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## **TECHNICAL DROP-IN SPECIFICATION**

**FlexLiner™ Series of LLDPE-R Geomembranes**

### **STANDARD GRADE**

Linear Low Density Polyethylene Reinforced (LLDPE-R)

Smooth and Textured

20 mil-60mil

**(908) 558-0899 | [www.e2geomembranes.com](http://www.e2geomembranes.com)**

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The following technical drop-in specifications are provided as guidelines to be customized and finalized by the design engineer for preparing specific project specifications. This information is provided for reference purposes only and is not intended as a warranty or guarantee. E SQUARED Technical Textiles assumes no liability in connection with the use of this information. Please visit the E SQUARED website at [www.e2geomembranes.com](http://www.e2geomembranes.com) for current product specification sheets.

## **REINFORCED LLDPE-R GEOMEMBRANE SPECIFICATION**

Reinforced LLDPE-R Geomembranes serve as liners and covers for the containment of water, leachate or other liquids. As a liner they can contain the liquid to prevent leakage or environmental impact, and as a cover to minimize evaporation or contamination. It is of great importance that the Reinforced Polyethylene Geomembrane be free from defects and installed without damage to perform as designed.

### **A. DESCRIPTION**

#### **1. GENERAL:**

The purpose of this specification is to provide details of Manufacturing Quality Control (MQC), Manufacturing Quality Assurance (MQA), Construction Quality Control (CQC), and Construction Quality Assurance (CQA) for the manufacture and pre-assembly of geomembrane products. The Contractor shall furnish all labor, material, and equipment to install the Reinforced Polyethylene Geomembrane including all necessary and incidental items as detailed or required to complete the installation in accordance with the Contract Drawing and these Specifications

#### **2. RELATED WORK:**

Related Contract Work is described in the following section of the specification as approved by the CQA Engineer.

#### **3. REFERENCE STANDARDS:**

- ASTM D5199 *Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.*
- ASTM D5994 *Standard Test Method for Measuring Core Thickness of Textured Geomembranes.*
- ASTM D7466 *Standard Test Method for Measuring Asperity Height of Textured Geomembranes.*
- ASTM D751 *Standard Test Methods for Coated Fabrics.*
- ASTM D5884 *Standard Test Method for Determining Tearing Strength of Internally Reinforced Geomembranes.*
- ASTM D7004 *Standard Test Method for Grab Tensile Properties of Reinforced Geomembranes.*
- ASTM D4833 *Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.*
- ASTM D5885 *Standard Test Method for Determining Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry.*
- The latest revision of the following standard of the Geosynthetic Research Institute (GRI) are hereby made a part of these specifications:
- GRI GM25 *Standard Specification for Test Methods, Test Properties and Testing Frequency for Reinforced Linear Low-Density Polyethylene (LLDPE-R) Geomembranes.*



#### 4. QUALITY ASSURANCE:

Quality Assurance during installation of Reinforced LLDPE-R Geomembrane will be provided by the Owner as described in the accompanying Project CQA Manual.

#### 5. MANUFACTURERS QUALIFICATIONS:

a. The Manufacturer shall have previously demonstrated his ability to produce the required Reinforced LLDPE-R Geomembrane by having successfully manufactured a minimum of 10,000,000 ft<sup>2</sup> of scrim reinforced Polyethylene Geomembrane.

#### 6. INSTALLER QUALIFICATIONS:

The Reinforced LLDPE-R Geomembrane Installer shall have installed a minimum of 2,000,000 ft<sup>2</sup> of LLDPE-R Geomembrane (or similar material) across the full 20-60 mil spectrum.

#### 7. WARRANTIES:

The manufacturer of the Reinforced LLDPE-R Geomembrane will warrant the material to the installer on a pro rata basis for up to 20 years from the date of shipping, based on thickness of product, the application and location of the installation. This warranty shall include but not be limited to defects related to workmanship and manufacturing for a period of one year from the date of shipping.

