oven Aging at 85°C ASTM D 5721 [7], [8]		UV Resistance GM 11 [9]	Manufacturer's Suggested Applications [11]
		Roll Width/Length m (ft)	Thickness ASTM D5199 (smooth) ASTM D5994 (textured) min. avg. mm (mils) [2]		Strength		Elongation							Standard OIT	High Pressure OIT				
					Yield Stress kN/m (lb/in)	Break Stress kN/m (lb/in)	Yield Elongation %	Break Elongation %								ASTM D3895 % retained after 90 days	ASTM D5885 % retained after 90 days		

Atarfil S.L. | www.atarfil.com

<b>GBM TMT HD EVO<sup>♦♦</sup></b> (asperity height 0.7mm / 30mils)	HDPE CX-T	"W:6.0 (19.7) / L:131 (432)"	2.0 (80)	≥ 0.942	29 (168)	21 (120)	> 13	≥ 300	0.556 (125)	0.249 (56)	2-2.5	1, 2	≥3000 <sup>♦</sup>	120	500	55 <sup>♦♦♦</sup>	80 <sup>♦♦♦</sup>	75	High demanding applications
<b>GMB TMT HD EVO<sup>♦♦</sup></b> (asperity height 0.5mm / 20mils)	HDPE CX-T	"W:6.0 / 6.3 / 7.5 (19.7 / 20.6 / 24.6) / L:100 (328)"	1.5 (60)	≥ 0.942	22 (126)	22 (125)	> 13	≥ 400	0.450 (101)	0.187 (42)	2-2.5	1, 2	≥3000 <sup>♦</sup>	120	500	55 <sup>♦♦♦</sup>	80 <sup>♦♦♦</sup>	75	High demanding applications
<b>GMB TMT HD EVO<sup>♦♦</sup></b> (asperity height 0.5mm / 20mils)	HDPE CX-T	"W:6.0 / 6.3 / 7.5 (19.7 / 20.6 / 24.6) / L:80 (262)"	2.0 (80)	≥ 0.942	29 (168)	30 (171)	> 13	≥ 400	0.570 (128)	0.249 (56)	2-2.5	1, 2	≥3000 <sup>♦</sup>	120	500	55 <sup>♦♦♦</sup>	80 <sup>♦♦♦</sup>	75	High demanding applications

♦Additional information regarding correlation between Test Methods ISO 18488 (Strain hardening) and ASTM D 5397 (Stress Crack Resistance) available upon request. Test conducted on representative smooth membrane samples.  
 ♦♦Product can be manufactured with single (TM) or double (TMT) structured textured.  
 ♦♦♦Product retained both Standard OIT (55%) and HP OIT (80%) after 90 days Oven Aging at 80 C ASTM D 5721  
 All Atarfil geomembranes are available in different thicknesses (from 0.75 to 4.00mm) and colors. Also an electrically conductive layer can be added upon request.

HUITEX | www.huitex.com

<b>HUITEX Both OIT Series</b>	HDPE CX	7 (23) ~ 8 (26) / 70 (230) ~ 420 (1378)	0.50 (20) ~ 3.00 (120)	0.940	7 (40) ~ 44 (252)	13 (74) ~ 80 (458)	12	100 ~ 700	0.16 (35) ~ 0.96 (211)	0.06 (14) ~ 0.37 (81)	2.0 ~ 3.0	cat.1/2	500	100	400	55	80	50	all
<b>HUITEX Colored Series</b>	HDPE CX	7 (23) ~ 8 (26) / 70 (230) ~ 420 (1378)	0.50 (20) ~ 3.00 (120)	0.940 (black layer)	7 (40) ~ 44 (252)	13 (74) ~ 80 (458)	12	100 ~ 700	0.16 (35) ~ 0.96 (211)	0.06 (14) ~ 0.37 (81)	2.0 ~ 3.0 black layer	cat.1/2 black layer	500	100 black layer	400 black layer	55 black layer	80 black layer	50 black layer	all
<b>HUITEX K-Linear CPL series</b>	HDPE	2.5 (8.21) ~ 3.0 (9.75) / 60 (197) ~ 70 (230)	2.00 (80) ~ 5.00 (200)	0.940	30 (172) ~ 75 (430)	50 (287) ~ 125 (716)	12	500	0.640 (141) ~ 1.60 (352)	0.25 (55) ~ 0.63 (138)	2.0 ~ 3.0	cat.1/2	500	100	400	NA	NA	NA	Concrete Protection

- [1] HDPE = High density polyethylene T = Textured  
CX = Coextruded S = Smooth
- [2] Lowest individual of 10 values
- [3] Machine direction (MD) and cross machine direction (XD) average values should be on the basis of 5 test specimens each direction  
• Yield elongation calculated with a gage length of 33mm  
• Break elongation calculated with a gage length of 50mm
- [4] Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

- [5] Carbon black dispersion for 10 different views:  
• minimum 9 of 10 in Categories 1 or 2  
• all 10 in Categories 1, 2, or 3
- [6] The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
- [7] The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
- [8] It also is recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

- [9] The condition of the test should be 20 hr. UV cycle at 75 C followed by 4 hr. condensation at 60 C.
- [10] UV resistance is based on percent retained value regardless of the original HP-OIT value.
- [11] CL = Canal liner DL = Dam liner  
SIL = Surface impoundment liner LPL = Leach pad liner  
SIC = Surface impoundment cover LC = Landfill cover  
LL = Landfill liner TL = Tunnel liner  
DP = Decorative pond RP = Reserve pit  
NP = Not provided by manufacturer  
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Product Name	Base Polymer [1]	Dimensional Properties		Density ASTM D1505/D792 (min.) (g/cm <sup>3</sup> min.)	Tensile Properties ASTM D 6693 [3]				Puncture Resistance D 4833 (min. avg.) kN (lb)	Tear Resistance ASTM D 1004 (min. avg.) kN (lb)	Carbon Black Content ASTM D 1603 range (%) [4]	Carbon Black Dispersion ASTM D 5596 [5]	Stress Crack Resistance ASTM D 5397 Appendix [6]	Oxidative Induction Time (OIT) (min. avg.) [7]		Oven Aging at 85°C ASTM D 5721 [7], [8]		UV Resistance GM 11 [9]	Manufacturer's Suggested Applications [11]
		Roll Width/Length m (ft)	Thickness ASTM D5199 (smooth) ASTM D5994 (textured) min. avg. mm (mils) [2]		Strength		Elongation							Standard OIT ASTM D 3895	High Pressure OIT ASTM D 5885	ASTM D3895 % retained after 90 days	High Pressure OIT (min. age.) % retained after 1600 hrs [10]		
					Yield Stress kN/m (lb/in)	Break Stress kN/m (lb/in)	Yield Elongation %	Break Elongation %											

