XR® Geomembranes by Seaman Corporation

XR® GEOMEMBRANES
By Seaman Corporation

Technical Data & Specifications for XR® Geomembranes

Industrial, Municipal, and Potable Water Grade Geomembranes

XR-5® XR-3®
XR-3®PW XR-5®PW
XR-5®ULT

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Industrial, Municipal, and Potable Water Grade Geomembranes

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Unless stated otherwise, values presented represent the minimum expected measurements at the time of manufacture. This information is offered as a suggestion in any appropriate experimentation you may care to undertake. It is subject to revision as additional knowledge and experience are gained.

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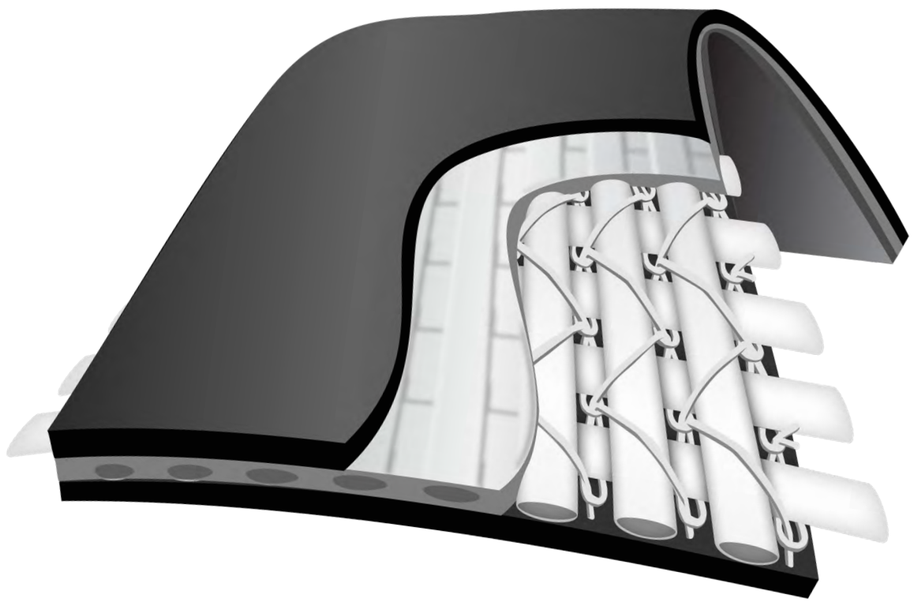
XR® Geomembrane Product Overview

- All **XR® Geomembrane** products are classified as an Ethylene Interpolymer Alloy (EIA)
- All **XR® Geomembranes** are fabric reinforced and are manufactured as polymer coated fabrics
- **XR-5®** grade is high strength and chemically resistant for maximum resistance to high temperature, and broad chemical resistance, including acids, oils and methane
- **XR-3®** grade for moderate chemical resistant requirement applications such as stormwater and domestic wastewater
- NSF 61 approved **XR-5 PW®** and **XR-3 PW®** grades for potable water contact
- **XR-5® ULT** for enhanced cold weather flexibility
- Heat weldable-thermal weldable for seams as strong as the membrane. Factory panels over 15,000 square feet (1400 sq meters) for less field seaming
- Stability is excellent, with low thermal expansion-contraction properties. All **XR® Geomembranes** are thermoplastic.
- **30+ year** application history



XR-5® : High Performance Composite Geomembrane

XR® Geomembrane Product Applications

Non Potable Applications	8130/8138/9146 XR-5® 9832 XR-5®G	8130 XR-5® ULT	8228 XR-3®
High Strength	•	•	
Long-term UV Resistance	•	•	•
Floating Covers	•	•	
Hydrocarbon/Chemical Resistance	•	•	
Floating Diversion Baffles/Curtains	•	•	
INDUSTRIES: Municipal Wastewater	•	•	•
Hydrocarbon (Secondary Containment)	•	•	
Mining	•	•	
Industrial Process	•	•	
Portable Spill Berms	•	•	
Airport Fuel Containment	•	•	
Deicing Applications	•	•	
Brine Storage	•	•	
Low temp handling		•	

Potable Water Applications	8142 XR-5PW®	8130 XR-3PW®	8228 XR-3PW®
Storage Tank Diversion Baffles		•	•
Tank Liners		•	•
Floating Reservoir Covers	•		
Reservoir Liners	•	•	
Disinfection Liners/ Baffles		•	•

XR® GEOMEMBRANES By Seaman Corporation

Materials for Non-Potable Applications

Municipal Wastewater
Hydrocarbon (Secondary Containment)
Mining
Industrial Process
Portable Spill Berms
Airport Fuel Containment
Deicing Applications
Brine Storage
Low temp handling

(see material applications, page 1)