### B. MATERIALS

#### 1. GENERAL:

The materials supplied under these Specifications shall consist of first-quality 100% virgin products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

#### 2. REINFORCED LLDPE-R GEOMEMBRANE MATERIALS:

a. Reinforced LLDPE-R Geomembrane shall be manufactured to meet the following requirements:

1. Provide finished product free from holes, pin holes, bubbles, blisters, excessive gels, undispersed resins and/or carbon black, or contamination by foreign matter.
2. Reinforced LLDPE-R Geomembrane shall be a Linear Low-Density LLDPE-R geomembrane composed of a heavy encapsulated 9 X 9 weft inserted 1000 denier anti-wicking polyester reinforcement for the 20 mil, 30 mil, 36 mil, 45 mil and 60 mil geomembranes.
3. Certified as PFAS free.
4. Must be BABAA compliant and made in the U.S.A.
5. Must be a standard width of 120.0" with fully encapsulated edges.

b. Approved Reinforced LLDPE-R Geomembrane:

1. FlexLiner™ 20 Smooth LLDPE-R  
FlexLiner™ 30 Smooth LLDPE-R  
FlexLiner™ 30N (textured one-side) LLDPE-R  
FlexLiner™ 36 Smooth LLDPE-R  
FlexLiner™ 36N (textured one-side) LLDPE-R  
FlexLiner™ 45 Smooth LLDPE-R  
FlexLiner™ 45N (textured one-side) LLDPE-R  
FlexLiner™ 60 Smooth LLDPE-R  
FlexLiner™ 60N (textured one-side) LLDPE-R  
As manufactured by E SQUARED Technical Textiles, Hillside, NJ
2. Equal material, as approved by the Engineer.



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### C. FACTORY FABRICATION

1. When Reinforced LLDPE-R Geomembrane are supplied in pre-fabricated panels. They shall be of maximum size to provide the largest manageable sheet for the fewest seams.
2. Factory seams are produced by thermal sealing methods and shall have a minimum seam width of 1 ½ inch scrim to scrim.
3. Factory seams are 100% visually inspected and destructive testing is done to verify quality compliance.
4. Labels on the panels shall identify the thickness, length, width, lot and panel numbers, and name of Manufacturer.
5. Factory pre-assembled panels are accordion folded and rolled on a cardboard core. Rolled panels are wrapped in a protective layer for shipment.

### D. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer:

#### 1. PRE-INSTALLATION REQUIREMENTS:

Prior to Reinforced LLDPE-R Geomembrane installation, the Contractor shall submit the following:

- a. Certificate of Conformance and Sample: Prior to shipping to the site, the Contractor shall submit a certificate or affidavit signed by a legally authorized official of the Manufacturer for the Reinforced LLDPE-R Geomembrane attesting that the Reinforced LLDPE-R Geomembrane meets the physical and manufacturing requirements stated in these Specifications. The Contractor shall also submit a sample of the Reinforced LLDPE-R Geomembrane to be used (sample may be of different color). The sample shall be labeled with the product name and be accompanied by the Manufacturer's specifications.
- b. Shipping, Handling, and Storage Instructions: The Manufacturer's plan for shipping, handling, and storage shall be submitted for review.
- c. Installation Procedures: Submit installation procedures for carrying out the work. Installation procedures to be addressed shall include but not be limited to material installation, repair, and protection to be provided in the event of rain or strong winds. With regard to protection, the Contractor shall provide a plan of sufficiently anchoring the Reinforced LLDPE-R Geomembrane to satisfy the Contractor's Performance Warranty. This plan shall be approved by the Engineer prior to construction.
- d. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into the construction.
- e. Provide manufacturer's certification letter stating the geomembrane exceeds the current requirements to be called "Made in the USA" according to the Build America, Buy America guidance as stated in the Bipartisan Infrastructure Law (Infrastructure Investment and Jobs Act of 2021).

#### 2. POST-INSTALLATION REQUIREMENTS:

Upon completion of the Reinforced LLDPE-R Geomembrane installation, the Contractor shall submit the following:

- a. Completed material performance warranty.