Layfield Environmental Containment   www.layfieldgroup.com																			
Layfield HDPE 60	HDPE	6.86/158.5 m (22.5/520 ft)	1.5 (60)	≥ 0.94	22 (126)	40 (228)	12%	700%	0.48 (108)	0.187 (42)	≥ 2.0%	Note [5]	500	100	400	55%	80%	50%	all
Layfield HDPE 80	HDPE	6.86/122 m (22.5/400 ft)	2.0 (80)	≥ 0.94	29 (168)	53 (304)	12%	700%	0.64 (144)	0.249 (56)	≥ 2.0%	Note [5]	500	100	400	55%	80%	50%	all
Layfield HDPE 60 Textured	HDPE	6.86/171 m (22.5/560 ft)	1.45 (57)	≥ 0.94	22 (126)	16 (90)	12%	100%	0.4 (90)	0.187 (42)	≥ 2.0%	Note [5]	500	100	400	55%	80%	50%	all
Layfield HDPE 80 Textured	HDPE	6.86/134 m (22.5/440 ft)	1.90 (76)	≥ 0.94	29 (168)	21 (120)	12%	100%	0.534 (120)	0.249 (56)	≥ 2.0%	Note [5]	500	100	400	55%	80%	50%	all
HEATGARD 60	HDPE	6.86/158.5 m (22.5/520 ft)	1.5 (60)	≥ 0.94	27 (152)	40 (228)	13%	600%	0.534 (120)	0.2 (45)	≥ 2.0%	CAT1	1000	100	400	55%	80%	50%	High Temperature Containment
HEATGARD 80	HDPE	6.86/122 m (22.5/400 ft)	2.0 (80)	≥ 0.94	36 (204)	53 (304)	13%	600%	0.712 (160)	0.260 (58)	≥ 2.0%	CAT1	1000	100	400	55%	80%	50%	High Temperature Containment
HDPE Conductive	HDPE	6.86/158.5 m (22.5/520 ft)	1.5 (60)	≥ 0.94	22 (126)	40 (228)	12%	700%	0.48 (108)	0.187 (42)	≥ 2.0%	Note [5]	500	100	400	55%	80%	50%	Leak Detection

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- [2] Lowest individual of 10 values
- [3] Machine direction (MD) and cross machine direction (XD) average values should be on the basis of 5 test specimens each direction  
• Yield elongation calculated with a gage length of 33mm  
• Break elongation calculated with a gage length of 50mm
- [4] Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
- T = Textured  
S = Smooth

- [5] Carbon black dispersion for 10 different views:  
• minimum 9 of 10 in Categories 1 or 2  
• all 10 in Categories 1, 2, or 3
- [6] The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
- [7] The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
- [8] It also is recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

- [9] The condition of the test should be 20 hr. UV cycle at 75 C followed by 4 hr. condensation at 60 C.
- [10] UV resistance is based on percent retained value regardless of the original HP-OIT value.
- [11] CL = Canal liner  
SIL = Surface impoundment liner  
SIC = Surface impoundment cover  
LL = Landfill liner  
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NP = Not provided by manufacturer  
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- DL = Dam liner  
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Product Name	Base Polymer [1]	Dimensional Properties		Density ASTM D1505/D792 (min.) (g/cm <sup>3</sup> min.)	Tensile Properties ASTM D 6693 [3]				Puncture Resistance D4833 (min. avg.) kN (lb)	Tear Resistance ASTM D 1004 (min. avg.) kN (lb)	Carbon Black Content: ASTM D 1603 range (%) [4]	Carbon Black Dispersion ASTM D 5596 [5]	Stress Crack Resistance ASTM D 5397 Appendix [6]	Oxidative Induction Time (OIT) (min. avg.) [7]		Oven Aging at 85°C ASTM D 5721 [7], [8]		UV Resistance GM 11 [9]	Manufacturer's Suggested Applications [11]
		Roll Width/Length m (ft)	Thickness ASTM D5199 (smooth) ASTM D5994 (textured) min. avg. mm (mils) [2]		Strength		Elongation							Standard OIT ASTM D 3895	High Pressure OIT ASTM D 5885	ASTM D3895 % retained after 90 days	ASTM D5885 % retained after 90 days		
					Yield Stress kN/m (lb/in)	Break Stress kN/m (lb/in)	Yield Elongation %	Break Elongation %											

Megaplast USA Inc. | www.megaplast.in

MegaLiner platinum 100 Smooth	HDPE	23.5 x 840	40	0.94	86	160	13	700	78	28	2.0-3.0	NA	500	more than 100	more than 500	55	80	50	CL, LL
MegaLiner platinum 150 Smooth	HDPE	23.5 x 560	60	0.94	131	246	13	700	112	42	2.0-3.0	NA	500	more than 100	more than 500	55	80	50	CL, LL
MegaLiner Platinum Textured S 100	HDPE	23.5 x 750	40	0.94	86	63	12	150	67	28	2.0-3.0	NA	500	more than 100	more than 500	55	80	50	CL, LL
MegaLiner Platinum Textured S 150	HDPE	23.5 x 550	60	0.94	131	91	12	150	101	42	2.0-3.0	NA	500	more than 100	more than 500	55	80	50	CL, LL
MegaLiner Platinum Textured D 100	HDPE	23.5 x 710	40	0.94	86	63	12	150	67	28	2.0-3.0	NA	500	more than 100	more than 500	55	80	50	CL, LL
MegaLiner Platinum Textured D 150	HDPE	23.5 x 525	60	0.94	131	91	12	150	101	42	2.0-3.0	NA	500	more than 100	more than 500	55	80	50	CL, LL
MegaLiner Platinum 75 Smooth	HDPE	23.5 x 1100	30	0.94	63	120	13	700	54	21	2.0-3.0	NA	500	more than 100	more than 500	55	80	50	CL, LL
MegaLiner Platinum Textured D 200	HDPE	23.5 x 355	80	0.94	171	120	12	150	135	56	2.0-3.0	NA	500	more than 100	more than 500	55	80	50	CL, LL

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• Yield elongation calculated with a gage length of 33mm  
• Break elongation calculated with a gage length of 50mm

[4] Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

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• minimum 9 of 10 in Categories 1 or 2  
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[7] The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

[8] It also is recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

[9] The condition of the test should be 20 hr. UV cycle at 75 C followed by 4 hr. condensation at 60 C.

[10] UV resistance is based on percent retained value regardless of the original HP-OIT value.

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Product Name	Base Polymer [1]	Dimensional Properties			Density ASTM D1505/D792 (min.) (g/cm <sup>3</sup> min.)	Tensile Properties ASTM D 6693 [3]				Puncture Resistance D 4833 (min. avg.) kN (lb)	Tear Resistance ASTM D 1004 (min. avg.) kN (lb)	Carbon Black Content ASTM D 1603 range (%) [4]	Carbon Black Dispersion ASTM D 5596 [5]	Stress Crack Resistance ASTM D 5397 Appendix [6]	Oxidative Induction Time (OIT) (min. avg.) [7]			Oven Aging at 85°C ASTM D 5721 [7], [8]		UV Resistance GM 11 [9]	Manufacturer's Suggested Applications [11]
		Roll Width/Length m (ft)	Thickness ASTM D5199 (smooth) ASTM D5994 (textured) min. avg. mm (mils) [2]	Strength		Elongation		Standard OIT	High Pressure OIT						ASTM D3895 % retained after 90 days	ASTM D5885 % retained after 90 days					
				Yield Stress kN/m (lb/in)		Break Stress kN/m (lb/in)	Yield Elongation %										Break Elongation %				