Physical Property	Test Method	8130 XR-5®	8138 XR-5®	9146 XR-5®	9832 XR-5®G	8130 XR-5® ULT	8228 XR-3®
Base Fabric Type Base Fabric Weight (nominal)	ASTM D 751	Polyester 6.5 oz/yd² (220 g/m²)	Polyester 6.5 oz/yd² (220 g/m²)	Polyester 11 oz/yd² (373 g/m²)	Polyester 7.5 oz/yd² (254 g/m²)	Polyester 6.5 oz/yd² (220 g/m²)	Polyester 3.0 oz/yd² (102 g/m²)
Thickness	ASTM D 751	30 mils min. (0.76 mm min.)	40 mils nom. (1.00 mm nom.)	50 mils minimum (1.27 mm minimum)	36 mils min. (0.91 mm min.)	30 mils min. (0.76 mm min.)	30 mils nom. (0.76 mm nom.)
Weight	ASTM D 751	30.0 ± 2 oz/yd² (1017 ± 70 g/m²)	38.0 ± 2 oz/yd² (1288 ± 70 g/m²)	46.0 ± 2 oz/yd² (1560 ± 68 g/m²)	32.0 ± 2 oz/yd² (1085 ± 70 g/m²)	30.0 ± 2 oz/yd² (1017 ± 70 g/m²)	28.0 ± 2 oz/yd² (950 ± 70 g/m²)
Tear Strength	ASTM D 751 *Trap Tear*	40/55 lbf min. (175/245 N min.)	40/55 lbf min. (175/245 N min.)	40/55 lbf min. (175/245 N min.)	50/50 lbf nom. (233/233 N min.)	40/55 lbf min. (175/245 N min.)	30/30 lbf min. (133/133 N min.)
Breaking Yield Strength	ASTM D 751 *Grab Tensile*	550/550 lbf min. (2448/2448 N min.)	550/550 lbf min. (2448/2448 N min.)	850/900 lbf min. (3781/4003 N min.)	650/650 lbf min. (2892/2892 N min.)	550/550 lbf min. (2448/2448 N min.)	250/200 lbf min. (1112/890 N min.)
Dimensional Stability	ASTM D 1204 *100° C/1hour*	0.5% max each direction	0.5% max each direction	0.5% max each direction	0.5% max each direction	0.5% max each direction	5.0% max each direction
Hydrostatic Resistance	ASTM D 751 *Method A*	800 psi min. (5.51 MPa min.)	800 psi min. (5.51 MPa min.)	800 psi min. (5.51 MPa min.)	800 psi min. (5.51 MPa min.)	800 psi min. (5.51 MPa min.)	300 psi min. (2.06 MPa min.)
Blocking Resistance	ASTM D 751 *180° F (82° C)*	#2 Rating max.	#2 Rating max.	#2 Rating max.	#2 Rating max.	#2 Rating max.	#2 Rating max.
Adhesion-Ply	ASTM D 413 *Type A*	15 lbf/in min. (13 daN/5 cm min.) *or film tearing bond*	15 lbf/in min. (13 daN/5 cm min.) *or film tearing bond*	15 lbf/in min. (13 daN/5 cm min.) *or film tearing bond*	15 lbf/in min. (13 daN/5 cm min.) *or film tearing bond*	15 lbf/in min. (13 daN/5 cm min.) *or film tearing bond*	12 lbf/in min. (13 daN/5 cm min.)
Adhesion -Heat Welded Seam *(minimum)*	ASTM D 751 *Dielectric Weld*	40 lbf/2" RF weld (17.5 daN/5 cm)	40 lbf/2" RF weld (17.5 daN/5 cm)	40 lbf/2" RF weld (17.5 daN/5 cm)	40 lbf/2" RF weld (17.5 daN/5 cm)	40 lbf/2" RF weld (17.5 daN/5 cm)	10 lbf/2" RF weld (9.0 daN/5 cm)
Dead Load Seam Strength	ASTM D 751 *4 hour Test @ 70° F (21° C)*	Pass 240 lbf/in (1068 N/2.54 cm)	Pass 240 lbf/in (1068 N/2.54 cm)	Pass 240 lbf/in (1068 N/2.54 cm)	Pass 266 lbf/in (1184 N/2.54 cm)	Pass 240 lbf/in (1068 N/2.54 cm)	Pass 100 lbf/in (445 N/2.54 cm)
	ASTM D 751 *4 hour Test @ 160° F (70° C)*	Pass 120 lbf/in (534 N/2.54 cm)	Pass 120 lbf/in (534 N/2.54 cm)	Pass 120 lbf/in (534 N/2.54 cm)	Pass 133 lbf/in (592 N/2.54 cm)	Pass 120 lbf/in (534 N/2.54 cm)	Pass 50 lbf/in (220 N/2.54 cm)
Bonded Seam Strength	ASTM D 751 *Procedure A - Grab*	550 lbf min. (2450 N min.)	550 lbs min. (2450 N min.)	850 lbs min. (3781 N min.)	650 lbs min. (2893 N min.)	550 lbs min. (2450 N min.)	250 lbs min. (1112 N min.)
Abrasion Resistance	ASTM D 3389 *H-18 Wheel 1kg Load*	2000 cycles min. *before fabric exposure,* 50 mg/100 cycles *max. weight loss*	2000 cycles min. *before fabric exposure,* 50 mg/100 cycles *max. weight loss*	2000 cycles min. *before fabric exposure,* 50 mg/100 cycles *max. weight loss*	2000 cycles min. *before fabric exposure,* 50 mg/100 cycles *max. weight loss*	2000 cycles min. *before fabric exposure,* 50 mg/100 cycles *max. weight loss*	Not Specified
Weathering Resistance	Carbon Arc ASTM G 153	8000 hours min. *with no appreciable changes or stiffening or cracking of coating*	8000 hours min. *with no appreciable changes or stiffening or cracking of coating*	8000 hours min. *with no appreciable changes or stiffening or cracking of coating*	8000 hours min. *with no appreciable changes or stiffening or cracking of coating*	8000 hours min. *with no appreciable changes or stiffening or cracking of coating*	8000 hours min. *with no appreciable changes or stiffening or cracking of coating*
Water Absorption	ASTM D 471, *Section 12 - 7 Days*	0.025 kg/m² max. @ 70° F/ 21° C 0.14 kg/m² max. @ 212° F/ 100° C	0.025 kg/m² max. @ 70° F/ 21° C 0.14 kg/m² max. @ 212° F/ 100° C	0.025 kg/m² max. @ 70° F/ 21° C 0.14 kg/m² max. @ 212° F/ 100° C	0.025 kg/m² max. @ 70° F/ 21° C 0.14 kg/m² max. @ 212° F/ 100° C	0.025 kg/m² max. @ 70° F/ 21° C 0.14 kg/m² max. @ 212° F/ 100° C	0.05 kg/m² max. @ 70° F/ 21° C 0.28 kg/m² max. @ 212° F/ 100° C
Wicking	ASTM D 751	1/8" max. (0.3 cm max.)	1/8" max. (0.3 cm max.)	1/8" max. (0.3 cm max.)	1/8" max. (0.3 cm max.)	1/8" max. (0.3 cm max.)	1/8" max. (0.3 cm max.)
Bursting Strength	ASTM D 751 *Ball Tip*	750 lbf min. (3330 N min.)	750 lbf min. (3330 N min.)	1100 lbf min. (4895 N min.)	950 lbf min. (3330 N min.)	750 lbf min. (3330 N min.)	950 lbf min. (3330 N min.)
Puncture Resistance	ASTM D 4833	275 lbf min. (1200 N min.)	275 lbs min. (1200 N min.)		275 lbs min. (1200 N min.)	275 lbs min. (1200 N min.)	50 lbs min. (225 N min.)
Coefficient of Thermal Expansion/Contraction *(maximum)*	ASTM D 696	8x10⁻⁶ in/in/° F. (1.4x10⁻⁵ cm/cm/° C)	8x10⁻⁶ in/in/° F (1.4x10⁻⁵ cm/cm/° C)	8x10⁻⁶ in/in/° F (1.4x10⁻⁵ cm/cm/° C)	8x10⁻⁶ in/in/° F. (1.4x10⁻⁵ cm/cm/° C)	8x10⁻⁶ in/in/° F (1.4x10⁻⁵ cm/cm/° C)	Not Specified
Environmental/Chemical Resistant Properties	30-day Full Immersions	*See Chemical Resistance Table, pg 8-9*	*See Chemical Resistance Table, pg 8-9*	*See Chemical Resistance Table, pg 8-9*	*See Chemical Resistance Table, pg 8-9*	*See Chemical Resistance Table, pg 8-9*	Water/ Municipal Wastewater only
Cold Crack	ASTM D 2136 *4 hrs, 1/8" Mandrel*	Pass @ -30° F Pass @ -34° C	Pass @ -30° F Pass @ -34° C	Pass @ -10° F Pass @ -23° C	Pass @ -30° F Pass @ -34° C	Pass @ -50° F Pass @ -45° C	Pass @ -25° F Pass @ -32° C
Elongation @ Yield	20% min	20% min	20% min			20% min	

Materials for
Potable Water Applications

Municipalities
Industrial
Reservoir Liners
Baffle Curtains

(see material applications, page 1)

Physical Property	Test Method	8142 XR-5®PW	8130 XR-3®PW	8228 XR-3®PW
Base Fabric Type Base Fabric Weight (nominal)	ASTM D 751	Polyester 6.5 oz/yd² (220 g/m²)	Polyester 6.5 oz/yd² (220 g/m²)	Polyester 3.0 oz/yd² (100 g/m²)
Thickness	ASTM D 751	45 mils min. (1.13 mm min.)	30 mils min. (0.76 mm min.)	30 mils min. (0.76 mm min.)
Weight	ASTM D 751	42.0 ± 2 oz/yd² (1424 ± 70 g/m²)	30.0 ± 2 oz/yd² (1017 ± 70 g/m²)	28.0 ± 2 oz/yd² (950 ± 68 g/m²)
Tear Strength	ASTM D 751 *Trap Tear*	40/55 lbf min. (175/245 N min.)	40/55 lbf min. (175/245 N min.)	30/30 lbf min. (133/133 N min.)
Breaking Yield Strength	ASTM D 751 *Grab Tensile*	550/550 lbf min. (2448/2448 N min.)	550/550 lbf min. (2448/2448 N min.)	250/200 lbf min. (1110/890 N min.)
Cold Crack		Pass @ -30° F (-35° C)	Pass @ -30° F (-35° C)	Pass @ -25° F (-32° C)
Dimensional Stability	ASTM D 1204 *100° C/1hour*	0.5% max each direction	0.5% max each direction	5.0% max each direction
Hydrostatic Resistance	ASTM D 751 *Method A*	800 psi min. (5.51 MPa min.)	800 psi min. (5.51 MPa min.)	300 psi min. (2.07 MPa min.)
Blocking Resistance	ASTM D 751 *180° F (82° C)*	#2 Rating max.	#2 Rating max.	#2 Rating max.
Adhesion-Ply	ASTM D 413 *Type A*	15 lbf/in. min. (13 daN/5 cm min.) *or film tearing bond*	15 lbf/in. min. (13 daN/5 cm min.) *or film tearing bond*	12 lbf/in. (10 daN/5 cm) *approx.*
Adhesion - Heat Welded Seam *(minimum)*	ASTM D 751 *Dielectric Weld*	40 lbf/2" RF weld (17.5 daN/5 cm.)	40 lbf/2" RF weld (17.5 daN/5 cm)	10 lbf/in. RF weld (17.5 daN/5 cm)
Dead Load Seam Strength	ASTM D 751 *4 hour Test @ 70° F (21° C)*	Pass 240 lbf/in. (1068 N/2.54 cm)	Pass 240 lbf/in. (1068 N/2.54 cm)	Pass 100 lbf/in. (445 N/2.54 cm)
	ASTM D 751 *4 hour Test @ 160° F (70° C)*	Pass 120 lbf/in. (534 N/2.54 cm)	Pass 120 lbf/in. (534 N/2.54 cm)	Pass 50 lbf/in. (220 N/2.54 cm)
Bonded Seam Strength	ASTM D 751 *Procedure A - Grab*	550 lbf min. (2450 N min.)	550 lbf min. (2450 N min.)	250 lbf min. (1112 N min.)
Abrasion Resistance	ASTM D 3389 *H-18 Wheel 1kg Load*	2000 cycles min. *before fabric exposure,* 50 mg/100 cycles *max. weight loss*	2000 cycles min. *before fabric exposure,* 50 mg/100 cycles *max. weight loss*	2000 cycles min.
Weathering Resistance	Carbon Arc ASTM G 153	8000 hours min. *with no appreciable changes or stiffening or cracking of coating*	8000 hours min. *with no appreciable changes or stiffening or cracking of coating*	8000 hours min. *with no appreciable changes or stiffening or cracking of coating*
Water Absorption	ASTM D 471, *Section 12 - 7 Days*	0.025 kg/m² max. @ 70° F/ 21° C 0.14 kg/m² max. @ 212° F/ 100° C	0.025 kg/m² max. @ 70° F/ 21° C 0.14 kg/m² max. @ 212° F/ 100° C	0.05 kg/m² max. @ 70° F/ 21° C 0.28 kg/m² max. @ 212° F/ 100° C
Wicking	ASTM D 751	1/8" max. (0.3 cm max.)	1/8" max. (0.3 cm max.)	1/8" max. (0.3 cm max.)
Bursting Strength	ASTM D 751 *Ball Tip*	750 lbf min. (3330 N min.)	750 lbf min. (3330 N min.)	350 lbf min. (1557 N min.)
Puncture Resistance	ASTM D 4833	275 lbs min. (1200 N min.)	275 lbs min. (1200 N min.)	50 lbf min. (225 N min.)
Coefficient of Thermal Expansion/Contraction *(maximum)*	ASTM D 696	8x10⁻⁶ in/in/° F. (1.4x10⁻⁵ cm/cm/° C)	8x10⁻⁶ in/in/° F. (1.4x10⁻⁵ cm/cm/° C)	8x10⁻⁶ in/in/° F. (1.4x10⁻⁵ cm/cm/° C)
Potable Water Certified	Testing and certification by NSF	NSF 61 approved for potable water	NSF 61 approved for potable water	NSF 61 approved for potable water
Elongation @ Yield Break	20% min	20% min	20% min	