### E. SITE PREPERATION AND INSTALLATION

1. Installation shall be in done in accordance with the Manufacturers Geomembrane Installation Guidelines.



**TABLE 1:**  
**FLEXLINER™ LLDPE-R REINFORCED GEOMEMBRANE 20 MIL**  
**BLACK/BLACK; SMOOTH/SMOOTH**

<b>Weight</b>	2.6 oz./yd <sup>2</sup>	(88 g/m <sup>2</sup> )
<b>Yarn</b>	Polyester	
<b>Polymer</b>	LLDPE	
<b>Color</b>	Black	
<b>Sealing</b>	Hot Air, Wedge	
<b>Width</b>	120.0 in	

PHYSICAL PROPERTIES	UNITS	TEST METHOD	TYPICAL VALUE
Thickness	mils	ASTM D751	20.0 (+/- 5%); 0.51
Weight	mm	ASTM D751	15.0 (+/- 5%); 475
Tear Resistance (Tongue Tear)	oz/yd <sup>2</sup> ; g/m <sup>2</sup>	ASTM D5884	60 (MD)/(TD); 267 (MD)/(TD)
Break Strength (Grab Tensile)	lbs; N	ASTM D7004	215 (MD)/(TD); 956 (MD)/(TD)
Elongation	lbs; N	ASTM D7003	22.0%
Adhesion – Ply	%	ASTM D751	10; 44
Adhesion – Weld	lb/in; N/25mm	ASTM D413	30; 263
Puncture Resistance (Flat Tip)	lbs; N	ASTM D4833	70; 311
Dimensional Stability (Max)	%	ASTM D1204	2.0%
Max Static Use Temperature	°F; °C		180; 82
Min Static Use Temperature	°F; °C		-70; -57

**Product Specifications are minimum values, actual results may be higher**

*We believe this information is the best currently available on the subject. It is provided as a suggestion in any appropriate experimentation you may care to undertake. It is subject to revision as additional knowledge, information and experience are gained. We make no guarantee of results and assume no obligation, warranty or liability whatsoever in connection with this information. In case of conflict between standard and metric specifications, standard shall apply.*

**TABLE 2:**  
**FLEXLINER™ LLDPE-R REINFORCED GEOMEMBRANE 30 MIL**  
**BLACK/BLACK; SMOOTH/SMOOTH**

<b>Weight</b>	2.6 oz./yd <sup>2</sup>	(88 g/m <sup>2</sup> )
<b>Yarn</b>	Polyester	
<b>Polymer</b>	LLDPE	
<b>Color</b>	Black	
<b>Sealing</b>	Hot Air, Wedge	
<b>Width</b>	120.0 in	

PHYSICAL PROPERTIES	UNITS	TEST METHOD	TYPICAL VALUE
Thickness	mils; mm	ASTM D751	30.0 (+/- 5%); 0.76
Weight	oz/yd <sup>2</sup> ; g/m <sup>2</sup>	ASTM D751	20.0 (+/- 5%); 678
Tear Resistance (Tongue Tear)	lbs; N	ASTM D5884	70 (MD)/(TD); 311 (MD)/(TD)
Break Strength (Grab Tensile)	lbs; N	ASTM D7004	220 (MD)/(TD); 979 (MD)/(TD)
Elongation	%	ASTM D7003	22.0%
Adhesion – Ply	lb/in; N/25mm	ASTM D6636	30; 88
Adhesion – Weld	lb/in; N/50mm	ASTM D413	30; 263
Low Temperature Bend Test (1/8" Mandrel, 4 hours)	°F; °C	ASTM D2136	-40; -40
Low Temperature Impact Test	°F; °C	ASTM D2137	-40; -40
Puncture Resistance (Flat Tip)	lbs; N	ASTM D4833	80; 356
Dimensional Stability (Max)	%	ASTM D1204	2.0%
Max Static Use Temperature	°F; °C		180; 82
Min Static Use Temperature	°F; °C		-70; -57

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**TABLE 3:**  
**FLEXLINER™ LLDPE-R REINFORCED GEOMEMBRANE 30 MIL**  
**BLACK/BLACK; SMOOTH/TEXTURED**

<b>Weight</b>	2.6 oz./yd <sup>2</sup>	(88 g/m <sup>2</sup> )
<b>Yarn</b>	Polyester	
<b>Polymer</b>	LLDPE	
<b>Color</b>	Black	
<b>Sealing</b>	Hot Air, Wedge	
<b>Width</b>	120.0 in	

