# **High Density Polyethylene (HDPE)**

Permathene supplies and installs liners made from HDPE worldwide. The advantages of HDPE over other materials is its resistance to mechanical damage and chemical attack.

- Containment of Water
- Reservoirs
- Golf Course Ponds
- Industrial

- Containment of Chemicals
- Sewage Lagoons
- Aquaculture
- Agriculture

#### Mining

An HDPE geomembrane can prevent contamination of water and soil by providing a highly resistant barrier to chemicals produced during the extraction of precious metals.

#### Landfills

Highly resistant to hazardous chemicals HDPE has long been the lining of choice for this application. Used as either primary or secondary containment/ caps with or without GCL.

#### **Irrigation Canals**

To prevent water loss from seepage of water for man-made canals.

### **Dam Liners**

Superior performance over prepared sub-base. HDPE has the highest resistance to mechanical damage and UV than any other material. Fast and economical installation.

## Description

Our HDPE is produced on state-of-the-art 3 layer extruders to 7.0 m and 8.0 m wide rolls to ISO 9001.

The product is available in smooth ranging in thickness from 0.50 mm to 3.0 mm, and textured ranging in thickness from 0.75 mm to 2.5 mm.

The material is manufactured to strict specifications with all testing in accordance with ASTM and GSI standards.

## Installation

**Hot Wedge Welding:** The primary method for sealing HDPE is on-site by fusion using a portable hot wedge welder.

The wedge melts the overlapped surfaces between pressure rollers. This produces a permanent homogenous seam with an air channel which allows for pressure testing. During testing a successful weld is stronger than the material (the sample material will break before the weld peels apart).

**Extrusion Welding:** This is used for all repairs and detail work such as pipe boots and protrusions. We use copper wire in our extrusion welds to reduce the possibility of defects for spark testing.

We also provide vacuum and lance testing where specified, though studies have indicated that these later methods are not as effective as once believed. Our preferred method is fusion welding





only as the pressure produced by the machine rollers ensures a perfect weld. Extrusion welding is kept to a minimum because the tensile strength of the weld is always considerably less than the material.

Although studies have proven that geomembrane failure is caused primarily during the covering stage from earth moving equipment, trucks, etc. an unacceptably high number (almost 20%) of failure is caused by poor workmanship during the welding stage.

Permathene installation crews pay particular attention to detail and follow proven methods to ensure long-term success of the geomembrane liner. Foremost in any successful geomembrane installation is good design. Success of any lining system is dependent upon this.

**QA/QC:** We can provide geotechnical engineers to assist designers during any stage and to ensure all QA/QC is completed in accordance with specification as well as to monitor our own ISO 9001, 14001 Standards.

Manufactured and tested to conform with GRI GM13.



