

High Density Polyethylene Drain Liner™



Product Data

Property	Test Method	Values			
Thickness (min. ave.), mil (mm)	ASTM D5994*	50 (1.25)	60 (1.5)	80 (2.0)	100 (2.5)
Thickness (lowest indiv.), mil (mm)	ASTM D5994*	50 (1.25)	54 (1.35)	72 (1.8)	90 (2.25)
*The thickness values may be changed due to project specifications (i.e., absolute minimum thickness)					
Drainage Stud Height (min. ave.), mil (mm)	GRI GM12/ASTM D7466	145 (3.68)	145 (3.68)	145 (3.68)	145 (3.68)
Density, g/cc, minimum	ASTM D792, Method B	0.94	0.94	0.94	0.94
Tensile Properties (ave. both directions)	ASTM D6693, Type IV				
Strength @ Yield (min. ave.), lb/in width (N/mm)	2 in/minute	95 (16.6)	120 (21)	160 (28)	220 (38.5)
Elongation @ Yield (min. ave.), % (GL=1.3in)	5 specimens in each direction	13	13	13	13
Strength @ Break (min. ave.), lb/in width (N/mm)		105 (18.4)	132 (23.1)	176 (30.8)	220 (38.5)
Elongation @ Break (min. ave.), % (GL=2.0in)		200	200	200	200
Tear Resistance (min. ave.), lbs. (N)	ASTM D1004	38 (169)	50 (222)	67 (298)	83 (369)
Puncture Resistance (min. ave.), lbs. (N)	ASTM D4833	80 (355)	95 (422)	126 (560)	158 (703)
Carbon Black Content (range in %)	ASTM D4218	2 - 3	2 - 3	2 - 3	2 - 3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates for 10 views: 9 views in Cat. 1 or 2, and 1 view in Cat. 3			
Stress Crack Resistance (Single Point NCTL), hours	ASTM D5397, Appendix	300	300	300	300
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O ₂	≥100	≥100	≥100	≥100
Melt Flow Index, g/10 minutes	ASTM D1238, 190°C, 2.16kg	≤1.0	≤1.0	≤1.0	≤1.0
Oven Aging	ASTM D5721				
with HP OIT, (% retained after 90 days)	ASTM D5885, 150°C, 500psi O ₂	80	80	80	80
UV Resistance	GRI GM11	20hr. Cycle @ 75°C/4 hr. dark condensation @ 60°C			
with HP OIT, (% retained after 1600 hours)	ASTM D5885, 150°C, 500psi O ₂	50	50	50	50

These product specifications meet or exceed GRI's GM13

Supply Information (Standard Roll Dimensions)

Thickness		Width		Length		Area (approx.)		Weight (average)*	
mil	mm	ft	m	ft	m	ft ²	m ²	lbs	kg
50	1.25	23	7	300	91.435	6,900	640.05	2,600	1,178.34
60	1.5	23	7	300	91.435	6,900	640.05	2,900	1,315.42
80	2.0	23	7	300	91.435	6,900	640.05	3,600	1,632.93
100	2.5	23	7	300	91.435	6,900	640.05	4,000	1,814.37

Notes:

All rolls are supplied with two slings. All rolls are wound on a 6 inch core. Special lengths are available on request. All roll lengths and widths have a tolerance of ±1%
*The weight values may change due to project specifications (i.e. absolute minimum thickness or special roll lengths) or shipping requirements (i.e. international containerized shipments).

All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, it is the users responsibility to determine the suitability for their own use of the products described herein. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Agru/America as to the effects of such use or the results to be obtained, nor does Agru/America assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