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Part A
Chemical Resistance (XR-5® Membranes)

Exposure	Rating
AFFF *(Aqueous Fire Fighting Foam)*	A
Acetic Acid (5%)	B
Acetic Acid (50%)	C
Acrylonitrile (10%)	A
Ammonium Phosphate	T
Ammonium Sulfate	T
Antifreeze (Ethylene Glycol)	A
Animal Oil	A
Aqua Regia	X
ASTM Fuel A (100% Iso-Octane)	A
ASTM Oil #2 (Flash Pt. 240° C)	A
ASTM Oil #3	A
Benzene	X
Black Liquor (Typical)	A
Biodiesel	B
Calcium Chloride Solutions	T
Calcium Hydroxide	T
Chloramine – PW (0.05%)	A
Chloramine – PW (1%)	A
Chlorobenzene	X
20% Chlorine Solution	A
Chlorine – PW (2 mg/l)	A
Clorox	A
Conc. Ammonium Hydroxide	A
Corn Oil	A
Crude Oil	A
Diesel Fuel	A

Exposure	Rating
Dimethyl Sulfoxide (10%)	A
Envirotemp® FR3	A
Ethanol	A
Ethyl Acetate	C
Ethyl Alcohol	A
Ethylene Dichloride	C
Ethylene Dichloride 0.1%	A
Ferric Chloride	A
Flowback/ Produced Water *(typical)*	A
#2 Fuel Oil	A
#6 Fuel Oil	A
Furfural	X
Gasoline	B
Glycerin	A
Hexane	A
Hydraulic Fluid *(Petroleum Based)*	A
Hydraulic Fluid *(Phosphate Ester Based)*	C
Hydrocarbon Type II (40% Aromatic)	C
Hydrochloric Acid (36%)	A
Hydrochloric Acid (50%)	A
Hydrofluoric Acid (5%)	A
Hydrofluoric Acid (50%)	A
Hydrofluosilicic Acid (30%)	A
Hydrogen Peroxide (2%, 3%, 35%)	T
Isopropyl Alcohol	T
Ivory Soap	A
Jet A	A

Exposure	Rating
JP-4 Jet Fuel	A
JP-5 Jet Fuel	A
JP-8 Jet Fuel	A
Kerosene	T
Liquid Nitrogen Fertilizer (28%)	A
Magnesium Chloride	T
Magnesium Hydroxide	T
Methanol	A
Methyl Alcohol	A
Methyl Ethyl Ketone	X
Mineral Spirits	A
Municipal Landfill Leachate *(typical)*	A
N-Serve® Nitrogen Stabilizer	C
Naphtha (White Gas)	A
Naphtha (TT-N-95B NOT.2 TYPE I)	A
Natural Gas Condensate *Synthetic Solution*	A
Nitric Acid (5%)	B
Nitric Acid (50%)	C
Palm Oil	A
Palm Oil (140° F)	A
Peracetic Acid – PW (15%)	A
Perchloroethylene	C
Phenol	X
Phenol Formaldehyde	B
Phosphoric Acid (50%)	A
Phosphoric Acid (85%)	A
Phosphoric Acid (100%)	C

Exposure	Rating
Phosphoric Chek® 075 Fire Retardant (60%)	A
Phthalate Plasticizer	C
Potassium Acetate (50%)	A
Potassium Chloride	T
Potassium Sulphate	T
Raw Linseed Oil	A
Roundup®	A
SAE-30 Oil	A
Salt Water (25%)	B
Sea Water	A
Shell Diala® Transformer Oil	A
Sodium Acetate Solution	T
Sodium Bisulfite Solution	T
Sodium Hydroxide (60%)	A
Sodium Hypochlorite (15%)	A
Sodium Hypochlorite - PW (1%)	A
Sodium Hypochlorite – PW (500 mg/l)	A
Sodium Hypochlorite – PW (50 mg/l)	A
Sodium Phosphate	T
Styrene Monomer	C
Sulfuric Acid (50%)	A
Sulfuric Acid ((10%, 140° F)	A
Tanic Acid (50%)	A
THF - Tetrahydrofuran	X
THF - Tetrahydrofuran (9%)	A
Toluene	C
Transformer Oil	A

Exposure	Rating
Turpentine	A
Urea Formaldehyde	A
UAN (28%) *Urea Ammonium Nitrogen*	A
Varsol	A
Vegetable Oil	A
Water	A
Water (Deionized)	A
Water (LSI -5)	A
Water (180°F)	A
White Gas	A
Xylene	C
Zinc Chloride	T

Rating Key:

A – *Fluid has little or no effect*
B – *Fluid has minor to moderate effect*
C – *Fluid has severe effect*
T – *No data - likely to be acceptable*
X – *No data - not likely to be acceptable*

Notes:

1. Results of visual and physical strength testing after 30 days minimum of constant exposure at room temperature.
2. All solutions are 100% unless indicated otherwise.
3. All XR-5® samples simulate field conditions with the treated base fabric exposed at edges.
4. XR-5® samples are completely submerged.
5. Solutions not on this chart should be tested prior to application.
6. "PW" refers to XR-5® PW products

Part B
Vapor Transmission Data (XR-5®)

Tested according to ASTM D 0814 Inverted Cup Method and/or ASTM E-96.
All tests with 8130 XR-5® Black are typical values.
All tests were run at room temperature.

Liquid	Test Method	SVT g/m² /day (typ.)	SVT fl. oz/ft²/day (typ.)	Hydraulic Conductivity* cm/sec
AFFF 3%	ASTM D 814	7.74	0.025	1.65×10^{-11}
ASTM Fuel B	ASTM D 814	65.25	0.283	7.76×10^{-11}
Crude Oil	ASTM D 814	2.70	0.010	1.68×10^{-12}
Diesel, No. 2	ASTM D 814	4.11	0.015	8.12×10^{-10}
Gasoline	ASTM D 814	130.93	0.612	3.58×10^{-11}
Jet A	ASTM D 814	13.13	0.052	7.14×10^{-11}
JP 8	ASTM D 814	6.05	0.024	3.29×10^{-11}
Kerosene	ASTM D 814	0.83	0.003	4.66×10^{-12}
Kerosene	ASTM E 96	1.30	0.005	7.27×10^{-12}
Methanol	ASTM D 814	19.52	0.081	1.34×10^{-11}
Water	ASTM D 814	4.05	0.013	8.77×10^{-12}

** Equivalent Hydraulic Conductivity (typical) per Koerner 2012, Sec 5.1.2*

Part C
Chemical Resistance Studies (XR-5®)

28 day immersion, room temperature, exposed edges, 100% solution; XR-5®.

i) Welded seam strength after immersion

Liquid	Seam Shear Strength, lbf	Seam Shear Strength, N
Control	340 – No Seam Failure	1513 –No Seam Failure
Kerosene	355	1579
Crude Oil	320	1424
Hydraulic Fluid	385	1713
Toluene	0 – Adhesion Failure	0 – Adhesion Failure
Naptha	380	1691
Perchlorethylene	390	1735

11 year immersion, room temperature, exposed edges, 100% solution, 8130 XR-5®, 2" thermal welds.