**SKAPS Industries** | www.skaps.com

<b>SKAPS HD - 40 Smooth</b>	HDPE	7.16 x 249.93 (23.5 x 820)	1.00 (40 mils)	0.94 min	15 (84)	27 (152)	12	700	320 (72)	125 (28)	2.0-3.0	9 to 10 in categories 1 or 2, max 1 in category 3	500 Hr min	100 Min min	400 Min min	55	80	50	CL, LC, TL, RP, SIC, DP, SIL, SC
<b>SKAPS HD - 60 Smooth</b>	HDPE	7.16 x 167.64 (23.5 x 550)	1.50 (60 mils)	0.94 min	22 (126)	40 (228)	12	700	480 (108)	187 (42)	2.0-3.0	9 to 10 in categories 1 or 2, max 1 in category 3	500 Hr min	100 Min min	400 Min min	55	80	50	CL, LPL, LC, TL, RP, DL, SIC, LL, DP, SIL, SC
<b>SKAPS HD - 80 Smooth</b>	HDPE	7.16 x 124.96 (23.5 x 410)	2.00 (80 mils)	0.94 min	29 (168)	53 (304)	12	700	640 (144)	249 (56)	2.0-3.0	9 to 10 in categories 1 or 2, max 1 in category 3	500 Hr min	100 Min min	400 Min min	55	80	50	LPL, TL, DL, SIL, SC
<b>SKAPS HD - 40 Textured</b>	HDPE	7.16 x 222.50 (23.5 x 730)	1.00 (40 mils)	0.94 min	15 (84)	10 (60)	12	100	267 (60)	125 (28)	2.0-3.0	9 to 10 in categories 1 or 2, max 1 in category 3	500 Hr min	100 Min min	400 Min min	55	80	50	CL, LC, TL, RP, SIC, DP, SIL, SC
<b>SKAPS HD - 60 Textured</b>	HDPE	7.16 x 155.44 (23.5 x 510)	1.50 (60 mils)	0.94 min	22 (126)	16 (90)	12	100	400 (90)	187 (42)	2.0-3.0	9 to 10 in categories 1 or 2, max 1 in category 3	500 Hr min	100 Min min	400 Min min	55	80	50	CL, LPL, LC, TL, RP, DL, SIC, LL, DP, SIL, SC
<b>SKAPS HD - 80 Textured</b>	HDPE	7.16 x 121.92 (23.5 x 400)	2.00 (80 mils)	0.94 min	29 (168)	21 (120)	12	100	534 (120)	249 (56)	2.0-3.0	9 to 10 in categories 1 or 2, max 1 in category 3	500 Hr min	100 Min min	400 Min min	55	80	50	LPL, TL, DL, SIL, SC

**Solmax International Inc.** | www.solmax.com

<b>Solmax HDPE Series Smooth Conductive White</b>	HD - CX -S	6.86/170.7 (22.5/560)	1.5 (60)	0.940	23 (132)	43 (243)	13	700	0.534 (120)	0.187 (42)	2-3	1, 2	500	100	400	55	80	50	all
<b>Solmax HDPE Series Textured Conductive White</b>	HD -CX-T	6.86/158.5 (22.5/520)	1.5 (60)	0.940	23 (132)	23 (132)	13	150	0.534 (120)	0.200 (45)	2-3	1, 2	500	100	400	55	80	50	all

Note: All of Solmax Geomembranes are available in a variety of thicknesses and with black, white or green surface layers.  
 Note: Textured geomembrane available in high asperity.  
 (A) ASTM D5397 Appendix (SP-NCTL) modified at 80 degrees C (176 degrees F) under a load of 3.4 Mpa (500 psi).

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CX = Coextruded
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- [3] Machine direction (MD) and cross machine direction (XD) average values should be on the basis of 5 test specimens each direction  
• Yield elongation calculated with a gage length of 33mm  
• Break elongation calculated with a gage length of 50mm
- [4] Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
- [5] Carbon black dispersion for 10 different views:  
• minimum 9 of 10 in Categories 1 or 2  
• all 10 in Categories 1, 2, or 3
- [6] The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
- [7] The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane. It also is recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
- [8]
- [9] The condition of the test should be 20 hr. UV cycle at 75 C followed by 4 hr. condensation at 60 C.
- [10] UV resistance is based on percent retained value regardless of the original HP-OIT value.
- [11] CL = Canal liner  
SIL = Surface impoundment liner  
SIC = Surface impoundment cover  
LL = Landfill liner  
DP = Decorative pond  
NP = Not provided by manufacturer  
NA = Not applicable, per manufacturer  
DL = Dam liner  
LPL = Leach pad liner  
LC = Landfill cover  
TL = Tunnel liner  
RP = Reserve pit

Product Name	Polymer Type	Dimensional Properties		Specific Gravity ASTM D792	Dimensional Stability ASTM D1204 %	Puncture Resistance ASTM D4833 kN (lb)	Tear Resistance STM D1004 Die C kN (lb)	Tensile Properties ASTM D638				Low Temperature Brittleness ASTM D2136 °C	Suggested Seam Strength ASTM D4545		Carbon Black Content ASTM D1603	Manufacturer's Suggested Applications [1]
		Maximum Panel Size m <sup>2</sup> (ft <sup>2</sup> )	Thickness ASTM D751 mm (mils)					Strength		Elongation			Shear kN/m (lb/in)	Peel kN/m (lb/in)		
								Yield kN/m (lb/in)	Break kN/m (lb/in)	Yield %	Break %					
<b>Atarfil S.L.</b>   <a href="http://www.atarfil.com">www.atarfil.com</a>																
<b>ATARPOL BLACK smooth</b>	PP	40m <sup>2</sup> (430ft <sup>2</sup> ) -width: 2.0m (6.5ft)	1.00-2.50 mm (40-100 mils)	≥ 0.88	±1.50	0.13-0.32	0.06-0.15	NA	12-30	NA	≥ 500	-40	NP	NP	2-2.5	CL, SIC, LPL, LC, RP, SIL
<b>ATARPOL COLOUR smooth</b>	PP	40m <sup>2</sup> (430ft <sup>2</sup> ) -width: 2.0m (6.5ft)	1.00-2.50 mm (40-100 mils)	≥ 0.88	±1.50	0.13-0.32	0.06-0.15	NA	12-30	NA	≥ 500	-40	NP	NP	2-2.5	CL, SIL, SIC, DP, RP
<b>Cooley Group</b>   <a href="http://www.cooleygroup.com">www.cooleygroup.com</a>																
<b>CoolPro-UPP30</b>	fPP	width = 65 to 150 in (1.6 to 3.8 m)	0.75 (30)	0.9	1	0.11 (25)	0.04 (10)	NP	10 (54)	NP	700	-40	NP	NP	NP	CL, SIC, SIL, TL, DP, LL, LPL, DL, LC
<b>CoolPro-UPP40</b>	fPP	width = 65 to 150 in (1.6 to 3.8 m)	1.0 (40)	0.9	1	0.13 (30)	0.05 (12)	NP	13 (72)	NP	700	-40	NP	NP	NP	CL, SIC, SIL, TL, DP, LL, LPL, DL, LC
<b>CoolPro-UPP100</b>	fPP	width = 65 to 150 in (1.6 - 3.8 m)	2.5 (100)	0.9	-0.5	0.30 (68)	0.19 (43)	NP	33 (180)	NP	700	-40	NP	NP	NP	CL, SIC, SIL, TL, DP, LL, LPL, DL, LC

[1] CL = Canal liner  
DL = Dam liner  
DP = Decorative Pond  
LPL = Leach pad liner

LC = Landfill cover  
LL = Landfill liner  
TL = Tunnel liner  
SIL = Surface impoundment liner  
SIC = Surface impoundment cover

[2] Cannot separate  
NP = Not provided by manufacturer  
NA = Not applicable, per manufacturer