Linear Low Density Polyethylene Drain Liner®



Product Data

Property	Test Method	Values			
Thickness (min. ave.), mil (mm)	ASTM D5994*	50 (1.25)	60 (1.5)	80 (2.0)	100 (2.5)
Thickness (lowest indiv.), mil (mm)	ASTM D5994*	50 (1.25)	54 (1.35)	72 (1.8)	90 (2.25)
*The thickness values may be changed due to project specifications (i.e., absolute minimum thickness)					
Drainage Stud Height (min. ave.), mil (mm)	GRI GM12/ASTM D7466	145 (3.68)	145 (3.68)	145 (3.68)	145 (3.68)
Density, g/cc, maximum	ASTM D792, Method B	0.939	0.939	0.939	0.939
Tensile Properties (ave. both directions)	ASTM D6693, Type IV				
Strength @ Break (min. ave.), lb/in width (N/mm)	2 in/minute	105 (18.4)	126 (22.1)	168 (29.4)	210 (36.8)
Elongation @ Break (min. ave.), % (GL=2.0in)	5 specimens in each direction	300	300	300	300
Tear Resistance (min. ave.), lbs. (N)	ASTM D1004	30 (133)	40 (178)	53 (236)	67 (298)
Puncture Resistance (min. ave.), lbs. (N)	ASTM D4833	55 (245)	70 (311)	90 (400)	110 (489)
Carbon Black Content (range in %)	ASTM D4218	2 - 3	2 - 3	2 - 3	2 - 3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates for 10 views: 9 views in Cat. 1 or 2, and 1 view in Cat. 3			
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O ₂	≥100	≥100	≥100	≥100
Melt Flow Index, g/10 minutes	ASTM D1238, 190°C, 2.16kg	≤1.0	≤1.0	≤1.0	≤1.0
Oven Aging	ASTM D5721	60	60	60	60
with HP OIT, (% retained after 90 days)	ASTM D5885, 150°C, 500psi O ₂				
UV Resistance	GRI GM11	20hr. Cycle @ 75°C/4 hr. dark condensation @ 60°C			
with HP OIT, (% retained after 1600 hours)	ASTM D5885, 150°C, 500psi O ₂	35	35	35	35
2% Secant Modulus (max.), lb/in. (N/mm)	ASTM D5323	3000 (520)	3600 (630)	4800 (840)	6000 (1050)
Axi-Symmetric Break Resistance Strain, % (min.)	ASTM D5617	30	30	30	30

These product specifications meet or exceed GRI's GM17

Supply Information (Standard Roll Dimensions)

Thickness		Width		Length		Area (approx.)		Weight (average)*	
mil	mm	ft	m	ft	m	ft ²	m ²	lbs	kg
50	1.25	23	7	300	91.435	6,900	640.05	2,600	1,178.34
60	1.5	23	7	300	91.435	6,900	640.05	2,900	1,315.42
80	2.0	23	7	300	91.435	6,900	640.05	3,600	1,632.93
100	2.5	23	7	300	91.435	6,900	640.05	4,000	1,814.37

Notes:

All rolls are supplied with two slings. All rolls are wound on a 6 inch core. Special lengths are available on request. All roll lengths and widths have a tolerance of ±1%
*The weight values may change due to project specifications (i.e. absolute minimum thickness or special roll lengths) or shipping requirements (i.e. international containerized shipments).

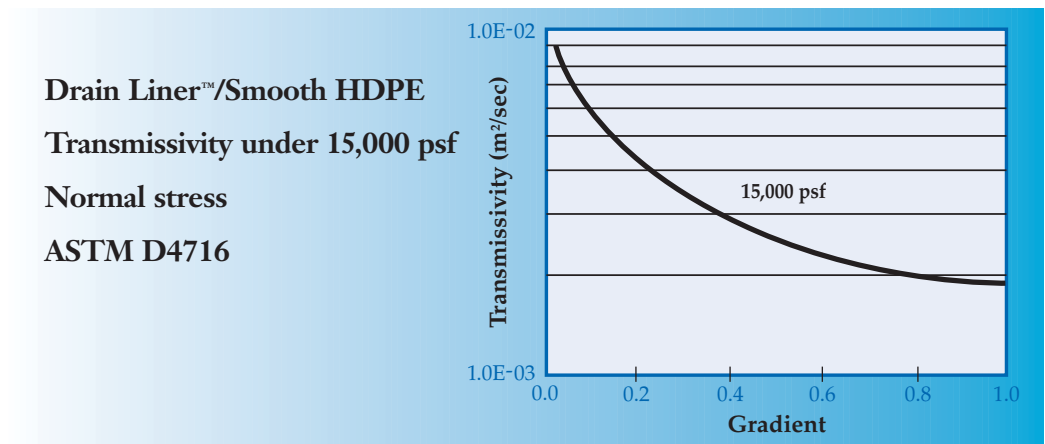
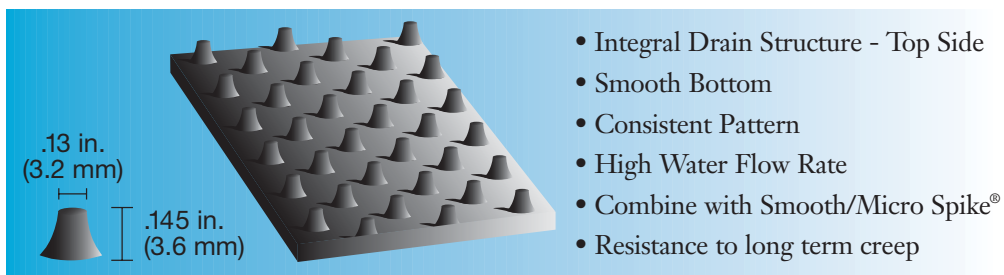
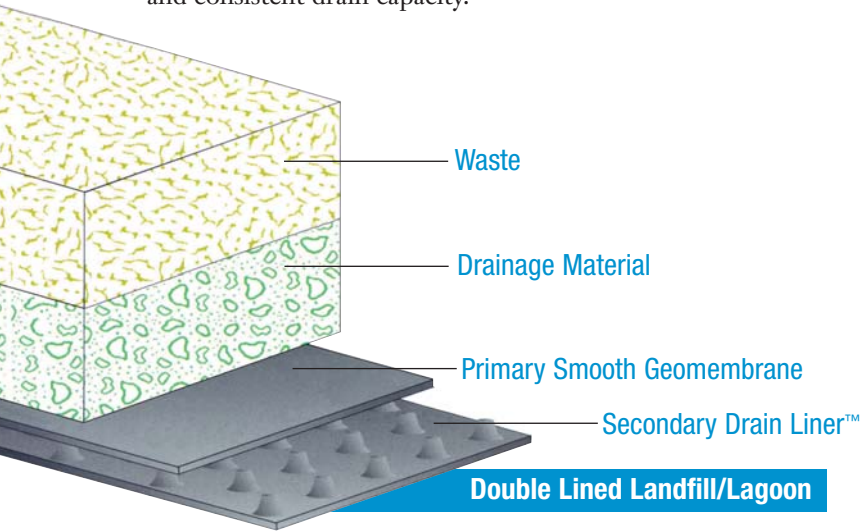
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Drain Liner™ Geomembrane