PHYSICAL PROPERTIES	UNITS	TEST METHOD	TYPICAL VALUE
Thickness	mils; mm	ASTM D751	30.0 (+/- 5%); 0.76
Asperity Height (nominal)	mils; mm	ASTM D751	7.0 (+/- 5%); 0.18
Weight	oz/yd <sup>2</sup> ; g/m <sup>2</sup>	ASTM D751	20.0 (+/- 5%); 678
Tear Resistance (Tongue Tear)	lbs; N	ASTM D5884	70 (MD)/(TD); 311 (MD)/(TD)
Break Strength (Grab Tensile)	lbs; N	ASTM D7004	220 (MD)/(TD); 979 (MD)/(TD)
Elongation	%	ASTM D7003	22.0%
Adhesion – Ply	lb/in; N/25mm	ASTM D6636	30; 88
Adhesion – Weld	lb/in; N/50mm	ASTM D413	30; 263
Low Temperature Bend Test (1/8" Mandrel, 4 hours)	°F; °C	ASTM D2136	-40; -40
Low Temperature Impact Test	°F; °C	ASTM D2137	-40; -40
Puncture Resistance (Flat Tip)	lbs; N	ASTM D4833	80; 356
Dimensional Stability (Max)	%	ASTM D1204	2.0%
Max Static Use Temperature	°F; °C		180; 82
Min Static Use Temperature	°F; °C		-70; -57

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**TABLE 4:**
**FLEXLINER™ LLDPE-R REINFORCED GEOMEMBRANE 36 MIL  
BLACK/BLACK; SMOOTH/SMOOTH**

<b>Weight</b>	2.6 oz./yd <sup>2</sup>	(88 g/m <sup>2</sup> )
<b>Yarn</b>	Polyester	
<b>Polymer</b>	LLDPE	
<b>Color</b>	Black	
<b>Sealing</b>	Hot Air, Wedge	
<b>Width</b>	120.0 in	

PHYSICAL PROPERTIES	UNITS	TEST METHOD	TYPICAL VALUE
Thickness	mils; mm	ASTM D751	36.0 (+/- 5%); 0.91
Weight	oz/yd <sup>2</sup> ; g/m <sup>2</sup>	ASTM D751	24.0 (+/- 5%); 814
Tear Resistance (Tongue Tear)	lbs; N	ASTM D5884	80 (MD)/(TD); 356 (MD)/(TD)
Break Strength (Grab Tensile)	lbs; N	ASTM D7004	240 (MD)/(TD); 1068 (MD)/(TD)
Elongation	%	ASTM D7003	22.0%
Adhesion – Ply	lb/in; N/25mm	ASTM D6636	20; 88
Adhesion – Weld	lb/in; N/50mm	ASTM D413	30; 263
Low Temperature Bend Test (1/8" Mandrel, 4 hours)	°F; °C	ASTM D2136	-40; -40
Low Temperature Impact Test	°F; °C	ASTM D2137	-40; -40
Puncture Resistance (Flat Tip)	lbs; N	ASTM D4833	75; 334
Dimensional Stability (Max)	%	ASTM D1204	2.0%
Max Static Use Temperature	°F; °C		180; 82
Min Static Use Temperature	°F; °C		-70; -57

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**TABLE 5:**  
**FLEXLINER™ LLDPE-R REINFORCED GEOMEMBRANE 36 MIL**  
**BLACK/BLACK; SMOOTH/TEXTURED**

<b>Weight</b>	2.6 oz./yd <sup>2</sup>	(88 g/m <sup>2</sup> )
<b>Yarn</b>	Polyester	
<b>Polymer</b>	LLDPE	
<b>Color</b>	Black	
<b>Sealing</b>	Hot Air, Wedge	
<b>Width</b>	120.0 in	