Liquid	Seam Shear Strength, lbf	Seam Shear Strength, N
Control	40 lbf/ 2" (20 lbf/in)	178 N/5 cm (89 N/2.54 cm)
Kerosene	40	178
Crude Oil	18	80
Naptha	33	146
JP4 Jet Fuel	33	146
Diesel Fuel	25	111

ii) Membrane strength after immersion in petroleum products

6 ½ year immersion, room temperature, exposed edges, 100% solution, 8130 XR-5®.

Liquid	Breaking (Yield) Strength - % retention *ASTM D 75 Proc B, 1" (2.54 cm)*
Kerosene	106%
Crude Oil	101%
Naptha	99%
JP4 Jet Fuel	101%
Diesel Fuel	99%

Example Immersion Results

Results from full immersion of XR-5® in various test chemicals, waste streams, or contaminated liquids.
All testing with 8130 XR-5® using *ASTM D 751* test methods, unless indicated otherwise.

No special sample preparation so that field conditions would be best simulated.
All test results are from single immersions and should be considered typical.

Solution	Immersion Period	Test	Specification Value *(imp.)*	Result	Specification Value *(metric)*	Result
26% UAN	60 days	Trap Tear	40/55 lbf	53/73 lbf	175/245 N	235/324 N
		Grab Tensile	550/550 lbf	608/719 lbf	2448/2448 N	2705/3200 N
3% AFFF	90 days	Strip Tensile	400/350 lbf	370/347 lbf	1780/1557 N	1646/1544 N
		Trap Tear	40/55 lbf	50/76 lbf	175/245 N	222/338 N
Concentrated Caustic with phenols	30 days	Strip Tensile	400/350 lbf	460/405 lbf	1780/1557 N	2047/1557 N
		Trap Tear	40/55 lbf	72/100 lbf	175/245 N	320/445 N
		Weight	30 +2/-1 oz/yd²	32 oz/yd²	1017 g/m²	1084 g/m²
Groundwater with Cresote	32 days	Grab Tensile	550/550 lbf	611/556 lbf	2448/2448 N	2718/2474 N
		Trap Tear	40/55 lbf	47/58 lbf	175/245 N	209/258 N
40% Ferric Chloride	30 days	Strip Tensile	400/350 lbf	408/393 lbf	1780/1557 N	1815/1748 N
		Weight	30 oz/yd²	32.7 oz/yd²	1017 g/m²	1108 g/m²
Flowback *Marcellus Shale*	30 days	Strip Tensile	400/350 lbf	399/434 lbf	1780/1557 N	1775/1886 N
		Trap Tear	40/55 lbf	48/66 lbf	175/245 N	213/293 N
50% Potassium Acetate	30 days *(6730 XR-5®)*	Grab Tensile		612/572 lbf	2448/2448 N	2723/2545 N
Natural Gas Condensate, *Synthetic*	30 days	Grab Tensile	550/550 lbf	614/681 lbf	2448/2448 N	2732/3030 N
		Trap Tear	40/55 lbf	42/63 lbf	175/245 N	186/280 N
Methanol	30 days	Strip Tensile	400/350 lbf	374/351 lbf	1780/1557 N	1664/1561 N
		Trap Tear	40/55 lbf	56/75 lbf	175/245 N	249/333 N
		Weld Adhesion	40 lbf/2"	30 lbf/in	89 N/2.54 cm	133 N/2.54 cm
3 % Hydrogen Peroxide	365 days	Strip Tensile	400/350 lbf	454/413 lbf	1780/1557 N	2020/1837 N
		Trap Tear	40/55 lbf	52/81 lbf	175/245 N	231/360 N
Palm Oil	365 days	Strip Tensile	400/350 lbf	471/451 lbf	1780/1557 N	2095/2006 N
		Trap Tear	40/55 lbf	52/84 lbf	175/245 N	231/373 N
85% Phosphoric Acid	30 days	Strip Tensile	400/350 lbf	426/409 lbf	1780/1557 N	1895/1820 N
		Trap Tear	40/55 lbf	28/37 lbf	175/245 N	124/164 N
3% AFFF	365 days	Strip Tensile	400/350 lbf	415/412 lbf	1780/1557 N	1846/1833 N
		Water Vapor Transmission *(ASTM E-96)*		0.0249 oz/24 hr/ft²		0.3165 g/m²/day
15% Sodium Hypochlo-rite	365 days	Strip Tensile	400/350 lbf	403/369 lbf	1780/1557 N	1793/1642 N
		Elongation @ Break	20%/20%	24.3%/37.0%	20%/20%	24.3%/37.0%

Laboratory Studies

- Atlas Carbon Arc, ASTM G 153 - Over 10,000 hours of continuous irradiance with 18 minutes of water spray every two hours. This exposure reflexes conditions recommended by industry for exposure of textiles, paint, rubber, and plastics. The samples showed no loss in flexibility and no significant color change.
- Xenon Ci65 Weather-o-Meter, ASTM G 155, Table X3.1 - Over 12,000 hours of exposure using a 6500/3500 watt Xenon burner tube with borosilicate glass inner and outer optical filter to simulate the SPD of natural daylight throughout the actinic region with little to no effect.
- Fluorescent Light UV Exposure (UV A-340) ASTM G 154 - 24,000+ hours of continuous exposure simulating the short and middle UV wavelength region of daylight at 70° C for 8 hours followed by a condensation cycle of 50° C for 4 hours. The material exhibited no significant color loss or flexibility.

Field Studies

- Emmaqua Testing, ASTM E838 - The XR-5® as subjected to 3 million Langleys of exposure in Arizona, showing no signs of degradation with no evidence of cracking, blistering, swelling or adhesion failure of the coating.
- Weathering Rack - 12 ½ years of a southerly facing weathering rack in Sarasota, Florida at 45°. No significant color loss, cracking, crazing, blistering, or adhesion failure of the coating was noted.

Longevity

XR Geomembranes are proven to stand the test of time. In many cases, reservoirs, landfill caps, secondary containments and floating covers were installed 20, 25 or even over 30 years ago are still in service today.

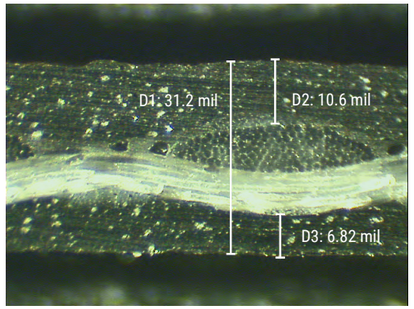
To demonstrate longevity, several long term projects are reviewed in this section. Samples have been retrieved from these XR-5 liners and have been tested for physical parameters and compared to the original specification. Microscopic cross sections are also shown of the aged material, indicating residual thickness after long term sunlight exposure. All of the projects shown have been uncovered and subjected to UV and weathering.