Applications for HDPE and LLDPE Agru Drain Liner™ include single or double lined projects where containment and leak detection are critical i.e. landfills, waste ponds/lagoons, mining heap leach pads and process ponds. Recent bids for installations have indicated cost savings of over \$3,000.00 per acre with the use of Drain Liner™ as a replacement for the geomembrane/geonet combination.

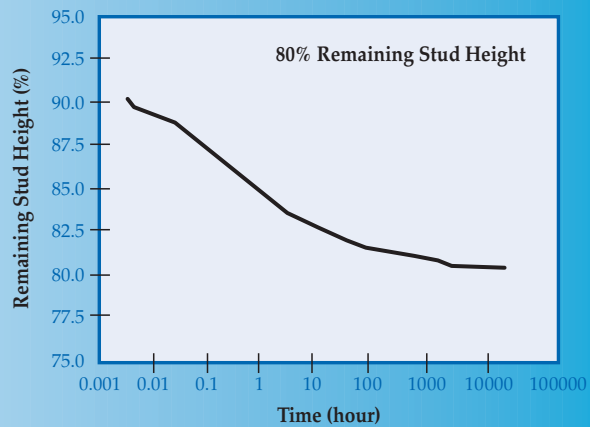
Agru America's structured geomembranes are manufactured on state-of-the-art manufacturing equipment using a flat cast extrusion manufacturing process as opposed to blown film extrusion. Agru America uses only the highest grade of HDPE and LLDPE resins manufactured in North America. The flat cast process results in a consistent core thickness resulting in higher tensile strength values than traditional textured materials. It also gives consistent structuring as the material production rollers are embossed with the appropriate pattern for the structured liner requirements. This results in higher flow rates and consistent drain capacity.



The in-plane drainage capacity of the drain liner used as either a primary or secondary liner is always higher than a conventional geonet due to the structure of the studs and stud spacing which results in a more laminar (less turbulent) flow and a constant bi-directional flow over time and minimal reduction due to creep. Additionally, the drain liner allows flow at very low gradients due again to the stud spacing and integral design.

Detection of potential leaks is faster with a drain liner structure than with a conventional geonet which forms an indirect flow path due to the net structure. Also, reduction factors for the potential of chemical or biological clogging are less for a stud or drain liner structure due to the fact that the studs do not form intermediate dams or inhibit water flow.

**Drain Liner™ 10,000 hour Creep
Testing under 15,000 psf
Normal stress
ASTM D5262**



Thus, the Drain Liner™ is a synthetic drainage media which has decided advantages over conventional geonets:

- Installed in one layer as an integral drain with the primary or secondary liner (depending on installation)
 - Installation time cut dramatically
 - Cost effective lagoon solution-significantly reduced material and installations costs
 - Less CQA cost
 - Better consistency
 - Bi-directional Flow.
- Higher flow rates than a conventional geonet
- Minimal reduction for creep (80% retention under 15,000 psf loading)
- Less impact by chemical/biological clogging
- Faster response time for leak detection
- Studs totally integrated with the liner-single production process
- No waste due to cutting and fitting of geonet sections or discard of end of rolls
- Excellent fluid barrier
- Manufactured in the most modern plant meeting stringent quality control standards

When engineers specify AGRU Drain Liner® or any other Agru product, the client not only gets a superior material with higher performance but also substantial cost savings.

Why specify or use anything else!