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Product Name	[1] Polymer Type	Dimensional Properties		Specific Gravity ASTM D792	Dimensional Stability ASTM D1204 %	Tear Resistance ASTM D1004 Die C kN (lb)	Tensile Properties [2] ASTM D882		Hydrostatic Resistance ASTM D751 Method A kPa (lb/in2)	Low Temperature Brittleness ASTM D1790 °C	Manufacturer's Sug- gested Applications [3]
		Roll Width/ Length m (ft)	Thickness ASTM D1593 or D5199 mm (mil)				MD kN/m (lb/in)	XD kN/m (lb/in)			
<b>Cooley Group</b>   <a href="http://www.cooleygroup.com">www.cooleygroup.com</a>											
CoolGuard-UCG40	EIA	width = 65 to 150 in (1.6 to 3.8 m)	1.0 (40)	1.2	5	0.30 (67)	0.09 (20)	NP	13 (72)	NP	350
CoolGuard-UCG80	EIA	width = 65 to 150 in (1.6 to 3.8 m)	2.0 (80)	1.2	5	0.59 (133)	0.18 (40)	NP	25 (144)	NP	350
<b>E Squared Technical Textiles</b>   <a href="http://www.e2techtexiles.com">www.e2techtexiles.com</a>											
E Squared Xtrm Ply fPVC	PVC - GP and/or ASTM-7176	Width 60" to 120"	20 to 120 mils	1.3	0.5	10°	50°	50°	80°	-30	CL, SIL, SIC, LL, LPL, DL SR, SC, LC, TL
E Squared Xtrm Ply fEIA	KEE/EIA - GP and/or ASTM-7176, NSF	Width 60" to 120"	20 to 120 mils	1.2	0.5	10°	50°	50°	80°	-40	CL, SIL, SIC, SR, SC, LC, LPL, TL
◇ Data listed is min. value for 20 mil product											
<b>Plastatech Engineering Ltd.</b>   <a href="http://www.plastatech.com">www.plastatech.com</a>											
Plastatech FG (Fish Grade)	PVC - Fish Grade	76 in. x 480 yd.	20-30 mil	1.20 min.	3-4 max.	6.0 min. - 8.0 min.	48 min. - 73 min.	48 min. - 73 min.	68 min. - 100 min.	Pass at 5°F (-15°C) and -9.4°F (-23°C)	CL, SIL, SC, LL, DL, LPL
Plastatech IG (Industrial Grade)	PVC - Industrial Grade	76 in. x 1,025 yd.	10-30 mil	1.20 min.	3-4 max.	2.5 min. - 8.0 min.	24 min. - 73 min.	24 min. - 73 min.	42 min. - 100 min.	Pass at -9.4°F (-23°C), -14.8°F (-26°C) and -20°F (-29°C)	CL, SIL, SC, LL, DL, LPL
Plastatech OR (Oil Resistant)	PVC - Oil Resistant	76 in. x 300 yd.	30 mil	1.20 min.	3 max.	8.0 min.	73 min.	73 min.	100 min.	Pass at 10.4°F (-12°C)	CL, SIL, SC, LL, DL, LPL

[5] PVC = Polyvinyl chloride  
PVC-R = Polyvinyl chloride-reinforced

[2] MD = Machine direction  
XD = Cross-machine direction

[3] CL = Canal liner  
SC = Secondary containment  
SR = Soil remediation  
SIL = Surface impoundment liner  
SIC = Surface impoundment cover

LL = Landfill liner  
LC = Landfill cover  
DL = Dam liner  
LPL = Leach pad liner  
TL = Tunner liner

NP = Not provided by manufacturer  
NA = Not applicable, per manufacturer

Unless otherwise indicated, these are minimum average roll values (MARV). All claims are the responsibility of the manufacturer.

Product Name	Polymer Type [1] (membrane)	Polymer Type [1] (reinforcement)	Dimensional Properties		Specific Gravity ASTM D792	Ply Adhesion ASTM D413 MD kN/m (lb/in)	Dimensional Strability ASTM D1204 %	Puncture Resistance FTMS 101 C Method 2031 kN (lb)	Tear Resistance ASTM D5884 Method B Tongue Tear kN (lb)	Tensile Strength ASTM D751 [2] kN (lb)	Hydrostatic Resistance ASTM D751 [2] Method A kN/m <sup>2</sup> (lb/in <sup>2</sup> )	Low Temperature Brittleness ASTM D1790 °C	Suggested Seam Strength		Manufacturer's Suggested Applications [4]	
			Maximum Panel Size Roll Width/Length m/m (ft/ft)	Thickness ASTM 1593 or D5199 mm (mil)									Shear ASTM D751 [3] kN/m (lb/in)	Peel ASTM D413 kN/m (lb/in)		
<b>Atarfil S.L.</b>   <a href="http://www.atarfil.com">www.atarfil.com</a>																
ATARPOL RSP	PP	PP/PES	width: 2.00 (6.5) Length: 20-25 (65.6-82)	1.0/1.14/1.2/1.5 mm (40/ 44/ 47/ 60 mil)	≥ 0.88	ASTMD 6636 ≥65N	≤0.3	NA	NA	NA	NA	-40	NA	NA	CL, SIL, SIC, DP, RP, roofing	
ATARTEC RSP Roofing	TPO/FPO	PP/PES	width: 2.00 (6.5) Length: 15-25 (49-82)	1.2/1.5/2.0 mm (47/ 60/ 80 mil)	NP	NP	≤0.3	NA	NA	NA	NA	-40	NA	NA	roofing	
<b>BTL Liners</b>   <a href="http://www.btl liners.com">www.btl liners.com</a>																
BTL™-30	LDPE	HDPE	65,000 ft <sup>2</sup>	(30 mil)				MD -2.8% CD -1.5%	202 LB	MD (50) CD (55)	MD (345) CD (420)	610 LB	-65	MD (188) CD (240)	5 LB	CL, DP, ILC, LC, LPL, GC, RP, RSC, SIL, SIC, TL
RPEL-30	LDPE	HDPE	55,000 ft <sup>2</sup>	(30 mil)				0.5% x 0.9%	325 LB	MD (60) CD (60)	MD (385) CD (385)	600 LB	-65	CD 315 lb/in	24 lb/in	CL, DP, ILC, LC, LPL, GC, RP, RSC, SIL, SIC, TL
BTL™-40	LDPE	HDPE	50,000 ft <sup>2</sup>	(40 mil)				MD -3.8% CD -1.8%	347 LB	MD (150) CD (155)	MD (460) CD (450)	685 LB	-65	MD (368) CD (360)	5 LB	CL, DP, ILC, LC, LPL, GC, RP, RSC, SIL, SIC, TL
BTL™-60	LDPE	HDPE	33,000 ft <sup>2</sup>	(60 mil)				NA	380 LB	MD (100) CD (100)	MD (385) CD (360)	881 LB	-85	MD (308) CD (288)	27 LB/IN	CL, DP, ILC, LC, LPL, GC, RP, RSC, SIL, SIC, TL
<b>Burke Industries</b>   <a href="http://www.burkeind.com">www.burkeind.com</a>																
M283	CSPE	PET	NP	36	1.45	-8	NA	(240)*	(100)**	-275	(405)[3]	-45 F[5]	NA	NA	NP	
M284	CSPE	PET	NP	45	1.45	-10	NA	(250)*	(105)**	-280	(415)[3]	-45 F[5]	NA	NA	NP	
M423	CSPE	PET	NP	60	1.45	-10	NA	(300)*	(115)*	-325	(450)[3]	-45 F[5]	NA	NA	NP	
<b>Cooley Group</b>   <a href="http://www.cooleygroup.com">www.cooleygroup.com</a>																
CoolGuard FTL30	EIA	PET	Width up to 61 in (1.5 m)	0.91 (36)	NP	2.6 (15)	1	1.45 (325)	0.13 (30)	105 x 105 (600 x 600)	6897 (1,000)	-34	NP	NP	SIL, SIC, SR, SC, LC, TL	
CoolGuard FTL40N	EIA	PET	Width up to 61 in (1.5 m)	1.17 (46)	NP	2.6 (15)	1	2.45 (550)	0.22 (50)	175 x 175 (1,000 x 1,000)	6897 (1,000)	-34	NP	NP	SIL, SIC, SR, SC, LC, TL	
CoolGuard HPK80	EIA	PET	Width up to 150 in (3.8 m)	2.03 (80)	NP	1.7 (10)	2.5	0.89 (200)	0.13 (30)	44 x 35 (250 x 200)	2413 (350)	-34	NP	NP	SIL, SIC, SR, SC, LC, TL	
CoolGuard HRL36 (PW version available)	EIA	PET	Width up to 150 in (3.8 m)	0.91 (36)	NP	2.1 (12)	2.5	1.67 (375)	0.53 (120)	109 x 105 (625 x 600)	5517 (800)	-40	NP	NP	SIL, SC, SR, SC, LC, TL	
CoolGuard MPK36 (PW version available)	EIA	PET	Width up to 150 in (3.8 m)	0.91 (36)	NP	1.8 (10)	2.5	0.89 (200)	0.18 (40)	44 x 35 (250 x 200)	2413 (350)	-25	NP	NP	SIL, SIC, SR, SC, LC, TL	
CoolGuard MPK60 (PW version available)	EIA	PET	Width up to 150 in (3.8 m)	1.52 (60)	NP	1.8 (10)	2	0.89 (200)	0.13 (30)	44 x 35 (250 x 200)	2413 (350)	-29	NP	NP	SIL, SIC, SR, SC, LC, TL	
CoolGuard SKX30 (PW version available)	EIA	PET	Width up to 150 in (3.8 m)	0.76 (30)	NP	3.5 (20)	0.5	1.56 (350)	0.22 (50)	88 x 88 (500 x 500)	5517 (800)	-34	NP	NP	SIL, SIC, SR, SC, LC, TL	