# HDPE (SMOOTH)

PROPERTY	METHOD	UNITS	P50	P75	P100	P150	P200	P250	P300
Minimum Values									
Thickness		mm	0.50	0.75	1.00	1.50	2.00	2.50	3.0
Lowest Individual of 10 reading			0.45	0.67	0.90	1.35	1.80	2.30	2.7
Density	ASTM D 1505/ D 792	g/ cm3	.94	.94	.94	.94	.94	.94	0.94
Tensile Properties (each direction)									
Strength at Yield	IV specimen @ 50mm/ min	kN/m	9	11	16	22	34	40	44
Strength at Break		kN/m	14	21	28	40	57	71	80
Elongation at Yield	G.L. 33 mm	%	13	13	13	12	13	13	13
Elongation at Break	G.L. 50 mm	%	700	700	700	700	700	700	700
Tear Resistance	ASTM D 1004	N	73	100	138	187	275	330	374
Puncture Resistance	ASTM D 4833	N	176	264	320	480	640	820	960
Carbon Black Content	ASTM D 1603	%	2	2	2	2	2	2	2
Carbon Black Dispersion	ASTM D 5596		Cat. 2	Cat. 2	Cat. 2	Cat. 2	Cat. 2	Cat. 2	Cat. 2
Oxidative Induction Time (OIT) (min.) (200 ° C, O2, 1 atm)	ASTM D 3895	minutes	100	100	100	100	100	100	100
Nominal Values									
Melt Flow Index (190 ° C, 2.16kg)	ASTM D 1238	g/10 min	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Stress Crack Resistance	ASTM D 5397	hrs	> 400	> 400	> 400	300	> 400	> 400	> 400
Dimensional Stability (100 ° C, 1 hr)	ASTM D 1204	%	± 1	± 1	± 1	± 1	± 1	± 1	± 1
Low Temperature Brittleness	ASTM D 746	°C	< - 77	< - 77	< - 77	< - 77	< - 77	< - 77	< -77
HDPE (TEXTURED)									
PROPERTY	METHOD	UNITS		PX75	PX100	PX150	PX200	PX250	
PROPERTY Minimum Values	METHOD	UNITS		PX75	PX100	PX150	PX200	PX250	-
PROPERTY Minimum Values Thickness	METHOD	UNITS		PX75 0.75	PX100 1.00	PX150 1.50	PX200 2.00	PX250 2.50	
PROPERTY Minimum Values Thickness Lowest Individual of 10 reading	METHOD ASTM D 5199	mm		PX75 0.75 0.64	PX100 1.00 0.85	PX150 1.50 1.28	PX200 2.00 1.70	PX250 2.50 2.30	
PROPERTY Minimum Values Thickness Lowest Individual of 10 reading Asperity Height	METHOD ASTM D 5199 GRI GM12	UNITS mm		PX75 0.75 0.64 0.25	PX100 1.00 0.85 0.25	PX150 1.50 1.28 0.25	PX200 2.00 1.70 0.25	PX250 2.50 2.30 0.25	
PROPERTY Minimum Values Thickness Lowest Individual of 10 reading Asperity Height Density	METHOD ASTM D 5199 GRI GM12 ASTM D 1505/ D 792	UNITS mm mm g/ cm3		PX75 0.75 0.64 0.25 .94	PX100 1.00 0.85 0.25 .94	PX150 1.50 1.28 0.25 .94	PX200 2.00 1.70 0.25 .94	PX250 2.50 0.25 .94	
PROPERTY Minimum Values Thickness Lowest Individual of 10 reading Asperity Height Density Tensile Properties (each direction)	METHOD ASTM D 5199 GRI GM12 ASTM D 1505/ D 792	UNITS mm mm g/ cm3		PX75 0.75 0.64 0.25 .94	PX100 1.00 0.85 0.25 .94	PX150 1.50 1.28 0.25 .94	PX200 2.00 1.70 0.25 .94	PX250 2.50 2.30 0.25 .94	
PROPERTY Minimum Values Thickness Lowest Individual of 10 reading Asperity Height Density Tensile Properties (each direction) Strength at Yield	METHOD ASTM D 5199 GRI GM12 ASTM D 1505/ D 792 ASTM D 6693 Type IV specimen @	UNITS mm mm g/ cm3 kN/m		PX75 0.75 0.64 0.25 .94 11	PX100 1.00 0.85 0.25 .94 15	PX150 1.50 1.28 0.25 .94 23	PX200 2.00 1.70 0.25 .94 30	PX250 2.50 2.30 0.25 .94 38	
PROPERTY Minimum Values Thickness Lowest Individual of 10 reading Asperity Height Density Tensile Properties (each direction) Strength at Yield Strength at Break	METHOD ASTM D 5199 GRI GM12 ASTM D 1505/ D 792 ASTM D 6693 Type V specimen @ 50mm/ min	UNITS mm mm g/ cm3 kN/m kN/m		PX75 0.75 0.64 0.25 .94 11 11	PX100 1.00 0.85 0.25 .94 15 13	PX150 1.50 1.28 0.25 .94 23 16	PX200 2.00 1.70 0.25 .94 30 21	PX250 2.50 0.25 .94 38 26	