Agru has over 20 years experience with Geomembranes and 50 years experience with Thermoplastic Extrusion Agru offers a wide range of concrete protective liners (Sure Grip), pipe fittings and semi-finished materials.

Executive Offices: 500 Garrison Road, Georgetown, SC 29440

843-546-0600

800-321-1379

Fax: 843-546-0516

Sales Office: 700 Rockmead, Suite 150, Kingwood, TX 77339

281-358-4741

800-373-2478

Fax: 281-358-5297

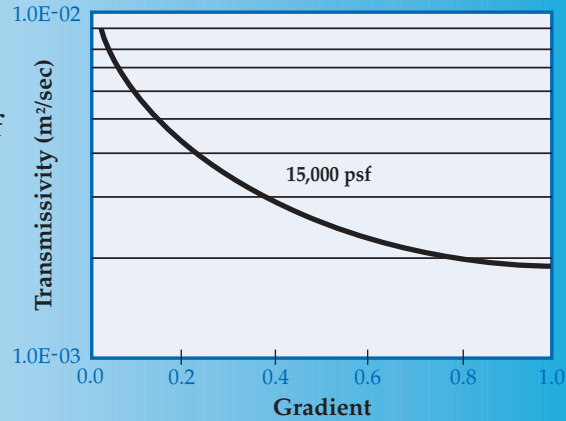
email: salesmkg@agruamerica.com

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Drain Liner™/Smooth HDPE
Transmissivity under 15,000 psf
Normal stress
ASTM D4716



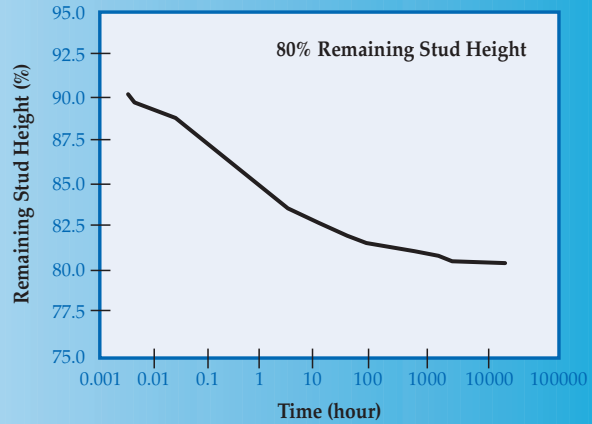


Drain Liner™ 10,000 hour Creep

Testing under 15,000 psf

Normal stress

ASTM D5262



Geomembrane Standard Frequency of Testing



Product Data

Property	Test Method	Frequency of testing (minimum)*
Thickness (min. ave.), mil	ASTM D5994/D5199	per roll
Asperity Height (min. ave.), mil	GRI GM-12 (for textured liner)	per roll, alternating top/bottom for dbl sided textured liner only
Density, g/cc, minimum	ASTM D792, Method B	200,000 lbs (railcar)
Tensile Properties (ave. both directions)	ASTM D6693, Type IV	
Strength @ Yield (min. ave.), lb/in width	2 in/minute	
Elongation @ Yield (min. ave.), % (GL=1.3in)	5 specimens in each direction	20,000 lbs
Strength @ Break (min. ave.), lb/in width		
Elongation @ Break (min. ave.), % (GL=2.0in)		
Tear Resistance, lbs. (min. ave.)	ASTM D1004	45,000 lbs
Puncture Resistance, lbs. (min. ave.)	ASTM D4833	45,000 lbs
Carbon Black Content (range in %)	ASTM D4218	20,000 lbs
Carbon Black Dispersion (Category)	ASTM D5596	45,000 lbs
Stress Crack Resistance (NCTL), hours	ASTM D5397, Appendix	200,000 lbs (railcar)
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O ₂	200,000 lbs (railcar) on finished liner
Melt Flow Index, g/10 minutes	ASTM D1238, 190°C, 2.16kg	200,000 lbs (railcar) on incoming resin
Low Temperature Brittleness, °C	ASTM D746, -60°C	200,000 lbs (railcar) on finished liner
Oven Aging	ASTM D5721	per resin formulation
with HP OIT, (% retained after 90 days)	ASTM D5885, 150°C, 500psi O ₂	
UV Resistance	GRI GM11	per resin formulation
with HP OIT, (% retained after 1600 hours)	ASTM D5885, 150°C, 500psi O ₂	
2% Secant Modulus, lb/in. (max.)	ASTM D5323	per resin formulation- for LLDPE liner only
Axi-Symmetric Break Resistance Strain, % (min.)	ASTM D5617	per resin formulation- for LLDPE liner only

These test frequencies meet or exceed GRI's GM-13

***Theses test frequencies may be changed based on project specifications, and represent the minimum MQC testing performed. Additional costs may be incurred if required testing is greater than listed above**

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