Projects:

NYSERDA West Valley Landfill Cap
Mammoth Cave Wastewater Stabilization Pond
OARDC Solar Pond
City of Houston, Baffle curtain
EPI-The Liner Company - Mancelona Plant Pond

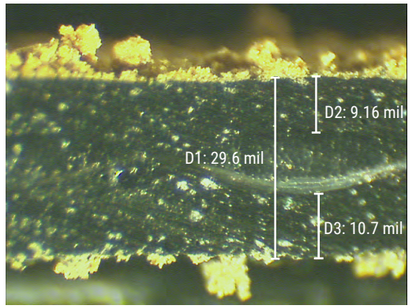
NYSERDA West Valley Landfill Cap

Location: West Valley, NY
Service: 1996 - 2016
Sample Taken: 2016
Size: 500,000 ft²
Owner: NYSERDA
Material installed: 8130 XR-5®
Application: Exposed Landfill Cap



Property	Standard	Specification (New)	Aged Liner
Finished Weight	ASTM D 751	30 oz/yd² (1017 g/m²)	29.6 oz/yd² (1004 g/m²)
Thickness	ASTM D 751	30 mil (0.76 mm)	31.2 mil (0.79 mm)
Strip Tensile (warp/fill)	ASTM D 751 - Procedure B	400/350 lbf/in. (69/61 kN/m)	389/356 lbf/in. (68/62 kN/m)
Strip Tensile % elongation	ASTM D 751	22.0/22.0	19.2/37.0
Grab Tensile (warp/fill)	ASTM D 751	550/550 lbf/in. (96/96 N/mm)	505/508 lbf/in. (88/89 N/mm)
Puncture (Ball Tip)	ASTM D 751	750 lbf (3336N)	550 lbf (2447 N)
Puncture (Screwdriver)	ASTM D 751	124 lbf (551N) nom.	79 lbf (351 N)

Mammoth Cave Wastewater Stabilization Pond

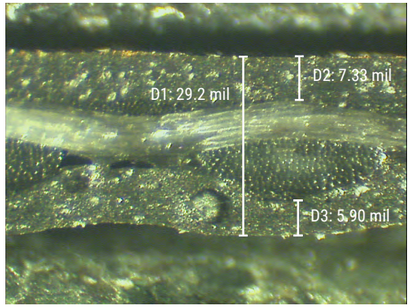


Location: Mammoth Cave, KY
Service: 1984 - Present
Sample Taken: 2017
Size: 30,000 ft²
Owner: U.S. National Park Service
Material installed: 8130 XR-5®
Application: Domestic Wastewater Impoundment

Property	Standard	Specification (New)	Aged Liner
Finished Weight	ASTM D 751	30 oz/yd² (1017 g/m²)	31.8 oz/yd² (1078 g/m²)
Thickness	ASTM D 751	30 mil (0.76 mm)	29.6 mil (0.75 mm)
Strip Tensile (warp/fill)	ASTM D 751 - Procedure B	400/350 lbf/in. (69/61 kN/m)	351/287 lbf/in. (61/50 N/mm)
Strip Tensile % elongation	ASTM D 751	22.0/22.0	18.3/31.1
Grab Tensile (warp/fill)	ASTM D 751	550/550 lbf/in. (96/96 N/mm)	574/566 lbf/in. (101/99 N/mm)
Puncture (Ball Tip)	ASTM D 751	750 lbf (3336N)	650 lbf (2891 N)
Puncture (Screwdriver)	ASTM D 751	124 lbf (551N) nom.	106 lbf (472 N)

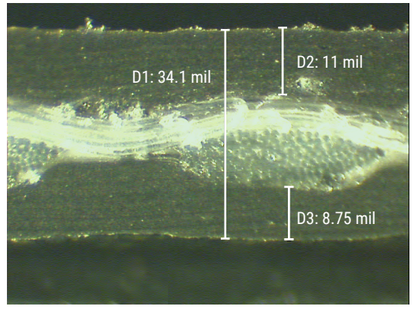
OARDC Solar Pond

Location: Wooster, OH
In Service: 1976-2000
Sample Taken: 2000
Size: 5,000 ft²
Owner: Ohio State University
Material installed: 8130 XR-5®
Application: Solar Pond for Heat Generation



Property	Standard	Specification (New)	Aged Liner
Finished Weight	ASTM D 751	30 oz/yd² (1017 g/m²)	26.4 oz/yd² (895 g/m²)
Thickness	ASTM D 751	30 mil (0.76 mm)	29.2 mil (0.74 mm)
Strip Tensile (warp/fill)	ASTM D 751 - Procedure B	400/350 lbf/in. (69/61 kN/m)	372/402 lbf/in. (65/70 N/mm)
Strip Tensile % elongation	ASTM D 751	22.0/22.0	20.3/34.3
Grab Tensile (warp/fill)	ASTM D 751	550/550 lbf/in. (96/96 N/mm)	641/596 lbf/in. (112/104 N/mm)
Puncture (Ball Tip)	ASTM D 751	750 lbf (3336N)	739 lbf (3287 N)
Puncture (Screwdriver)	ASTM D 751	124 lbf (551N) nom.	91 lbf (404 N)

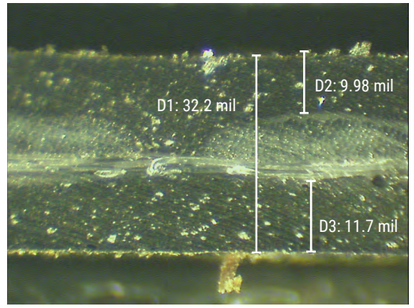
City of Houston, Baffle curtain



Location: Houston, TX
In Service: 2001-2018
Sample Taken: 2018
Size: 20,000 ft²
Owner: City of Houston
Material installed: 8130 XR-5®PW
Application: Finished Water Diversion

Property	Standard	Specification (New)	Aged Liner
Finished Weight	ASTM D 751	30 oz/yd² (1017 g/m²)	27.4 oz/yd² (929 g/m²)
Thickness	ASTM D 751	30 mil (0.76 mm)	34.1 mil (0.87 mm)
Strip Tensile (warp/fill)	ASTM D 751 - Procedure B	400/350 lbf/in. (69/61 kN/m)	388/378 lbf/in. (68/66 N/mm)
Strip Tensile % elongation	ASTM D 751	22.0/22.0	21.2/37
Grab Tensile (warp/fill)	ASTM D 751	550/550 lbf/in. (96/96 N/mm)	580/626 lbf/in. (102/110 N/mm)
Puncture (Ball Tip)	ASTM D 751	750 lbf (3336N)	748 lbf (3327 N)
Puncture (Screwdriver)	ASTM D 751	124 lbf (551N) nom.	104 lbf (463 N)

EPI-The Liner Company - Mancelona Plant Pond



Traverse City, MI
In Service: 1986 - 2015
Sample Taken: 2015
Size: 5,000 ft²
Owner: EPI
Material installed: 8130 XR-5®
Application: Plant Stormwater Runoff Impoundment

Property	Standard	Specification (New)	Aged Liner
Finished Weight	ASTM D 751	30 oz/yd² (1017 g/m²)	27.4 oz/yd² (929 g/m²)
Thickness	ASTM D 751	30 mil (0.76 mm)	32.2 mil (0.82 mm)
Strip Tensile (warp/fill)	ASTM D 751 - Procedure B	400/350 lbf/in. (69/61 kN/m)	413/470 lbf/in. (72/82 N/mm)
Strip Tensile % elongation	ASTM D 751	22.0/22.0	20.4/29.6
Grab Tensile (warp/fill)	ASTM D 751	550/550 lbf/in. (96/96 N/mm)	573/616 lbf/in. (100/108 N/mm)
Puncture (Ball Tip)	ASTM D 751	750 lbf (3336N)	757 lbf (3367 N)
Puncture (Screwdriver)	ASTM D 751	124 lbf (551N) nom.	86 lbf (383 N)

Tensile

XR-5 based on Seaman Corporation specifications, Strip (1")

HDPE based on GRI Specification GRI-GM13 Specifications, rev 14, ASTM D6693, Type IV

Material	Thickness *mils (mm)*	Yield *lbf/in*	Yield *N/2.54 cm*	Break *lbf/in*	Break *N/2.54 cm*
8130 XR-5	30 min. (0.75 min.)	400/350 min.	1780/1557 min.	400/350 min.	1780/1557 min.
8138 XR-5	40 nom. (1.0 nom.)	400/350 min.	1780/1557 min.	400/350 min.	1780/1557 min.
30 mil HDPE *Smooth*	30 min. (0.75 min.)	63 min. (avg.)	280 min. (avg.)	114 min. (avg.)	507 min. (avg.)
40 mil HDPE *Smooth*	40 min. (1.0 min.)	84 min. (avg.)	373 min. (avg.)	152 min. (avg.)	676 min. (avg.)
60 mil HDPE *Smooth*	60 min. (1.5 min.)	126 min. (avg.)	560 min. (avg.)	228 min. (avg.)	1014 min. (avg.)
80 mil HDPE *Smooth*	80 min. (2.0 min.)	168 min. (avg.)	747 min. (avg.)	304 min. (avg.)	1352 min. (avg.)
100 mil HDPE *Smooth*	100 min. (2.5 min.)	210 min. (avg.)	934 min. (avg.)	380 min. (avg.)	1691 min. (avg.)
30 mil HDPE *Textured*	30 min. (0.75 min.)	63 min. (avg.)	280 min. (avg.)	45 min. (avg.)	200 min. (avg.)
40 mil HDPE *Textured*	40 min. (1.0 min.)	84 min. (avg.)	373 min. (avg.)	60 min. (avg.)	267 min. (avg.)
60 mil HDPE *Textured*	60 min. (1.5 min.)	126 min. (avg.)	560 min. (avg.)	90 min. (avg.)	400 min. (avg.)
80 mil HDPE *Textured*	80 min. (2.0 min.)	168 min. (avg.)	747 min. (avg.)	120 min. (avg.)	534 min. (avg.)
100 mil HDPE *Textured*	100 min. (2.5 min.)	210 min. (avg.)	934 min. (avg.)	150 min. (avg.)	667 min. (avg.)