PHYSICAL PROPERTIES	UNITS	TEST METHOD	TYPICAL VALUE
Thickness	mils; mm	ASTM D751	36.0 (+/- 5%); 0.91
Asperity Height (nominal)	mils; mm	ASTM D751	7.0 (+/- 5%); 0.18
Weight	oz/yd <sup>2</sup> ; g/m <sup>2</sup>	ASTM D751	24.0 (+/- 5%); 814
Tear Resistance (Tongue Tear)	lbs; N	ASTM D5884	80 (MD)/(TD); 356(MD)/(TD)
Break Strength (Grab Tensile)	lbs; N	ASTM D7004	240 (MD)/(TD); 1068 (MD)/(TD)
Elongation	%	ASTM D7003	22.0%
Adhesion – Ply	lb/in; N/25mm	ASTM D6636	20; 88
Adhesion – Weld	lb/2 in; N/50mm	ASTM D413	30; 263
Low Temperature Bend Test (1/8" Mandrel, 4 hours)	°F; °C	ASTM D2136	-40; -40
Low Temperature Impact Test	°F; °C	ASTM D2137	-40; -40
Puncture Resistance (Flat Tip)	lbs; N	ASTM D4833	75; 334
Dimensional Stability (Max)	%	ASTM D1204	2.0%
Max Static Use Temperature	°F; °C		180; 82
Min Static Use Temperature	°F; °C		-70; -57

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**TABLE 6:**  
**FLEXLINER™ LLDPE-R REINFORCED GEOMEMBRANE 45 MIL**  
 BLACK/BLACK; SMOOTH/SMOOTH

<b>Weight</b>	2.6 oz./yd <sup>2</sup>	(88 g/m <sup>2</sup> )
<b>Yarn</b>	Polyester	
<b>Polymer</b>	LLDPE	
<b>Color</b>	Black	
<b>Sealing</b>	Hot Air, Wedge	
<b>Width</b>	120.0 in	

PHYSICAL PROPERTIES	UNITS	TEST METHOD	TYPICAL VALUE
Thickness	mils; mm	ASTM D751	45.0 (+/- 5%); 1.04
Weight	oz/yd <sup>2</sup> ; g/m <sup>2</sup>	ASTM D751	28.0 (+/- 5%); 949
Tear Resistance (Tongue Tear)	lbs; N	ASTM D5884	100 (MD)/(TD); 445 (MD)/(TD)
Break Strength (Grab Tensile)	lbs; N	ASTM D7004	250 (MD)/(TD); 1112 (MD)/(TD)
Elongation	%	ASTM D7003	22.0%
Adhesion – Ply	lb/in; N/25mm	ASTM D6636	30; 131
Adhesion – Weld	lb/2 in; N/50mm	ASTM D413	30; 263
Puncture Resistance (Flat Tip)	lbs; N	ASTM D4833	85; 378
Dimensional Stability (Max)	%	ASTM D1204	2.0%
Max Static Use Temperature	°F; °C		180; 82
Min Static Use Temperature	°F; °C		-70; -57

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**TABLE 7:**  
**FLEXLINER™ LLDPE-R REINFORCED GEOMEMBRANE 45 MIL**  
**BLACK/BLACK; SMOOTH/TEXTURED**

<b>Weight</b>	2.6 oz./yd <sup>2</sup>	(88 g/m <sup>2</sup> )
<b>Yarn</b>	Polyester	
<b>Polymer</b>	LLDPE	
<b>Color</b>	Black	
<b>Sealing</b>	Hot Air, Wedge	
<b>Width</b>	120.0 in	

PHYSICAL PROPERTIES	UNITS	TEST METHOD	TYPICAL VALUE
Thickness	mils; mm	ASTM D751	45.0 (+/- 5%); 1.04
Asperity Height (nominal)	mils; mm	ASTM D751	7 mils (+/- 5%); 0.18
Weight	oz/yd <sup>2</sup> ; g/m <sup>2</sup>	ASTM D751	29.4 (+/- 5%); 997
Tear Resistance (Tongue Tear)	lbs; N	ASTM D5884	100 (MD)/(TD); 445 (MD)/(TD)
Break Strength (Grab Tensile)	lbs; N	ASTM D7004	275 (MD)/(TD); 1223 (MD)/(TD)
Elongation	%	ASTM D7003	22.0%
Adhesion – Ply	lb/in; N/25mm	ASTM D6636	30; 131
Adhesion – Weld	lb/2 in; N/50mm	ASTM D413	30; 263
Puncture Resistance (Flat Tip)	lbs; N	ASTM D4833	85; 378
Dimensional Stability (Max)	%	ASTM D1204	2.0%
Max Static Use Temperature	°F; °C		180; 82
Min Static Use Temperature	°F; °C		-82; -57