PROPERTY Minimum Values Thickness Lowest Individual of 10 reading Asperity Height Density Tensile Properties (each direction) Strength at Yield Strength at Break Elongation at Yield	METHOD ASTM D 5199 GRI GM12 ASTM D 1505/ D 792 ASTM D 6693 Type V specimen @ 50mm/ min	UNITS mm mm g/ cm3 kN/m kN/m %		PX75 0.75 0.64 0.25 .94 11 8 8	PX100 1.00 0.85 0.25 .94 15 13 13	PX150 1.50 1.28 0.25 .94 23 16 13	PX200 2.00 1.70 0.25 .94 30 21 13	PX250 2.50 2.30 0.25 .94 38 26 13	
PROPERTY Minimum Values Thickness Lowest Individual of 10 reading Asperity Height Density Tensile Properties (each direction) Strength at Yield Strength at Break Elongation at Yield Elongation at Break	METHOD ASTM D 5199 GRI GM12 ASTM D 1505/ D 792 ASTM D 6693 Type Somm/ min G.L. 33mm G.L. 50 mm	UNITS mm mm g/ cm3 g/ cm3 kN/m kN/m kN/m kN/m kN/m		PX75 0.75 0.64 0.25 .94 11 8 13 100	PX100 1.00 0.85 0.25 .94 15 13 13 100	PX150 1.50 1.28 0.25 .94 23 16 13 100	PX200 2.00 1.70 0.25 .94 30 21 13 100	PX250 2.50 2.30 0.25 .94 38 26 13 100	
PROPERTY Minimum Values Thickness Lowest Individual of 10 reading Asperity Height Density Tensile Properties (each direction) Strength at Yield Strength at Break Elongation at Break Elongation at Break	METHOD         ASTM D 5199         GRI GM12         ASTM D 1505/ D 792         ASTM D 6693 Type (Somm/min)         GL. 33mm         G.L. 50 mm         ASTM D 1004	UNITS mm mm g/cm3 g/cm3 kN/m kN/m kN/m % c kN/m kN/m kN/m		PX75 0.75 0.64 0.25 .94 11 11 8 13 100 98	PX100 1.00 0.85 0.25 .94 15 13 13 100 135	PX150 1.50 1.28 0.25 .94 23 16 13 100 200	PX200 2.00 1.70 0.25 .94 30 21 13 100 250	PX250 2.50 0.25 .94 38 26 13 100 312	
PROPERTY         Minimum Values         Thickness         Lowest Individual of 10 reading         Asperity Height         Density         Tensile Properties (each direction)         Strength at Yield         Strength at Break         Elongation at Yield         Elongation at Break         Tear Resistance         Puncture Resistance	METHOD         ASTM D 5199         GRI GM12         ASTM D 1505/ D 792         ASTM D 6693 Type distribution         GL. 33mm         GL. 50 mm         ASTM D 1004         ASTM D 4833	UNITS mm m m g/cm3 kN/m kN/m % % N N N N N		PX75 0.75 0.64 0.25 .94 11 8 13 100 98 240	PX100 1.00 0.85 0.25 .94 15 13 13 100 135 270	PX150 1.50 1.28 0.25 .94 23 16 13 100 200 410	PX200 2.00 1.70 0.25 .94 30 21 13 100 250 534	PX250 2.50 0.25 .94 38 26 13 100 312 800	
PROPERTY Minimum Values Thickness Lowest Individual of 10 reading Asperity Height Density Tensile Properties (each direction) Strength at Yield Strength at Break Elongation at Yield Elongation at Break Tear Resistance Puncture Resistance	METHOD         ASTM D 5199         GRI GM12         ASTM D 1505/ D 792         ASTM D 6693 Type distribution         GL. 33mm         GL. 50 mm         ASTM D 1004         ASTM D 1003	UNITS  mm fmm g/cm3 fmN/m kN/m fm fma fm		PX75 0.75 0.64 0.25 .94 11 11 8 13 100 98 240 2	PX100 1.00 0.85 0.25 .94 15 13 13 100 135 270 2	PX150 1.50 1.28 0.25 .94 23 16 13 100 200 410 2	PX200 2.00 1.70 0.25 .94 30 21 13 100 250 534 2	PX250 2.50 2.30 0.25 .94 38 26 13 26 13 100 312 800 2	
PROPERTYMinimum ValuesThicknessLowest Individual of 10 readingAsperity HeightDensityTensile Properties (each direction)Strength at YieldStrength at BreakElongation at BreakElongation at BreakTear ResistancePuncture ResistanceCarbon Black ContentCarbon Black Dispersion	METHOD         ASTM D 5199         GRI GM12         ASTM D 1505/ D 792         ASTM D 6693 Type         Syspecimen @         GL. 33mm         GL. 50 mm         ASTM D 1004         ASTM D 1603         ASTM D 1603	UNITS mm m g/cm3 g/cm3 kN/m kN/m % N N N N N N N N N N N N N N N N N N		PX75 0.75 0.64 0.25 .94 11 11 8 13 100 98 240 2 2 Cat. 2	PX100 1.00 0.85 0.25 .94 15 13 13 100 135 270 2 Cat. 2	PX150 1.50 1.28 0.25 .94 23 10 13 100 200 410 20 21 2	PX200 2.00 1.70 0.25 .94 30 21 13 100 250 534 2 2 2 Cat. 2	PX250 2.30 0.25 .94 38 26 13 100 312 800 2 2 Cat. 2	