Elongation

XR-5 based on Seaman Corporation specifications, ASTM D751

HDPE based on GRI Specification GRI-GM13 Specifications, rev 14, ASTM D6693, Type IV

Material	Yield Elongation	Break Elongation
8130 XR-5	20% min	20% min
8138 XR-5	20% min	20% min
HDPE *Smooth*	12% min. (avg.)	700% typ.
HDPE *Textured*	12% min. (avg.)	100% typ.

Density

XR-5 based on Seaman Corporation specifications, ASTM D751

HDPE based on GRI Specification GRI-GM13 Specifications, rev 14, ASTM D1505/D792

Material	Density *g/cm³*
8130 XR-5	1.28 nom.
8138 XR-5	1.28 nom.
HDPE *Smooth*	0.94 min.
HDPE *Textured*	0.94 min.

Tear

XR-5 based on Seaman Corporation specifications, Trapezoidal Tear

HDPE based on GRI Specification GRI-GM13 Specifications, rev 14, ASTM D1004

Material	Thickness *mils (mm)*	Tear *lbf*	Tear *N*
8130 XR-5	30 (0.75) min.	40/55 min.	175/245 min.
8138 XR-5	40 (1.0) min.	40/55 min.	175/245 min.
30 mil HDPE *Smooth*	30 (0.75) min.	21 min. (avg.)	93 min. (avg.)
40 mil HDPE *Smooth*	40 (1.0) min.	28 min. (avg.)	124 min. (avg.)
60 mil HDPE *Smooth*	60 (1.5) min.	42 min. (avg.)	186 min. (avg.)
80 mil HDPE *Smooth*	80 (2.0) min.	56 min. (avg.)	249 min. (avg.)
100 mil HDPE *Smooth*	100 (2.5) min.	70 min. (avg.)	311 min. (avg.)
30 mil HDPE *Textured*	30 (0.75) min.	21 min. (avg.)	93 min. (avg.)
40 mil HDPE *Textured*	40 (1.0) min.	28 min. (avg.)	124 min. (avg.)
60 mil HDPE *Textured*	60 (1.5) min.	42 min. (avg.)	186 min. (avg.)
80 mil HDPE *Textured*	80 (2.0) min.	56 min. (avg.)	249 min. (avg.)
100 mil HDPE *Textured*	100 (2.5) min.	70 min. (avg.)	311 min. (avg.)

Puncture Resistance

XR-5 based on Seaman Corporation specifications, ASTM D 4833

HDPE based on GRI Specification GRI-GM13, ASTM D 433

Material	Puncture Resistance *lbf*	Puncture Resistance *N*
8130 XR-5	275 min	1223 min.
8138 XR-5	275 min	1223 min.
30 mil HDPE *Smooth*	54 min. (avg.)	240 min. (avg.)
40 mil HDPE *Smooth*	72 min. (avg.)	320 min. (avg.)
60 mil HDPE *Smooth*	108 min. (avg.)	480 min. (avg.)
80 mil HDPE *Smooth*	144 min. (avg.)	640 min. (avg.)
100 mil HDPE *Smooth*	180 min. (avg.)	801 min. (avg.)
30 mil HDPE *Textured*	45 min. (avg.)	200 min. (avg.)
40 mil HDPE *Textured*	60 min. (avg.)	267 min. (avg.)
60 mil HDPE *Textured*	90 min. (avg.)	400 min. (avg.)
80 mil HDPE *Textured*	120 min. (avg.)	534 min. (avg.)
100 mil HDPE *Textured*	150 min. (avg.)	667 min. (avg.)

Thermal Expansion/Contraction

XR-5 Data from Antor Laboratories

HDPE Data from "The Intimate Contact Issue of Field Placed Geomembranes with respect to Wave (or Wrinkle) Management" ***Koerner, 2013***

Material	CTE *length/length/ºF*	CTE *length/length/ºC*
XR-5	8.0×10^{-6}	1.4×10^{-5}
HDPE	7.2×10^{-5}	1.3×10^{-4}

Sample specification: 8130 XR-5

For other product specifications, scan here or visit our ***Document Library*** *at* ***www.XRGeomembranes.com***

General

1.01 Scope Of Work

Furnish and install flexible membrane lining in the areas shown on the drawings. All work shall be done in strict accordance with the project drawings, these specifications and membrane lining fabricator's approved shop drawings.

Geomembrane panels will be supplied sufficient to cover all areas, including appurtenances, as required in the project, and shown on the drawings. The fabricator/installer of the liner shall allow for shrinkage and wrinkling of the field panels.

1.02 Products

The lining material shall be 8130 XR-5 as manufactured by Seaman Corporation (1000 Venture Boulevard, Wooster, OH 44691 USA; 330-262-1111), with the following physical specifications:

Physical Property	Test Method	Requirement *Imperial*	Requirement *Metric*
Base Fabric	Type	Polyester	Polyester
Base Fabric Construction	Type	Dip Coated	Dip Coated
Base Fabric Weight	ASTM D 751	6.5 oz/yd^2 nom.	220 g/m^2 nom.
Finished Membrane Weight	ASTM D 751	30 ±1 oz/yd^2	1017 ±2 g/m^2
Trapezoid Tear	ASTM D 751	40/55 lbf min.	175/245 N min.
Yield Tensile Strength	ASTM D751 *Grab Method, Procedure A*	550/550 lbf min.	2448/2448 N min.
Elongation at Yield	ASTM D751	20% min.	20% min.
Adhesion - Ply	ASTM D751 *Type A*	15 lbs min/in or Film Tearing Bond	130 N min/5 cm or Film Tearing Bond
Hydrostatic Resistance	ASTM D751 *Method A*	800 psi min.	5.51 MPa min.
Puncture Resistance	ASTM D4833	275 lbf min.	1200 N min.
Bursting Strength	ASTM D751 *Ball Tip*	750 lbf min.	3300 N min.
Low Temperature Bend	ASTM D2136 *4 hours, 1/8" mandrel*	Pass at -30ºF	Pass at -34º C
Weathering Resistance	ASTM G153 *Carbon Arc, no appreciable changes, or stiffening/cracking or coating*	Pass at 8,000 hours	Pass at 8,000 hours
Dimensional Stability	ASTM D1204 *212ºF/100ºC, 1 hour, each direction*	0.5% max.	0.5% max.
Coefficient of Thermal Expansion/Contraction	ASTM D696	8 x 10^{-6} in/in/ºF max.	*1.4 x 10^{-5} cm/cm/ºC max.*
Abrasion Resistance	ASTM D3389 *H-18 wheel, 100g load*	2000 cycles before base fabric exposure	2000 cycles before base fabric exposure
Wicking	ASTM D751	1/8" max.	0.3 cm max
Water Absorption	ASTM D471 *7 days, 212ºF/100º C*	0.45 oz/ft^2 max.	0.14/kg/m^2 max.
Chemical Resistance			
Dead Load	ASTM D751 *Room Temperature, 2" weld, 4 hours*	Pass at 240 lbf min.	Pass at 1068 N min.
Dead Load	ASTM D751 *160ºF/70ºC, 2" weld, 4 hours*	Pass at 120 lbf min.	Pass @ 534 N min.
Bonded Seam Strength	ASTM D751 *Grab Method, Procedure A*	550 lbf min.	2450 N min.
Adhesion – Thermal Seam	ASTM D751	40 lbf min.2" weld	175 N min./5 cm weld

1.03 Submittals

The fabricator of panels used in this work shall prepare shop drawings with a proposed panel layout to cover the liner area shown in the project plans. Shop drawings shall indicate the direction of factory seams and shall show panel sizes consistent with the material quantity requirements of 1.01.

Details shall be included to show the termination of the panels at the perimeter of lined areas, the methods of sealing around penetrations, and methods of anchoring.