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 CSPE = Chlorosulfonated polyethylene  
 EIA = Ethylene interpolymer alloy  
 fPP = Flexible polypropylene  
 HDPE = High density polyethylene  
 HDPE-T = High density polyethylene, textured

LLDPE = Linear low density polyethylene  
 LLDPE-T = Linear low density polyethylene, textured  
 PET = Polyester  
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 O/C = Other or combination  
 TPO = Thermoplastic polyolefin

[2] As modified in NSF 54, appendix A Note: NSF 54 has been withdrawn.

[3] Method A, Procedure I

[4] CL = Canal liner  
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 ILC = Interim landfill cover  
 LC = Landfill cover  
 LL = Landfill liner  
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 GC = Geofam Cover  
 PT = Pillow Tanks

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 SIL = Surface impoundment liner  
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\* = FTMS 101B  
 \*\* = ASTM D751  
 \*\*\* = ASTM D4833  
 \*\*\*\* = ASTM D7003

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Product Name	Polymer Type [1] (membrane)	Polymer Type [1] (reinforcement)	Dimensional Properties		Specific Gravity ASTM D792	Ply Adhesion ASTM D413 MD kN/m (lb/in)	Dimensional Stability ASTM D1204 %	Puncture Resistance FTMS 101C Method 2031 kN (lb)	Tear Resistance ASTM D5884 Method B Tongue Tear kN (lb)	Tensile Strength ASTM D751 [2] kN (lb)	Hydrostatic Resistance ASTM D751 [2] Method A kN/m <sup>2</sup> (lb/in <sup>2</sup> )	Low Temperature Brittleness ASTM D1790 °C	Suggested Seam Strength		Manufacturer's Suggested Applications [4]
			Maximum Panel Size Roll Width/Length m/m (ft/ft)	Thickness ASTM 1593 or D5199 mm (mil)									Shear ASTM D751 [3] kN/m (lb/in)	Peel ASTM D413 kN/m (lb/in)	
CoolTect RPE	PE	PET	Width up to 150 in (3.8 m)	0.76 (30)	NP	3.5 (20)	1	NP	0.36 (80)	44 x 44 (250 x 250)	NP	-57	NP	NP	CL, SIL, SIC, LL, DL, LPL, LC, TL
CoolTect RPE	PE	PET	Width up to 150 in (3.8 m)	0.91 (36)	NP	3.5 (20)	1	NP	0.36 (80)	44 x 44 (250 x 250)	NP	-57	NP	NP	CL, SIL, SIC, LL, DL, LPL, LC, TL
CoolTect RPE	PE	PET	Width up to 150 in (3.8 m)	1.14 (45)	NP	3.5 (20)	1	NP	0.36 (80)	52 x 52 (300 x 300)	NP	-57	NP	NP	CL, SIL, SIC, LL, DL, LPL, LC, TL
CoolTect RPE	PE	PET	Width up to 150 in (3.8 m)	1.52 (60)	NP	3.5 (20)	1	NP	0.36 (80)	52 x 52 (300 x 300)	NP	-57	NP	NP	CL, SIL, SIC, LL, DL, LPL, LC, TL
CoolPro 36	PP	PET	Width = 78 or 197 in (2.0 or 5.0 m)	0.91 (36)	0.9	3.5 (20)	1	1.11 (250)	0.31 (70)	48 x 44 (275 x 250)	2413 (350)	-40	NP	NP	CL, SIL, SIC, LL, DL, LPL, LC, TL
CoolPro 45	PP	PET	Width = 78 or 197 in (2.0 or 5.0 m)	1.14 (45)	0.9	3.5 (20)	1	1.33 (300)	0.31 (70)	52 x 44 (300 x 250)	2413 (350)	-40	NP	NP	CL, SIL, SIC, LL, DL, LPL, LC, TL
CoolPro 60	PP	PET	Width = 78 or 197 in (2.0 or 5.0 m)	1.52 (60)	0.9	3.5 (20)	1	1.33 (300)	0.31 (70)	52 x 44 (300 x 250)	2413 (350)	-40	NP	NP	CL, SIL, SIC, LL, DL, LPL, LC, TL
CoolThane FML 87	Urethane	PET	Width = 60 to 68 in (1.5 to 1.7 m)	0.89 (35)	NP	3.5 (20)	2	NP	0.67 (150)	70 x 61 (400 x 350)	3447 (500)	-43	NP	NP	SIL, SIC, SR, SC, LC, TL
CoolThane L1023DEP	Urethane	PET	Width = 61 to 74 in (1.5 to 1.9 m)	0.76 (30)	NP	3.0 (17.5)	2	NP	0.71 (160)	61 X 51 (350 X 300)	2758 (400)	-54	NP	NP	SIL, SIC, SR, SC, LC, TL
CoolThane L1612ESU	Urethane	PET	Width = 60 to 68 in (1.5 to 1.7 m)	0.50 (20)	NP	2.6 (15)	2	NP	0.29 (65)	57 x 44 (325 x 250)	3448 (500)	-43	NP	NP	SIL, SIC, SR, SC, LC, TL
CoolThane L3390NESU	Urethane	PET	Width = 60 to 68 in (1.5 to 1.7 m)	1.3 (50)	NP	2.6 (15)	2	NP	0.18 (40)	193 x 193 (1,100 x 1,100)	4138 (600)	-46	NP	NP	SIL, SIC, SR, SC, LC, TL
CoolThane L4090NESUe	Urethane	Nylon	Width = 60 to 68 in (1.5 to 1.7 m)	1.4 (54)	NP	2.6 (15)	2	NP	0.18 (40)	210 x 193 (1,200 x 1,100)	4138 (600)	-46	NP	NP	SIL, SIC, SR, SC, LC, TL
CoolThane L4090UPW	Urethane	Nylon	Width = 60 to 68 in (1.5 to 1.7 m)	1.4 (54)	NP	2.6 (15)	2	NP	0.16 (35)	88 x 88 (500 x 500)					
CoolShield 45E	PVDF	PET	Width up to 76.5 in (1.9 m)	1.10 (45)	NP	4.4 (25)	2	NP	0.45 (100)	52 x 44 (300 x 250)	2413 (350)	-29	NP	NP	SIL, SIC, SR, SC, LC, TL
Oasis HP	TPA	PET	Width = 150 in (3.8 m)	1.52 (60)	NP	3.5 (20)	2	NP	0.58 (130)	70 x 61 (400 x 350)	4482 (650)	-26	NP	NP	SIL, SIC, SR, SC, LC, TL
Oasis HP	TPA	PET	Width = 196 in (5.0 m)	1.10 (45)	NP	2.6 (15)	2.5	NP	0.24 (55)	44 x 44 (250 x 250)	2413 (350)	-26	NP	NP	SIL, SIC, SR, SC, LC, TL
Oasis	TPA	PET	Width = 150 in (3.8 m)	1.52 (60)	NP	3.5 (20)	2	NP	0.24 (55)	52 x 57 (300 x 325)	3792 (550)	-34	NP	NP	SIL, SIC, SR, SC, LC, TL
Oasis	TPA	PET	Width = 196 in (5.0 m)	1.10 (45)	NP	3.5 (20)	2.5	NP	0.24 (55)	44 x 44 (250 x 250)	2413 (350)	-34	NP	NP	SIL, SIC, SR, SC, LC, TL