PROPERTY Minimum Values Thickness Lowest Individual of 10 reading Asperity Height Density Tensile Properties (each direction) Strength at Yield Strength at Break Elongation at Yield Elongation at Yield Elongation at Break Tear Resistance Puncture Resistance Puncture Resistance Carbon Black Content Carbon Black Dispersion	METHOD         ASTM D 5199         GRI GM12         ASTM D 1505/ D 792         ASTM D 6693 Type distribution         GL. 33mm         G.L. 33mm         G.L. 33mm         ASTM D 1004         ASTM D 1004         ASTM D 1603         ASTM D 1603         ASTM D 3895	UNITS mm fmm fmm fmm fmm fmm fmm fmm fmm fmm		PX75 0.75 0.64 0.25 .94 11 11 8 13 100 98 240 2 2 Cat. 2	PX100 1.00 0.85 0.25 .94 15 13 13 100 135 270 2 Cat. 2 100	PX150 1.50 1.28 0.25 .94 .025 .026 .025 .026	PX200 2.00 1.70 0.25 .94 30 21 13 100 250 534 2 2 534 2 2 Cat. 2	PX250 2.50 0.25 .94 38 26 13 26 13 100 312 800 2 2 0 2 Cat. 2	
PROPERTY         Minimum Values         Thickness         Lowest Individual of 10 reading         Asperity Height         Density         Tensile Properties (each direction)         Strength at Yield         Strength at Break         Elongation at Break         Tear Resistance         Puncture Resistance         Carbon Black Content         Carbon Black Dispersion         Oxidative Induction Time (OIT) (min.)         (200 °C, O2, 1 atm)         Nominal Values	METHOD         ASTM D 5199         GRI GM12         ASTM D 1505/ D 792         ASTM D 6693 Type         Symm/ min         GL. 33mm         GL. 50 mm         ASTM D 1004         ASTM D 1603         ASTM D 1603         ASTM D 1603         ASTM D 1603         ASTM D 3895	UNITS mm m g/cm3 g/cm3 KN/m KN/m % N N N N N M m m m m m m m m m m m m m m		PX75 0.75 0.64 0.25 .94 11 8 13 100 98 240 2 Cat. 2 100	PX100 1.00 0.85 0.25 .94 15 13 13 100 135 270 2 Cat. 2 100	PX150 1.50 1.28 0.25 .94 23 10 10 200 410 200 410 20 100 21 100	PX200 2.00 1.70 0.25 .94 30 21 13 100 250 534 2 2 534 2 2 Cat. 2	PX250 2.30 0.25 .94 38 26 13 100 312 800 2 2 Cat.2 100	
PROPERTY         Minimum Values         Thickness         Lowest Individual of 10 reading         Asperity Height         Density         Tensile Properties (each direction)         Strength at Yield         Strength at Break         Elongation at Yield         Elongation at Break         Tear Resistance         Puncture Resistance         Carbon Black Content         Carbon Black Dispersion         Oxidative Induction Time (OIT) (min.)         (200 °C, O2, 1 atm)         Nominal Values         Melt Flow Index (190 °C, 2.16kg)	METHOD         ASTM D 5199         GRI GM12         ASTM D 1505/ D 792         ASTM D 1505/ D 792         GL: 33mm         GL: 33mm         GL: 50 mm         ASTM D 1004         ASTM D 1603         ASTM D 1603         ASTM D 1603         ASTM D 1603         ASTM D 1895         ASTM D 1238	UNITS  mm  mm  g/ cm3  kN/m  kN/m  %  N  %  N  %  mm  mm  mm  mm  mm  mm		PX75 0.75 0.64 0.25 .94 11 8 13 100 98 240 2 2 Cat. 2 100 cat. 2	PX100 1.00 0.85 0.25 .94 15 13 13 13 100 135 270 2 Cat. 2 100	PX150 1.50 1.28 0.25 .94 23 16 13 100 200 410 200 410 20 410 410 410 410 410 410 410 41	PX200 2.00 1.70 0.25 .94 30 21 13 100 250 534 2 Cat. 2 100 	PX250 2.50 2.30 0.25 .94 38 26 13 100 312 800 2 Cat. 2 100 2 Cat. 2 100	
