



DROP-IN SPECIFICATIONS FOR CONCRETE PROTECTION LINERS

The following drop-in specifications is a sample guideline to be customized by the engineer for preparing site specific specification. This information is provided for reference purposes only and is not intended as a warranty or guarantee. GSE assumes no liability in connection with the use of this information. Please contact GSE for current specifications.

1 GENERAL

1.1 SCOPE

This drop-in specification covers the technical requirements for the Manufacturing and Installation of the concrete protection product. All materials meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
1. D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
 2. D 1603 Test Method for Carbon Black in Olefin Plastics
 3. D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
 4. D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
 5. D 6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
 6. D 1204 Standard Test Method for Linear Dimensional Changes of Nongrid Thermoplastic Sheeting or Film at Elevated Temperature
 7. D 696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer
 8. D 746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
 9. D 570 Standard Test Method for Water Absorption of Plastics
 10. E 96 Standard Test Method for Water Vapor Transmission of Material

1.3 POST AWARD AND SUBMITTALS

- A. All work for and in connection with the installation of the lining, field seaming and welding joints shall be completed in strict conformity with all applicable instructions and recommendations of the liner manufacturer.
- B. All surfaces in contact with corrosive, erosive environment or environments susceptible to mechanical damage shall be lined with GSE StudLiner as manufactured by GSE Lining Technology, Inc.
- C. At the request of the Engineer, Pre-Caster or End User, samples, datasheets, installation instructions, etc will be provided.
- D. Included with the shipment of liner, submit certified test reports that the liner and material are manufactured in accordance with standards specified herein.

1.4 QUALIFICATIONS

- A. The HDPE liner specified in this section shall be furnished by a manufacturer who is fully experienced, reputable and qualified in the manufacturing of the materials. The manufacturer must at least 10 years of manufacturing experience.
- B. The HDPE liner and all raw materials and components shall be manufactured or produced in the United States of America.

- C. Locking devices must be extruded to the sheet as a one step process.
- D. Liner shall be GSE StudLiner as manufactured by GSE Lining Technology, Inc.
- E. Liner shall be produced in the United States.
- F. Liner shall be 8 feet in width.
- G. Liner shall demonstrate a minimum pull-out strength of 14,000 psf.

2.0 PRODUCT

2.1 ROLL DIMENSIONS

- A. Concrete protection product shall be produced in rolls that are 8.0 ft (2.4 m) in width and a thickness range of 80 mils (2.0 mm) to 200 mils (5.0 mm) in thickness. Roll lengths vary according to thickness.
- B. Locking studs of the same material as that of the liner shall be integrally extruded with the sheet. Stud spacing shall be on approximate 1.25 in (30 mm) centers, such that there are approximately 110 studs per square foot (1200 per square meter).

2.2 MATERIAL PROPERTIES

- A. The material used in the embedment liner and in all welding strips shall be made from 97-98% virgin high density polyethylene produced in the United States of America and 1.5-3% carbon black or pigmentation for the purpose of an otherwise specified color.
- B. Plasticizer shall not be added to the resin formulation.
- C. Concrete protection product and welding strips shall be free of holes, pinholes, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges and be manufactured in the United States of America.
- D. All HDPE cap strips and patches shall be made from coextruded conductive HDPE to facilitate spark testing, have good impact resistance and have an elongation sufficient to bridge up to 1/4 inch settling cracks.
- E. Cap strips shall be approximately 6 inches wide or greater and shall be equivalent to that of the liner.
- F. Material shall maintain a repairable state through it's lifecycle by methods approved and recommended by the manufacturer.
- G. Concrete protection product shall have the following physical properties when tested in accordance with Table 2.2G and be manufactured in the United States of America.