Coolley Group | www.coolleygroup.com

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- [2] As modified in NSF 54, appendix A. Note: NSF 54 has been withdrawn.
- [3] Method A, Procedure I
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- DP = Decorative pond
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Product Name	Polymer Type [1] (membrane)	Polymer Type [1] (reinforcement)	Dimensional Properties		Specific Gravity ASTM D792	Ply Adhesion ASTM D413 MD kN/m (lb/in)	Dimensional Stability ASTM D1204 %	Puncture Resistance FTMS 101C Method 2031 kN (lb)	Tear Resistance ASTM D5884 Method B Tongue Tear kN (lb)	Tensile Strength ASTM D751 [2] kN (lb)	Hydrostatic Resistance ASTM D751 [2] Method A kN/m <sup>2</sup> (lb/in <sup>2</sup> )	Low Temperature Brittleness ASTM D1790 °C	Suggested Seam Strength		Manufacturer's Suggested Applications [4]
			Maximum Panel Size Roll Width/Length m/m (ft/ft)	Thickness ASTM 1593 or D5199 mm (mil)									Shear ASTM D751 [3] kN/m (lb/in)	Peel ASTM D413 kN/m (lb/in)	
<b>E Squared Xtrm Ply KEE/EIA</b>	KEE/EIA - NSF Available	PET	60" - 120"	20° to 120	1.2	12°	0.5	350°	125°	300°	700°	-35	NP	NP	CL, SIL, SIC, SR, SC, LC, LPL, TL
<b>E Squared Xtrm Ply KEE/EIA HPL</b>	KEE/EIA - NSF Available	PET	60" - 120"	30° to 120	1.2	12°	0.5°	400°	150°	500°	800°	-35	NP	NP	CL, SIL, SIC, SR, SC, LC, LPL, TL
<b>E Squared Xtrm Ply PRG for EPS Geofoam</b>	KEE/EIA	PET	120"	38° to 120	1.2	15°	2	750°	200°	650°	800°	-25	NP	NP	CL, SIL, SIC, SR, SC, LC, LPL, TL
<b>E Squared ER1000</b>	KEE/EIA	PET	81"	30	1.2	22	2	800	280	660	900	-40	NP	NP	CL, SIL, SIC, SR, SC, LC, LPL, TL
<b>E Squared ER1000 PW</b>	KEE/EIA - NSF 6	PET	81"	30° to 60	1.2	22	2	800	280	660	900	-40	NP	NP	CL, SIL, SIC, SR, SC, LC, LPL, TL

↳ Data listed is min. value for 30 mil products

Inland Tarp & Liner, LLC   www.inlandtarp.com															
<b>ITL® 12</b>	LDPE	HDPE	3,716m <sup>2</sup> (100,000ft <sup>2</sup> )	.325(12)	<0.97	NP	<-4%	(78****)	(MD56/CD50)**	(MD179/CD154)	(81psi)	-60	(>80)	(>2LB)	CL, DP, ILC, LC, RP, RSC, SIL, SIC
<b>ITL® 17</b>	LDPE	HDPE	3,716m <sup>2</sup> (100,000ft <sup>2</sup> )	.45(17)	<0.97	NP	<-4%	(95****)	(MD58/CD57)**	(MD191/CD201)	(124psi)	-60	(>80)	(>2LB)	CL, DP, ILC, LC, RP, RSC, SIL, SIC
<b>ITL® 20 LGB</b>	LDPE	HDPE	3,716m <sup>2</sup> (80,000ft <sup>2</sup> )	.5(20)	<0.97	NP	<-4%	(126****)	(MD59/CD63)**	(MD235/CD225)	(160psi)	-60	(>100)	(>2LB)	CL, DP, ILC, LC, RP, RSC, SIL, SIC
<b>ITL® 30LGB</b>	LDPE	HDPE	3,716m <sup>2</sup> (70,000ft <sup>2</sup> )	.75(30)	<0.97	NP	<-4%	(167****)	(MD93/CD83)**	(MD431/CD388)	(258psi)	-60	(>150)	(>2LB)	CL, DP, ILC, LC, LPL, RP, RSC, SIL, SIC
<b>ITL® 30-3</b>	LDPE	HDPE	3,716m <sup>2</sup> (50,000ft <sup>2</sup> )	.75(30)°	<0.97	NP	<-4%	(165****)	(MD80/CD95)**	(MD300/CD325)	(425psi)	-60	(>175)	(>2LB)	CL, DP, ILC, LC, LPL, RP, RSC, SIL, SIC
<b>ITL® 40</b>	LDPE	HDPE	3,716m <sup>2</sup> (40,000ft <sup>2</sup> )	1(40)	<0.97	NP	<-4%	(200****)	(MD90/CD120)	(MD285/CD350)****	(612psi)	-65	(>200)	(>5LB)	CL, DP, ILC, LC, LPL, RP, RSC, SIL, SIC
<b>ITL® 40 X</b>	LDPE	HDPE	3,716m <sup>2</sup> (40,000ft <sup>2</sup> )	1(40)	<0.97	NP	<-4%	(291****)	(MD83/CD92)**	(MD453/CD504)	(590psi)	-60	(>200)	(>5LB)	CL, DP, ILC, LC, LPL, RP, RSC, SIL, SIC
<b>ITL® 40 XGL</b>	LDPE	HDPE	3,716m <sup>2</sup> (40,000ft <sup>2</sup> )	1(40)°	<0.97	NP	<-4%	(255****)	(MD92/CD137)**	(MD628/CD668)	(542psi)	-60	(>200)	(>5LB)	CL, DP, ILC, LC, LPL, RP, RSC, SIL, SIC
<b>ITL® 60 XGL</b>	LDPE	HDPE	2,787m <sup>2</sup> (30,000ft <sup>2</sup> )	1.5(60)°	<0.97	NP	<-4%	(438****)	(MD91/CD144)**	(MD839/CD865)	(523psi)	-60	(>300)	(>5LB)	CL, DP, ILC, LC, LPL, RP, RSC, SIL, SIC