PROPERTY Minimum Values Thickness Lowest Individual of 10 reading Asperity Height Density Tensile Properties (each direction) Strength at Yield Strength at Break Elongation at Yield Elongation at Yield Elongation at Break Tear Resistance Puncture Resistance Puncture Resistance Carbon Black Content Carbon Black Dispersion Oxidative Induction Time (OIT) (min.) (200 ° C, O2, 1 atm) <b>Nominal Values</b> Melt Flow Index (190 ° C, 2.16kg)	METHOD         ASTM D 5199         GRI GM12         ASTM D 1505/ D 792         ASTM D 6693 Type distribution         ASTM D 6693 Type distribution         GL. 33mm         GL. 33mm         GL. 33mm         ASTM D 1004         ASTM D 1603         ASTM D 1603         ASTM D 3895         ASTM D 1238         ASTM D 1238	UNITS mm m g mm g g g g m m g m m m m m m m		PX75 0.75 0.64 0.25 .94 11 8 13 100 98 240 2 2 Cat. 2 100 2 Cat. 2 100 2 Cat. 2	PX100 1.00 0.85 0.25 0.94 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	PX150 1.50 1.28 0.25 .94 .02 .02 .02 .02 .02 .02 .02 .02	PX200 2.00 1.70 0.25 .94 30 21 13 100 250 534 2 25 100 534 2 100 5 5 100 5 5 100 5 5 100 5 5 100 5 5 100 5 5 100 5 5 100 5 5 100 5 5 100 5 5 100 5 5 100 5 5 100 5 5 100 5 5 100 5 5 100 5 5 5 5 5 5 5 5 5 5 5 5 5	PX250 2.50 2.30 0.25 .94 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	
PROPERTY         Minimum Values         Thickness         Lowest Individual of 10 reading         Asperity Height         Density         Tensile Properties (each direction)         Strength at Yield         Strength at Break         Elongation at Yield         Elongation at Break         Puncture Resistance         Puncture Resistance         Carbon Black Content         Carbon Black Dispersion         Oxidative Induction Time (OIT) (min.)         (200°C, O2, 1 atm)         Stress Crack Resistance         Dimensional Stability (100°C, 1 hr)	METHOD         ASTM D 5199         GRI GM12         ASTM D 1505/ D 792         ASTM D 1505/ D 792         ASTM D 1505/ D 792         GL. 33mm         GL. 33mm         GL. 50 mm         ASTM D 1004         ASTM D 1603         ASTM D 3895         ASTM D 1238         ASTM D 1204	UNITS mm m g mm g g m g m M M M M M M M M M M		PX75 0.75 0.64 0.25 .94 11 8 13 100 98 240 2 240 2 (10) 98 240 2 (10) 98 240 2 (10) 98 240 2 (10) 98 240 2 (10) 2 (10) 2 (10) (	PX100 1.00 0.85 0.25 .94 15 13 13 100 135 270 2 2 2 2 2 2 2 100 2 2 100 2 2 100 2 2 100 2 2 100 2 100 2 100 135 270 2 100 135 270 2 100 135 270 2 100 135 270 2 100 135 270 2 100 135 270 2 100 135 270 2 100 135 270 2 100 135 270 2 100 135 135 270 2 100 135 270 2 100 135 270 2 100 135 2 100 135 2 100 135 2 100 135 2 100 2 100 135 100 100 135 100 135 100 100 100 100 105 100 105 100 105 100 100	PX150 1.50 1.28 0.25 .94 23 100 200 410 200 410 200 410 20 410 410 410 410 410 410 410 41	PX200 2.00 1.70 0.25 .94 30 21 13 100 250 534 2 534 2 Cat. 2 100 	PX250 2.50 2.30 0.25 .94 38 26 13 100 312 800 2 2 ( 100 2 100 2 100 2 ( 100 2 100 2 ( 100 2 ( 100 2 ( 100 2 ( 100 2 ( 100 2 ( 100 2 ( 100 2 ( 100 2 ( 100 2 ( 100 2 ( 100 2 ( 100) ( 100 ( 100 ( 100) ( 100 ( 100 ( 100) ( 100 ( 100) ( 100 ( 100) ( 100 ( 100 ( 100 ( 100 ( 100 ( 100 ( 100 ( 100 ( 100 ( 100 ( 100 ( 100 ( 100 ( 100 ( 100 ( 100 ( 100 ( 100 ( 10)) ( 100 ( 100 ( 100 ( 100 ( 100 ( 10) ( 100 ( 100 ( 100 ( 100 ( 10) ( 100 ( 100 ( 10)	

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Note: HDPE Smooth and Textured conforms to GRI GM13