Table 2.2 G: GSE StudLiner Concrete Protection Liner

TESTED PROPERTY	TEST METHOD	FREQUENCY	NOMINAL VALUE			
Thickness, mm (mil)	ASTM D 5199	Every 5th roll	2.00 (80)	3.00 (120)	4.00 (160)	5.00 (200)
Density, g/cm ³	ASTM D 1505	1/1 00,000 ft ²	0.94	0.94	0.94	0.94
Tensile Properties (each direction)	ASTM D 6693, Type IV Dumbbell	1/100,000 ft ²	2,200	2,200	2,200	2,200
Strength at Yield, lb/in ² (MPa)	G.L. = 2.0 in (50 mm)		(15.2)	(15.2)	(15.2)	(15.2)
Elongation at Break, %			500	500	500	500
Stud Pull-Out Strength ¹ , lb/ft ² (kN/m ²)		1/product	>14,000 (669.89)	>14,000 (669.89)	>14,000 (669.89)	>14,000 (669.89)
Carbon Black Content/Pigment Content, %	ASTM D 1603*/421 8	1/100,000 ft ²	2-3	2-3	2-3	2-3
Black (carbon)	ASTM D 5630, Modified		1.5-2.5	1.5-2.5	1.5-2.5	1.5-2.5
Gray (pigment)						
Carbon Black Dispersion ²	ASTM D 5596	1/100,000 ft ²	Note 2	Note 2	Note 2	Note 2
Notched Constant Tensile Load, hours	ASTM D 5397	1/formulation	1,000	1,000	1,000	1,000
Coefficient of Linear Thermal Expansion, per °C	ASTM D 696	1/product	1 .20E-04	1 .20E-04	1 .20E-04	1 .20E-04
Low Temperature Brittleness, °C	ASTM D 746	1/product	-77	-77	-77	-77
Dimensional Stability, % (each direction)	ASTM D 1204	1/product	±1.0	±1.0	±1.0	±1.0
Water Absorption, %	ASTM D 570	1/product	0.1	0.1	0.1	0.1
Water Vapor Transmission, (g/m ² /day)	ASTM E 96	1/product	<0.01	<0.01	<0.01	<0.01
Roll Width, ft (m)			8 (2.44)	8 (2.44)	8 (2.44)	8 (2.44)
Roll Length, ft (m)			246 (74.97)	213 (64.91)	196 (59.73)	196 (59.73)
Roll Area, ft ² (m ²)			1,968 (182.83)	1,704 (158.30)	1,568 (145.67)	1,568 (145.67)

NOTES:

¹Note: Concrete must have compressive strength of at least 5,000 lb/in² (34,500 kPa).

²Note: Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from category 3.

H. Raw resin shall have the following properties when tested in accordance with Table 2.2H and be manufactured in the United States of America.

Table 2.2 H: Raw Material Properties

Property	Test Method	Value	Testing Frequency
Density, g/cm ³	ASTM D 1505	0.932	1/ resin lot
Melt Flow, g/10 min	ASTM D 1238 (190/2.16)	≤ 1.0	1/ resin lot
OIT, minutes	ASTM D 3895 (1atm/200°C)	100	1/ formulation

2.3 MATERIAL SUPPLY

- A. Concrete protection product shall be supplied in roll form, sheets, pre-fabricated tubes or panels.
- B. Cap strips shall be supplied in 6 inch widths or greater.
- C. All materials shall be manufactured and fabricated in the United States of America.

2.4 MATERIAL HANDLING AND STORAGE

- A. Materials are to be handled as to prevent damage.
- B. The on-site storage location for geomembrane material, provided by the CONTRACTOR to protect the liner from punctures, abrasions and excessive

dirt and moisture. Storage area should have the following characteristics:

1. level (no wooden pallets)
2. smooth
3. dry
4. protected from theft and vandalism

2.5 MANUFACTURING CERTIFICATION

- A. All resins and raw materials and resins used in the manufacturing process of the HDPE liner shall be certified as manufactured and produced in the United States of America.
- B. All HDPE liners shall be certified as manufactured in the United States of America.
- C. Manufacturer shall, upon request, submit a statement letter certifying that all HDPE liners are manufactured in the United States of America.

END OF SECTION