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			Maximum Panel Size Roll Width/Length m/m (ft/ft)	Thickness ASTM 1593 or D5199 mm (mil)									Shear ASTM D751 [3] kN/m (lb/in)	Peel ASTM D413 kN/m (lb/in)	
InterTape Polymer Group   www.itape.com															
Aquamaster NovaLiner 12	LDPE	HDPE	3.65 m x 1800 m (12 ft x 6000 ft) 6600 m <sup>2</sup> (72000 ft <sup>2</sup> )	0.30 (12)	NA	NA	-2.9% MD -2.2% CD	0.27 (60) <sup>◇</sup>	0.20 (45) MD 0.16 (35) CD	24.5 (125) MD 17.5 (80) CD	717 (104)	-40 <sup>◇◇</sup>	19.9 (112) MD 14.0 (80) CD	0.8 (5)	CL, DP, RSC, ILC, SIC
Aquamaster NovaLiner 20	LDPE	HDPE	3.65 m x 900 m (12 ft x 3000 ft) 3300 m <sup>2</sup> (36000 ft <sup>2</sup> )	0.51 (20)	NA	NA	-2.5% MD -1.8% CD	0.53 (120) <sup>◇</sup>	0.22 (50) MD 0.27 (60) CD	28 (160) MD 36.8 (210) CD	772 (112)	-65 <sup>◇◇</sup>	24.5 (140) MD 37.8 (216) CD	0.8 (5)	CL, DP, RSC, ILC, SIC
Aquamaster NovaLiner 24	LDPE	HDPE	3.65 m x 900 m (12 ft x 3000 ft) 3300 m <sup>2</sup> (36000 ft <sup>2</sup> )	0.61 (24)	NA	NA	-2.9% MD -1.8% CD	0.49 (110) <sup>◇</sup>	0.33 (75) MD 0.36 (80) CD	35.9 (205) MD 28.9 (165) CD	1440 (209)	-65 <sup>◇◇</sup>	30.8 (176) MD 25.9 (148) CD	0.8 (5)	CL, DP, RSC, ILC, SIC, RP
Aquamaster NovaLiner 30	LDPE	HDPE	3.65 m x 450 m (12 ft x 1500 ft) 1650 m <sup>2</sup> (18000 ft <sup>2</sup> )	0.76 (30)	NA	NA	-2.2% MD -1.6% CD	0.53 (120) <sup>◇</sup>	0.18 (40) MD 0.24 (55) CD	28 (160) MD 33.3 (190) CD	2329 (338)	-65 <sup>◇◇</sup>	26.3 (150) MD 31.5 (180) CD	0.8 (5)	CL, DP, SIL, SIC, LC, RP
Aquamaster NovaLiner 40	LDPE	HDPE	3.65m x 411m (12 ft x 1350ft) 1500m <sup>2</sup> (18000ft <sup>2</sup> )	1.00 (40)	NA	NA	-3.7% MD -2.1% CD	0.76 (170) <sup>◇</sup>	0.31 (70) MD 0.38 (85) CD	45.5 (260) MD 57.8(330) CD	3376 (490)	-65 <sup>◇◇</sup>	38.5 (220) MD 49.0 (280) CD*	0.8 (5)	CL, DP, SIL, SIC, LC, RP
Aquamaster ArmorLiner 24	LDPE	HDPE	3.65 m x 900 m (12 ft x 3000 ft) 3300 m <sup>2</sup> (36000 ft <sup>2</sup> )	0.61 (24)	NA	NA	-2.7% MD -1.4% CD	0.71 (160) <sup>◇</sup>	0.40 (90) MD 0.40 (90) CD	38.5 (220) MD 39.4 (225) CD	2343 (340)	-65 <sup>◇◇</sup>	34.8 (196) MD 35.0 (200) CD	0.8 (5)	CL, DP, SIL, SIC, LC, RP
Aquamaster ArmorLiner 30	LDPE	HDPE	3.65 m x 450 m (12 ft x 1500 ft) 1650 m <sup>2</sup> (18000 ft <sup>2</sup> )	0.76 (30)	NA	NA	-2.2% MD -1.4% CD	0.71 (160) <sup>◇</sup>	0.16 (35) MD 0.18 (40) CD	35 (200) MD 49 (280) CD	3362 (488)	-65 <sup>◇◇</sup>	29.4 (168) MD 34.2 (195) CD	0.8 (5)	CL, DP, SIL, SIC, LC, RP
Aquamaster ArmorLiner 40L	LDPE	HDPE	3.65 m x 450 m (12 ft x 1500 ft) 1642 m <sup>2</sup> (18000 ft <sup>2</sup> )	1.02 (40)	NA	NA	-2.2% MD -1.2% CD	1.22 (275) <sup>◇</sup>	0.54 (122) MD 0.53 (120) CD	76.1 (435) MD 73.5 (420) CD	3776 (548)	-65 <sup>◇◇</sup>	64.5 (368) MD 64.5 (368) CD	0.8 (5)	CL, DP, SIL, SIC, LC, TL, LPL
Aquamaster ArmorLiner 45L	LDPE	HDPE	3.65 m x 450 m (12 ft x 1500 ft) 1642 m <sup>2</sup> (18000 ft <sup>2</sup> )	1.14 (45)	NA	NA	*-2.1% MD -1.5% CD*	1.33 (300) <sup>◇</sup>	0.36 (80) MD 0.36 (80) CD	*61.3 (350) MD 61.3 (350) CD*	4851 (704)	-65 <sup>◇◇</sup>	61.0 (348) MD 51.1 (452) CD	0.8 (5)	CL, DP, SIL, SIC, LC, TL, LPL
Aquamaster ArmorLiner 30SFL	LDPE / LLDPE	HDPE	3.65 m x 450 m (12 ft x 1500 ft) 1642 m <sup>2</sup> (18000 ft <sup>2</sup> )	0.76 (30)	NA	NA	-1.9% MD -1.6% CD	0.67 (150) <sup>◇</sup>	0.35 (79) MD 0.36 (81) CD	40.3 (230) MD 35.9 (205) CD	3500 (508)	-65 <sup>◇◇</sup>	36.4 (208) MD 36.4 (208) CD	0.8 (5)	CL, DP, SIL, SIC, LC, TL, LPL
Aquamaster ArmorPad 3NWL	LDPE + PP Non-Woven	HDPE	3.65 m x 450 m (12 ft x 1500 ft) 1642 m <sup>2</sup> (18000 ft <sup>2</sup> )	0.61 (24) <sup>◇◇◇</sup>	NA	NA	-1.9% MD -1.4% CD	0.62 (140) <sup>◇</sup>	0.40 (90) MD 0.42 (95) CD	35.9 (205) MD 31.5 (180) CD	2205 (320)	NA	35.0 (200) MD 28.0 (160) CD	0.8 (5)	CL, DP, RP
Aquamaster ArmorPad 3NWL D	LDPE + PP Non-Woven	HDPE	3.65 m x 450 m (12 ft x 1500 ft) 1642 m <sup>2</sup> (18000 ft <sup>2</sup> )	0.61 (24) <sup>◇◇◇</sup>	NA	NA	-1.5% MD -1.0% CD	0.111 (250) <sup>◇</sup>	0.36 (80) MD 0.40 (90) CD	35.9 (205) MD 31.5 (180) CD	2205 (320)	NA	35.0 (200) MD 28.0 (160) CD	0.8 (5)	CL, DP, RP

