

# Linear Low Density Polyethylene (LLDPE)



## Linear Low Density Polyethylene (LLDPE) geosynthetic liner

LLDPE has a very high degree of flexibility and puncture resistance. LLDPE elongates under stress and has good resistance to the stresses of chemicals and ultraviolet light. It is the most appropriate lining material for projects which require significant material flexibility due to its ability to conform to any shape.

### Applications:



### Material Properties:

- UV Stable
- Cost Effective
- Fabrication Capability
- Chemical Resistance

### Product Range:

- Smooth
- Textured
- Conductive

### Product Mils:

20 / 30 / 40 / 60/  
80 / 100 / 120

# LLDPE Geomembrane (Smooth)



Properties	Test Method	Test Values								Testing Frequency (minimum)
		20 mils	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness - mils (min. ave.)	ASTM D 5199	nom.	nom.	nom.	nom.	nom.	nom.	nom.	nom.	per roll
• Lowest individual of 10 values	—	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	—
Density g/ml (max.)	ASTM D 1505 ASTM D 792	0.939	0.939	0.939	0.939	0.939	0.939	0.939	0.939	200,00 lb
Tensile Properties (1) min. ave.) • break strength - lb/in. • break elongation - %	ASTM D 6693 Type IV	76 800	114 800	152 800	190 800	228 800	304 800	380 800	456 800	20,000 lb
2% Modulus - lb/in (max.)	ASTM D 5323	1200	1800	2400	3000	3600	4800	6000	7200	per formulation
Tear Resistance - lb (min. ave.)	ASTM D 1004	11	16	22	27	33	44	55	66	45,000 lb
Puncture Resistance - lb (min. ave.)	ASTM D 4833	28	42	56	70	84	112	140	168	45,000 lb
Axi-Symmetric Break Resistance Strain - % (min.)	ASTM D 5617	30	30	30	30	30	30	30	30	per formulation
Carbon Black Content - %	ASTM D 4218 (2)	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	45,000 lb
Carbon Black Dispersion	ASTM D 5596	note (3)	note (3)	note (3)	note (3)	note (3)	note (3)	note (3)	note (3)	45,000 lb
Oxidative Induction Tim (OIT) (4) (a) Standard OIT (min ave.) - or - (b) High Pressure OIT (min. ave)	ASTM D 3895	100 400	100 400	100 400	100 400	100 400	100 400	100 400	100 400	200,000 lb
Oven Aging at 85°C (5) (a) Standard OIT (min.ave.) - % retained after 90 days -- or -- (b) High PPressure OIT (min. ave.) - % retained after 90 days	ASTM D 5721 ASTM D 3895  ASTM D 5885	35 60	35 60	35 60	35 60	35 60	35 60	35 60	35 60	per formulation
UV Resistance (6) (a) Standard OIT (min. ave.) --or-- (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs (8)	ASTM D 7238 ASTM D 3895  ASTM D 5885	N. R. (7) 35	N. R. (7) 35	N. R. (7) 35	N. R. (7) 35	N. R. (7) 35	N. R. (7) 35	N. R. (7) 35	N. R. (7) 3 5	per formulation

- (1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.  
• Break elongation is calculated using a gage length of 2.0 in. at 2.0 in./min.
- (2) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.
- (3) Carbon black dispersion (only near spherical agglomerates) for 10 different views:  
• 9 in Categories 1 or 2 and 1 in Category 3
- (4) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
- (5) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
- (6) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
- (7) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
- (8) UV resistance is based on percent retained value regardless of the original HP-OIT value.

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# LLDPE Raw Material Information



A structured geomembrane manufactured from maximum quality linear low density polyethylene LLDPE resins, duly contrasted, that comply with the most rigorous requirements established for their use. Contains 97.5% of pure polymer, and approximately 2.5% of Carbon Black, antioxidants and thermal stabilizers.

<b>Surface</b>	TM Structured 1 side	<b>Color RAL Code</b>	Black
	TMT Structured 2 sides		-

	Tested Property	Unit	Test Method	Value
<b>Raw Material Identification</b>	Density of Raw Materials	g/cm <sup>3</sup>	ASTM D 792	0.915 - 0.926
	Density of Geomembrane	g/cm <sup>3</sup>	ASTM D 792	0.925 - 0.939
	Melt Flow Index	g/10min	ASTM D 1238 (190°C/2.16 Kg)	<1.0
	Carbon Black Content	%	ASTM D 4218	2.0 - 2.5
	Carbon Black Dispersion	—	ASTM D 5596	Note (2)
<b>Durability</b>	Oxidative Induction Time (OIT) Standard OIT High Pressure OIT	min	ASTM D 3895 (200°C) ASTM D 5885	≥ 100 ≥ 400
	Oven Aging at 85°C HP OIT, % retained after 90 days	%	ASTM D 5721 ASTM D 5885	≥ 60
	UV Resistance HP OIT, % Retained after 1600 hrs	%	ASTM D 7238 ASTM D 5885	≥ 35