Placement of the lining shall not commence until the shop drawings and details have been approved by the Owner, or his representative.

1.04 Factory Fabrication

The individual XR-5 liner widths shall be factory fabricated into large sheets custom designed for this project so as to minimize field seaming. The number of factory seams must exceed the number of field seams by a factor of at least 10, except as approved by the engineer

A two-inch overlap seam done by heat or RF welding is recommended. The surface of the welded areas must be dry and clean. Pressure must be applied to the full width of the seam on the top and bottom surface while the welded area is still in a melt-type condition. The bottom welding surface must be flat to insure that the entire seam is welded properly. Enough heat shall be applied in the welding process that a visible bead is extruded from both edges being welded. The bead insures that the material is in a melt condition and a successful chemical bond between the two surfaces is accomplished.

Two-inch seams must withstand a minimum of 240 lbf per inch width dead load at 70ºF. and 120 lbf per inch at 160ºF. as outlined in ASTM D-751. All seams must exceed 550 lbf. Bonded seam strength per ASTM D-751 Bonded Seam Strength Grab Test Method, Procedure A.

1.05 Inspection And Testing Of Factory Seams

The fabricator shall monitor each linear foot of seam as it is produced. Upon discovery of any defective seam, the fabricator shall stop production of panels used in this work and shall repair the seam, and determine and rectify the cause of the defect prior to continuation of the seaming process.

The fabricator must provide a Quality Control procedure plan to the owner or his representative which details their procedures for inspections, non destructive testing and destructive testing to ensure leak-proof factory fabrication.

1.06 Certification and Test Reports

Prior to installation of the panels, the fabricator shall provide the Owner, or his representative, with written certification that the factory seams were inspected in accordance with Section 1.05.

1.07 Panel Packaging and Storage

Factory fabricated panels shall be accordian-folded, or rolled, onto a sturdy wooden pallet designed to be moved by a forklift or similar equipment. Each factory fabricated panel shall be prominently and indelibly marked with the panel size. Panels shall be protected as necessary to prevent damage to the panel during shipment.

Panels which have been delivered to the project site shall be stored in a dry area.

1.08 Qualifications of Suppliers

The fabricator of the lining shall be experienced in the installation of flexible membrane lining, and shall provide the Owner or his representative with a list of not less than five (5) projects and not less than 500,000 square feet of successfully installed XR-5 synthetic geomembrane lining. The project list shall show the name, address, and telephone number of an appropriate party to contact in each case. The manufacturer of the sheet goods shall

provide similar documentation with a 10 million square foot minimum, with at least 5 projects demonstrating 15+ years service life.

The installer shall provide similar documentation to that required by the fabricator.

1.09 Subgrade Preparation By Others

Lining installation shall not begin until a proper base has been prepared to accept the membrane lining. Base material shall be free from angular rocks, roots, grass and vegetation. Foreign materials and protrusions shall be removed, and all cracks and voids shall be filled and the surface made level, or uniformly sloping as indicated on the drawings. The prepared surface shall be free from loose earth, rocks, rubble and other foreign matter.

Generally, no rock or other object larger than USCS sand (SP) should remain on the subgrade in order to provide and an adequate safety factor against puncture. Geotextiles may be used to compensate for irregular subgrades.

The subgrade shall be uniformly compacted to ensure against settlement. The surface on which the lining is to be placed shall be maintained in a firm, clean, dry and smooth condition during lining installation.

1.10 Lining Installation

Prior to placement of the liner, the installer will indicate in writing to the owner or his representative that they believe the subgrade to be adequately prepared for the liner placement.

The lining shall be placed over the prepared surface in such a manner as to assure minimum handling. The sheets shall be of such lengths and widths and shall be placed in such a manner as to minimize field seaming.

In areas where wind is prevalent, lining installation should be started at the upwind side of the project and proceed downwind. The leading edge of the liner shall be secured at all times with sandbags or other means sufficient to hold it down during high winds.

Sandbags or rubber tires may be used as required to hold down the lining in position during installation. Materials, equipment or other items shall not be dragged across the surface of the liner, or be allowed to slide down slopes on the lining. All parties walking or working upon the lining material shall wear soft-sole shoes and the geomembrane protected against vehicle egress and other equipment.

Lining sheets shall be closely fit and sealed around inlets, outlets and other projections through the lining.

Lining to concrete seals shall be made with a mechanical anchor, or as shown on the drawings. All piping, structures and other projections through the lining shall be sealed with approved sealing methods.

1.11 XR-5 Field Seaming

All requirements of Section 1.04 and 1.05 apply. Field seaming is not allowed when weather conditions do not provide for adequate welding conditions.

Field fabrication of lining material will not be allowed.

1.12 Inspection

All field seams will be tested using the Air Lance Method [ASTM D 4437-08 (*2013)* section 4.2]. A compressed air source will deliver 55 psi minimum to a 3/16 inch nozzle. The nozzle will be directed to the lip of the field seam in a near perpendicular direction to the length of the field seam. The nozzle will be held 4 inches maximum from the seam and travel at a rate not to exceed 40 feet per minute. Any loose flaps of 1/8" or greater will require a repair.

Alternatively all field seams should also be inspected utilizing the Vacuum Box Technique as described in Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber [ASTM D-5641-94 (*2006*)], using a 3 to 5 psi vacuum pressure. All leaks shall be repaired and tested.

All joints, on completion of work, shall be tightly bonded. Any lining surface showing injury due to scuffing, penetration by foreign objects, or distress from rough subgrade, shall as directed by the Owner or his representative be replaced or covered, and sealed with an additional layer of lining of the proper size, in accordance with the patching procedure.

1.13 Patching

Any repairs to the lining shall be patched with the lining material. The patch material shall have rounded corners and shall extend a minimum of four inches (4") in each direction from the damaged area.

Seam repairs or seams which are questionable should be cap stripped with a 1" wide (min.) strip of the liner material. The requirements of Section 1.11 apply to this cap stripping.

1.14 Warranty

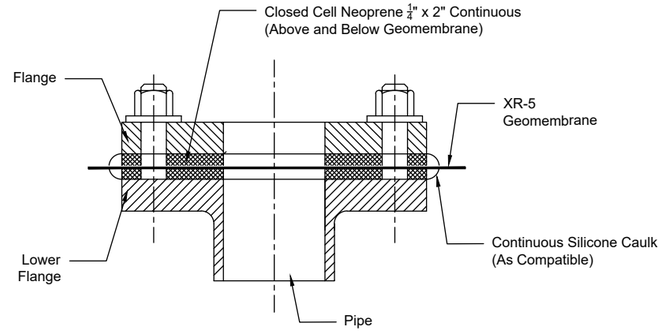
The lining material shall be warranted on a pro-rated basis for 10 years against both weathering and chemical compatibility in accordance with Seaman Corporation warranty for XR-5 Style 8130. A test immersion will be performed by the owner and the samples evaluated by the manufacturer. Workmanship of installation shall be warranted for one year on a 100% basis.

Product specifications available at *www.XRGeomembranes.com*
Click on *Document Library*
and find the *Installation Guides* section

Section 8: Installation Details

Installation detail technical drawings available at *www.XRGeomembranes.com*
Click on *Document Library*
and find the *Technical Drawings* page

XR Geomembrane Installation Details are available
in PDF & DWG formats



SEAMAN CORP 1000 VENTURE BLVD WOOSTER, OH 44691 330.262.1111 www.seamancorp.com www.xrgeomembranes.com	XR-5® Flange Connection to Pipe Typical Section	Rev. Date	Revision
		3/4/2020	fw
	Page No.: 1 of 1 / Drawing: XRD-019		

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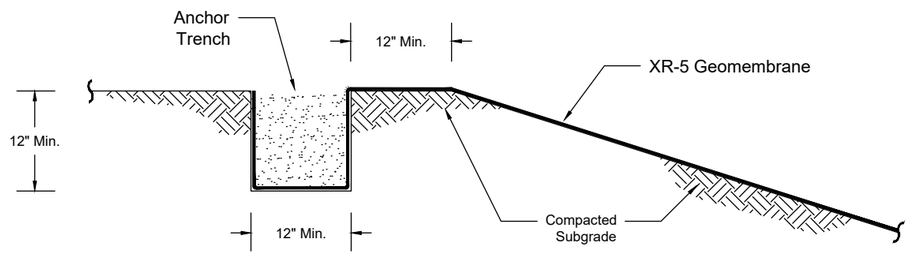