◇ ASTM D4833    ◇◇ ASTM D2136    ◇◇◇ Without non-woven layers

- [1] PVC = Polyvinyl chloride
- CPE = Chlorinated polyethylene
- CSPE = Chlorosulfonated polyethylene
- EIA = Ethylene interpolymer alloy
- fPP = Flexible polypropylene
- HDPE = High density polyethylene
- HDPE-T = High density polyethylene, textured

- LLDPE = Linear low density polyethylene
- LLDPE-T = Linear low density polyethylene, textured
- PET = Polyester
- PP = Polypropylene
- O/C = Other or combination
- TPO = Thermoplastic polyolefin

- [2] As modified in NSF 54, appendix A  
Note: NSF 54 has been withdrawn.
- [3] Method A, Procedure I
- [4] CL = Canal liner  
DP = Decorative pond  
ILC = Interim landfill cover  
LC = Landfill cover  
LL = Landfill liner  
LPL = Leach pad liner  
GC = Geofoam Cover  
PT = Pillow tanks

- RP = Reserve pit
- RSC = Rain shed cover
- SIL = Surface impoundment liner
- SIC = Surface impoundment cover
- TL = Tunnel liner
- NP = Not provided by manufacturer
- NA = Not applicable, per manufacturer

- \* = FTMS 101B
- \*\* = ASTM D751
- \*\*\* = ASTM D4833
- \*\*\*\* = ASTM D7003

# GEOMEMBRANES REINFORCED

Product Name	Polymer Type [1] (membrane)	Polymer Type [1] (reinforcement)	Dimensional Properties		Specific Gravity ASTM D792	Ply Adhesion ASTM D413 MD kN/m (lb/in)	Dimensional Stability ASTM D1204 %	Puncture Resistance FTMS 101C Method 2031 kN (lb)	Tear Resistance ASTM D5884 Method B Tongue Tear kN (lb)	Tensile Strength ASTM D751 [2] kN (lb)	Hydrostatic Resistance ASTM D751 [2] Method A kN/m <sup>2</sup> (lb/in <sup>2</sup> )	Low Temperature Brittleness ASTM D1790 °C	Suggested Seam Strength		Manufacturer's Suggested Applications [4]
			Maximum Panel Size Roll Width/Length m/m (ft/ft)	Thickness ASTM 1593 or D5199 mm (mil)									Shear ASTM D751 [3] kN/m (lb/in)	Peel ASTM D413 kN/m (lb/in)	
<b>Layfield Geosynthetics &amp; Industrial Fabrics Ltd.</b>   <a href="http://www.layfieldgroup.com">www.layfieldgroup.com</a>															
CSPE 36	O/C	CSPE	2,300 m <sup>2</sup> (25,000 ft <sup>2</sup> )	0.91 (36)	NA	1.22 (7)	2	0.89 (200)	0.31 (70)	1.0 (225)	1.33 (300)	-40	0.89 (200)	Film Tear Bond	SC
CSPE 45	O/C	CSPE	2,135 m <sup>2</sup> (23,000 ft <sup>2</sup> )	1.14 (45)	NA	1.22 (7)	2	1.0 (225)	0.36 (80)	1.11 (250)	1.56 (350)	-40	1.0 (225)	Film Tear Bond	SC
CSPE 60	O/C	CSPE	1670 m <sup>2</sup> (18,000 ft <sup>2</sup> )	1.52 (60)	NA	1.22 (7)	2	1.33 (300)	0.36 (80)	1.33 (300)	1.78 (400)	-40	1.2 (270)	Film Tear Bond	SC
<b>Plastatech Engineering Ltd.</b>   <a href="http://www.plastatech.com">www.plastatech.com</a>															
Plastatech Tech 5	PVC	PVC	64 in. x 150 yd.	30 mil	NA	NA	-0.7 MD / 0.03 CMD	>180	105 MD / 81 CMD	NA	>660	NA	NA	NA	CL, DP, RP, RSC, SIL
Plastatech Tech 7	PVC	PVC	120 in. x 250 yd.	40 mil	NA	NA	-0.1 MD / 0.1 CMD	416	349 MD / 187 CMD	NA	NA	NA	NA	NA	CL, DP, RP, RSC, SIL
<b>Seaman Corporation</b>   <a href="http://www.xr-technology.com">www.xr-technology.com</a>															
9146 XR-5 ULT	EIA	PET	1,200 m <sup>2</sup> 13,000 ft <sup>2</sup>	1.5 (60)	1.2 app.	2.63 (15)	0.5	700	150	4.0 (900)	6900 (1000)	-50	4.0 (900)	3.50 (20)	CL, SIL, SIC, LL, DL
8130 XR-3 PW	EIA	PET	1,400 m <sup>2</sup> 15,000 ft <sup>2</sup>	0.75 (30)	1.2 app.	2.63 (15)	0.5	350	125	2.46 (550)	5520 (800)	-35	2.46 (550)	3.50 (20)	CL, SIL, SIC, DL
8130 XR-5	EIA	PET	1,400 m <sup>2</sup> 15,000 ft <sup>2</sup>	0.75 (30)	1.2 app.	2.63 (15)	0.5	350	125	2.46 (550)	5520 (800)	-35	2.46 (550)	3.50 (20)	CL, SIL, SIC, LL, DL, LC, LPL
8138 XR-5	EIA	PET	1,200 m <sup>2</sup> 13,000 ft <sup>2</sup>	1.0 (40)	1.2 app.	2.63 (15)	0.5	350	125	2.46 (550)	5520 (800)	-35	2.46 (550)	3.50 (20)	CL, SIL, SIC, LL, DL, LC, LPL
8228 XR-3	EIA	PET	1,400 m <sup>2</sup> 15,000 ft <sup>2</sup>	0.75 (30)	1.2 app.	2.10 (12)	0.5	205	50	0.89 (200)	2070 (300)	-32	1.11 (250)	1.75 (10)	CL, SIL, SIC, LC, LPL
8142 XR-5 PW	EIA	PET	1,200 m <sup>2</sup> 13,000 ft <sup>2</sup>	1.13 (45)	1.2 app.	2.63 (15)	0.5	350	125	2.46 (550)	5520 (800)	-35	2.46 (550)	3.50 (20)	SIC, SIL, CL
9832 XR-5G	EIA	PET	1,400 m <sup>2</sup> 15,000 ft <sup>2</sup>	0.914 (36)	1.2 app.	2.63 (15)	0.5	440	125	2.90 (650)	5520 (800)	-40	2.90 (650)	3.50 (20)	CL, SIL, SIC, LL, DL, LC, LPL, GC
1936 PTF	TPU	Nylon	1,400 m <sup>2</sup> 15,000 ft <sup>2</sup>	1.0 (40)	1.2 app.	7.01 (40)	0.5	700	125	4.46 (1,000)	10,340 (1,500)	-50	4.46 (1,000)	3.50 (20)	SIL, OB, PT
8130 XR FR	EIA	PET	1,400 m <sup>2</sup> 15,000 ft <sup>2</sup>	0.75 (30)	1.2 app.	2.63 (15)	0.5	350	125	2.46 (550)	5520 (800)	-50	2.46 (550)	3.50 (20)	CL, SIL, SIC, LL, DL, LC, LPL

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 PT = Pillow Tanks

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 TL = Tunnel liner  
 NP = Not provided by manufacturer  
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\* = FTMS 101B  
 \*\* = ASTM D751  
 \*\*\* = ASTM D4833  
 \*\*\*\* = ASTM D7003

« Geosynthetics recommends you contact the manufacturers before making any specifying/purchasing decisions »