	Tested Property	Unit	Test Method	Value
<b>Function Properties</b>	Low Temperature Brittleness (t <sup>3</sup> : -40°C)	—	ASTM D 746	No cracks
	Water Permeability	m <sup>3</sup> /m <sup>2</sup> · day	EN 14150	<1·10 <sup>-6</sup>
	Coefficient of Linear Thermal Expansion	1/K	ASTM D 696	2.15·10 <sup>-4</sup>
	Water Absorption	%	ASTM D 570 (24h)	≤0.2
			ASTM D 570 (6 days)	≤1
	Asperity Height	mils	ASTM D 7466	≥ 30
	Friction Angle (3)	°	ISO 12957-1	≥ 29
Spikes Density	spikes/ft <sup>2</sup>	—	1,997	

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	Tested Property	Unit	Test Method	Value						
	Strength Characteristics Quality of Final Product	Thickness	mils	ASTM S 5994	30	40	60	80	100	120
Tolerance		%	-10							
<b>Mechanical Properties</b>										
Tensile Strength at Break (*)		lb/in	ASTM D 6693 (Type IV), lo: 2.0 in	≤ 45	64 (60)	95 (90)	125 (120)	152 (150)	185 (180)	
Elongation at Break		%		≤ 250						
Tear Resistance		lb	ASTM D 1004	≤ 16	≤ 21	≤ 32	≤ 43	≤ 53	≤ 64	
Puncture Resistance		lb	ASTM D 4833	≤ 33	≤ 42	≤ 64	≤ 85	≤ 112	≤ 128	
2% Modulus		lb/in	ASTM D 5323	≤ 1.800	≤ 2.400	≤ 3.600	≤ 4.800	≤ 6.000	≤ 7.200	
Axi-Symmetric Break Resistance Strain		%	ASTM D 5617	≤ 30						
Dimensional Stability		%	ASTM D 1204 (100°C, 1h)	± 1.5						

Parameter	Units	LTM 30 LTMT		LTM 40 LTMT		LTM 60 LTMT		LTM 80 LTMT		LTM 100 LTMT		LTM 120 LTMT	
Roll Width	ft	19.7		19.7		19.7		19.7		19.7		19.7	
Roll Length	ft	981	624	864	570	669	495	504	432	405	384	339	333
Surface	ft (2)	19,325.7	12,292.8	17,020.8	11,229	13,179.3	9,751.5	9,928.8	8,510.4	7,978.5	7,564.8	6,678.3	6,560.1

\* Customer encouraged to perform their own testing.

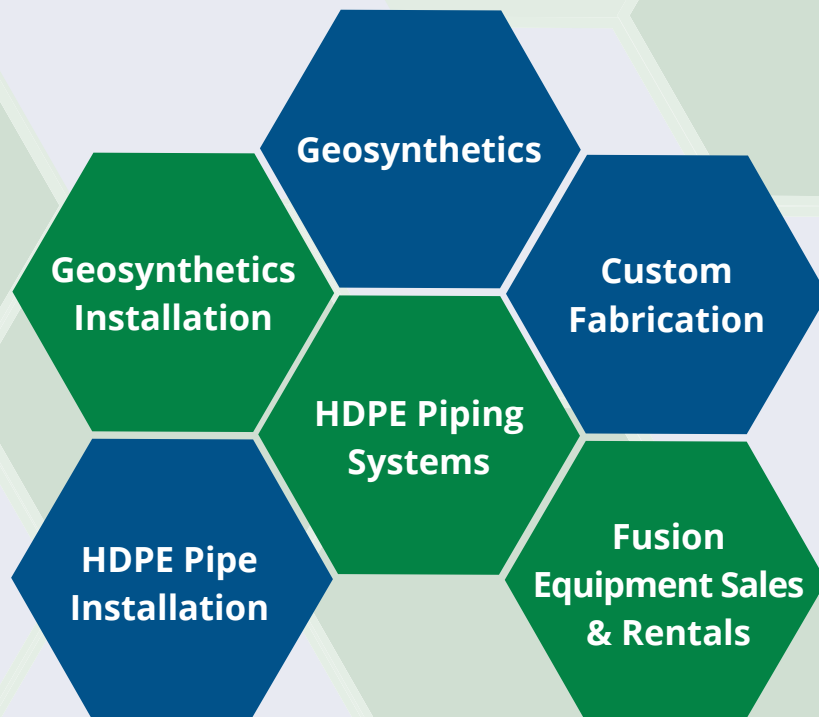
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# LLDPE Material Information



**EnviroCon Systems, Inc.**, specializes in technical and safety intensive geosynthetics and HDPE piping solutions.



**EnviroCon Systems, Inc.**, is committed to providing high quality, innovative containment solutions dedicated to a strong culture of best safety work practices and outstanding service, with integrity, loyalty, and meticulous attention to detail for our customers, employees, and investors.

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