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**TABLE 8:**  
**FLEXLINER™ LLDPE-R REINFORCED GEOMEMBRANE 60 MIL**  
 BLACK/BLACK; SMOOTH/SMOOTH

<b>Weight</b>	2.6 oz./yd <sup>2</sup>	(88 g/m <sup>2</sup> )
<b>Yarn</b>	Polyester	
<b>Polymer</b>	LLDPE	
<b>Color</b>	Black	
<b>Sealing</b>	Hot Air, Wedge	
<b>Width</b>	120.0 in	

PHYSICAL PROPERTIES	UNITS	TEST METHOD	TYPICAL VALUE
Thickness	mils; mm	ASTM D751	60.0 (+/- 5%); 1.52
Weight	oz/yd <sup>2</sup> ; g/m <sup>2</sup>	ASTM D751	40.0 (+/- 5%); 1356
Tear Resistance (Tongue Tear)	lbs; N	ASTM D5884	100 (MD)/(TD); 445 (MD)/(TD)
Break Strength (Grab Tensile)	lbs; N	ASTM D7004	290 (MD)/(TD); 1290 (MD)/(TD)
Elongation	%	ASTM D7003	22.0%
Adhesion – Ply	lb/in; N/25mm	ASTM D6636	30; 131
Adhesion – Weld	lb/2 in; N/50mm	ASTM D413	30; 263
Low Temperature Bend Test (1/8" Mandrel, 4 hours)	°F; °C	ASTM D2136	-40; -40
Low Temperature Impact Test	°F; °C	ASTM D2137	-40; -40
Puncture Resistance (Flat Tip)	lbs; N	ASTM D4833	100; 445
Dimensional Stability (Max)	%	ASTM D1204	2.0%
Max Static Use Temperature	°F; °C		180; 82
Min Static Use Temperature	°F; °C		-70; -57

*Available in Matte and Dimple finish embossing.*

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**TABLE 9:**  
**FLEXLINER™ LLDPE-R REINFORCED GEOMEMBRANE 60 MIL**  
 BLACK/BLACK; SMOOTH/TEXTURED

<b>Weight</b>	2.6 oz./yd <sup>2</sup>	(88 g/m <sup>2</sup> )
<b>Yarn</b>	Polyester	
<b>Polymer</b>	LLDPE	
<b>Color</b>	Black	
<b>Sealing</b>	Hot Air, Wedge	
<b>Width</b>	120.0 in	

PHYSICAL PROPERTIES	UNITS	TEST METHOD	TYPICAL VALUE
Thickness	mils; mm	ASTM D751	60.0 (+/- 5%); 1.52
Asperity Height (nominal)	mils; mm	ASTM D751	7 mils (+/- 5%); 0.18
Weight	oz/yd <sup>2</sup> ; g/m <sup>2</sup>	ASTM D751	40.0 (+/- 5%); 1356
Tear Resistance (Tongue Tear)	lbs; N	ASTM D5884	100 (MD)/(TD); 445 (MD)/(TD)
Break Strength (Grab Tensile)	lbs; N	ASTM D7004	290 (MD)/(TD); 1290 (MD)/(TD)
Elongation	%	ASTM D7003	22.0%
Adhesion – Ply	lb/in; N/25mm	ASTM D6636	30; 131
Adhesion – Weld	lb/2 in; N/50mm	ASTM D413	30; 263
Low Temperature Bend Test (1/8" Mandrel, 4 hours)	°F; °C	ASTM D2136	-40; -40
Low Temperature Impact Test	°F; °C	ASTM D2137	-40; -40
Puncture Resistance (Flat Tip)	lbs; N	ASTM D4833	100; 445
Dimensional Stability (Max)	%	ASTM D1204	2.0%
Max Static Use Temperature	°F; °C		180; 82
Min Static Use Temperature	°F; °C		-70; -57

*Available in Matte and Dimple finish embossing.*

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