Cross Section

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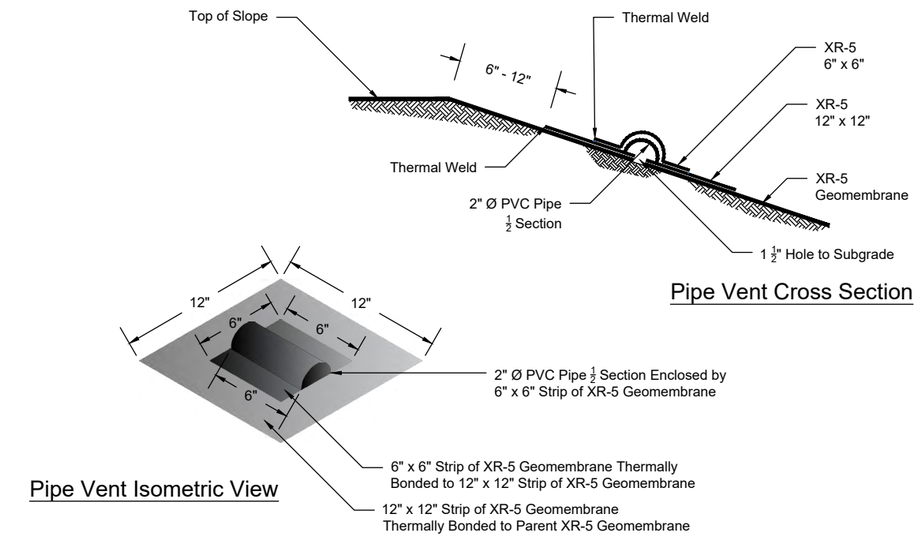
XR-5® Anchor Trench Typical Section

Page No.: 1 of 1
Drawing: XRD-001

Rev. Date	Revision
3/4/2020	fw



Pipe Vent Cross Section

Pipe Vent Isometric View

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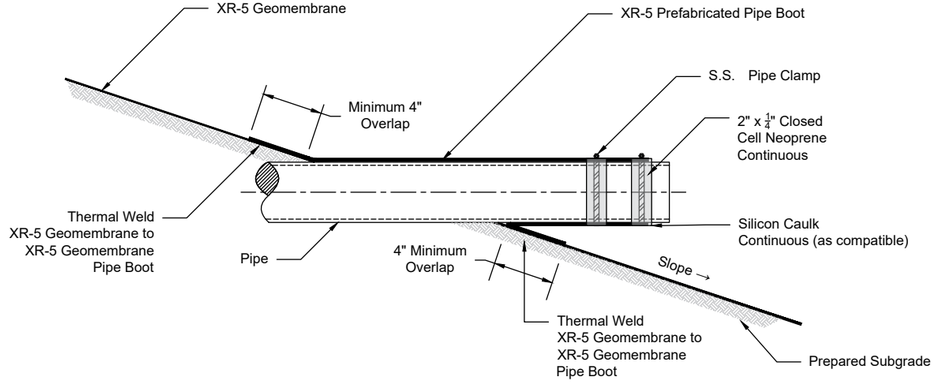
XR-5® Berm Vent Detail

Page No.: 1 of 1
Drawing: XRD-012

Rev. Date	Revision
3/24/2020	fw



Cross Section

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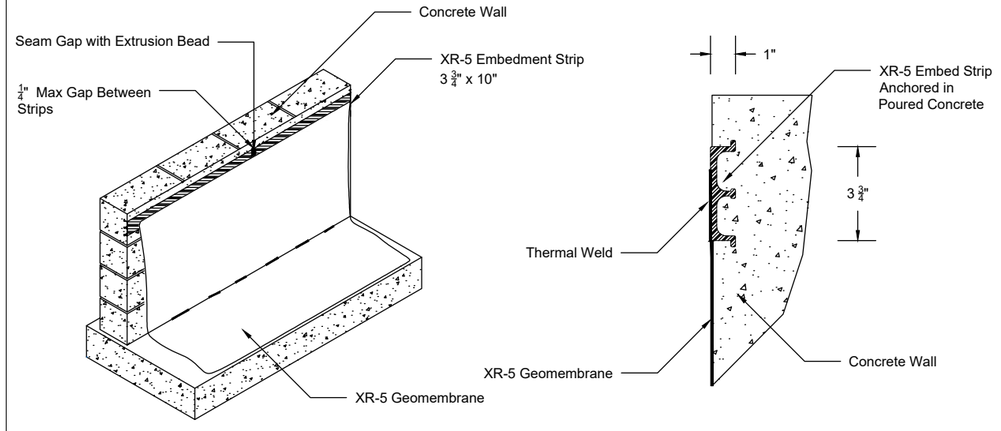
XR-5® Pipe Penetration Detail

Page No.: 1 of 1
Drawing: XRD-018

Rev. Date	Revision
3/20/2020	fw



Isometric View

Cross Section

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XR-5® Embed Detail

Page No.: 1 of 1
Drawing: XRD-020

Rev. Date	Revision
3/8/2020	fw

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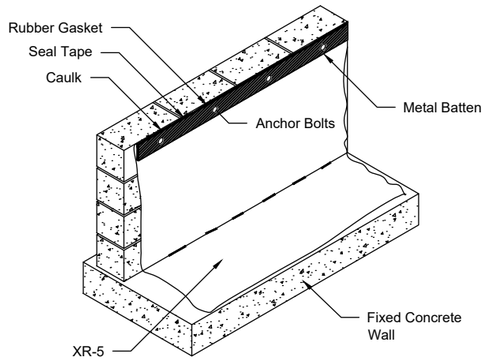
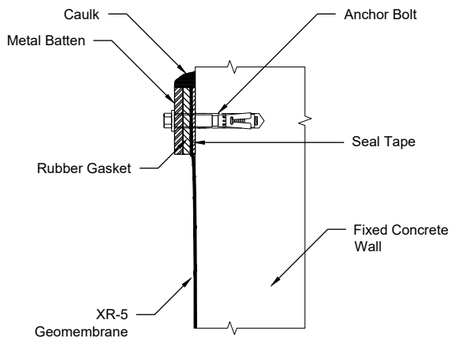
Notes:

1. Caulk should be continuous and compatible with liner type. Sika 1A is commonly used.
2. Metal batten to be $\frac{1}{4}$" x 2" and either aluminum or S.S. or approved equal
3. Stainless steel anchor bolts typically $\frac{3}{8}$" x 3" at discretion of engineer. Stainless steel washers and bolts. Bolts located 6" O.C. when installed below water line. 12" O.C. when installed above water line. Bolts should be located a minimum of 4" from concrete perimeter.
4. Rubber Gasket typically $\frac{1}{4}$" x 2" Neoprene or EPDM rubber continuous
5. Seal tape to be $\frac{1}{8}$" x 2" butyl gum and applied over bolt pattern.

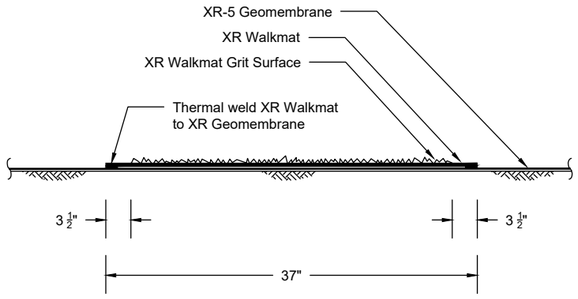


Isometric View



Cross Section

SEAMAN CORP 1000 VENTURE BLVD WOOSTER, OH 44691 330.262.1111 www.seamancorp.com www.xrgeomembranes.com	XR-5® Mechanical Attachment Detail	Rev. Date	Revision
		3/19/2020	fw
	Page No.: 1 of 1 / Drawing: XRD-023		



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		3/4/2020	fw
	Page No.: 1 of 1 / Drawing: XRD-024		

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Seaman Corporation

Since 1949, Seaman Corporation continues to be a world leader in the innovation and design of high-performance coated fabrics. A vertically integrated company, Seaman Corporation develops proprietary formulations, knits, weaves and coats fabric in two facilities located in the United States. Offering a consistent coating formulation and base fabric has led to actual field performance exceeding warranty length on a regular basis.

In addition to being a market leader in the geomembrane market, Seaman Corporation is a leading global producer of industrial fabrics used in high-performance FiberTite® roof systems, Shelter-Rite® architectural structures, Shelter-Rite® truck tarps, Shelter-Rite® dock seals, and numerous military applications, including flexible fuel and water tanks and tents.

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