

RAW MATERIAL

All Geo-Glide U-Point fittings are manufactured from 100% virgin HDPE 4710/100 resin, meeting or exceeding Standard ASTM D3350.

PE4710 RAW MATERIAL SPECIFICATIONS			
Parameter	Test Method	Typical Values*	
		English Units	SI Units
Density (Natural)	ASTM D4883	-	0.9485 g/cm ³
Density (Black)	ASTM D4883	-	0.9590 g/cm ³
Melt Index	ASTM D1238	-	8.0 g/10 min
Flexural Modulus	ASTM D790	150,000 psi	1,035 Mpa
Tensile Strength at Yield (2 in/min)	ASTM D638	3,625 psi	25.0 Mpa
Tensile Strength at Break (2 in/min)	ASTM D638	5,500 psi	38.0 Mpa
Elongation at Break (2 in/min)	ASTM D638	>600%	>600%
Environmental Stress Crack Resistance, F50	ASTM D1693	>5,000 hours	>5,000 hours
Notch Tensile (PENT)	ASTM F1473	>10,000 hours	>10,000 hours
Notched Izod Impact Strength	ASTM D256	9 ft.-lbf /in	0.49 kJ/m
Hardness (Shore D)	ASTM D2240	66	66
Brittleness Temperature	ASTM D746	< -180 °F	< -118 °C
Vicat Softening Point	ASTM D1525	259 °F	126 °C
Thermal Stability	ASTM D2513/3350	428 °F min	220 °C min
Hydrostatic Design Basis at 23°C	ASTM D2837	1,600 psi	11.0 Mpa
Hydrostatic Design Basis at 60°C	ASTM D2837	1,000 psi	6.9 Mpa
Carbon Black Concentration	ASTM D1603	2.2%	2.2%

* Typical values; not to be construed as specification limits.

STANDARD ASTM D3350

TABLE 1 PRIMARY PROPERTIES ^A — CELL CLASSIFICATION LIMITS										
Property	Test Method	0	1	2	3	4	5	6	7	8
1. Density, g/cm ³	D 1505	Unspecified	0.925 or lower	>0.925-0.940	>0.940-0.947	>0.947-0.955	>0.955	...	Specify Value	
2. Melt index	D 1238	Unspecified	>1.0	1.0 to 0.4	<0.4 to 0.15	<0.15	B		Specify Value	
3. Flexural modulus, MPa (psi)	D 790	Unspecified	<138 (<20 000)	138- <276 (20 000 to <40 000)	276- <552 (40 000 to 80 000)	552- <758 (80 000 to 110 000)	758- <1103 (110 000 to <160 000)	>1103 (>160 000)	Specify Value	
4. Tensile strength at yield, MPa (psi)	D 638	Unspecified	<15 (<2200)	15- <18 (2200- <2600)	18- <21 (2600- <3000)	21- <24 (3000- <3500)	24- <28 (3500- <4000)	>28 (>4000)	Specify Value	
5. Slow Crack Growth Resistance I. ESCR a. Test condition (100% Igepal.) b. Test duration, h c. Failure, max, %	D 1693	Unspecified	A 48 50	B 24 50	C 192 20	C 600 20	...	...	...	Specify Value
II. PENT (hours) Molded plaque, 80°C, 2.4 MPa Notch depth, F 1473, Table 1	F 1473	Unspecified	...	...	...	10	30	100	500	Specify Value
6. Hydrostatic Strength Classification I. Hydrostatic design basis, MPa (psi), (23°C)	D 2837	NPR C	5.52 (800)	6.89 (1000)	8.62 (1250)	11.03 (1600)	...	...
II. Minimum required strength, MPa (psi), (20°C)	ISO 12162	...	...	...	...	...	8 (1160)	10 (1450)		

^A Compliance with physical properties in accordance with Section 8 is required including requirements for cell classification, color, and ultraviolet (UV) stabilizer, thermal stability, brittleness temperature, density, tensile strength at yield, and elongation at break.

^B Refer to 10.1.4.1.

^C NPR = Not Pressure Rated.

TABLE 1 SPECIFICATION D3350 CLASSIFICATION OF POLYETHYLENE FITTINGS MATERIALS								
Physical Properties	Cell Classification and Properties for Polyethylene Pipe Materials							
	PE2606	PE2706	PE2708	PE3608	PE3708	PE3710	PE4708	PE4710
Density	2	2	2	3	3	3	4	4
Melt Index	3 or 4	3 or 4	3 or 4	4	4	4	4	4
Flexural modulus	≥4	≥4	≥4	≥4	≥4	≥4	≥4	≥5
Tensile Strength	≥3	≥3	≥3	≥4	≥4	≥4	≥4	≥4
Slow crack growth resistance (F1473)	6	7	7	6	7	7	7	7
Hydrostatic strength classification	3	3	3	4	4	4	4	4
Color and UV Stabilizer ^A	C or E	C or E	C or E	C or E	C or E	C or E	C or E	C or E
HDB at 140°F (60°C), PPI TR-4, psi (MPa)	B	B	B	B	B	B	B	B
HDB at 73°F (23°C), PPI TR-4, psi (MPa)	630 (4.34)	630(4.34)	800(5.52)	800(5.52)	800(5.52)	1000(6.90)	800 (5.52)	1000(6.90)

^A See 6.2.

^B Listing required; consult manufacturer for listed value.

BURST PRESSURE AND SUSTAINED PRESSURE TESTING:

All Geo-Glide U-Point fittings are designed, manufactured, and pressure tested in accordance with Standard ASTM D3261.

TABLE 9 BURST PRESSURE REQUIREMENTS AT 73.4°F FOR COMMON FITTING SIZES^A

Wall Thickness, DR, or Schedule	Nominal Diameter	Minimum Pressure, psi(MPa)	Minimum Pressure, Density 3 or 4 Materials psi (MPa)
DR 7	ALL ^B	833 (5.744)	967 (6.667)
SDR 9	ALL ^B	625 (4.309)	725 (4.999)
DR 9.3	ALL ^B	602 (4.151)	699 (4.820)
SDR 11	ALL ^B	500 (3.448)	580 (3.999)
DR 11.5	ALL ^B	476 (3.282)	552 (3.806)
DR 15.5	ALL ^B	345 (2.379)	400 (2.758)
SDR 17	ALL ^B	313 (2.158)	363 (2.503)
SDR 21	ALL ^B	250 (1.724)	290 (2.000)
DR 26	ALL ^B	200 (1.379)	232 (1.600)
DR 32.5	ALL ^B	159 (1.096)	184 (1.269)

^A Fiber stress of 2520 psi (17.4 MPa) for PE2406 and PE3408.

^B Refers to IPS, DIPS and ISO diameters shown in Table2, Table3 and Table4.

TABLE 10 Elevated Temperature Sustained Pressure Test Requirements^{A, B}

Condition	Test Temperature, °F (°C) ^B	PE2606, PE2706, PE2708 PE3608 PE3708, PE4708		PE3710, PE4710	
		Test Pressure Hoop Stress, ^A psi (kPa) ^B	Minimum Average Time Before Failure, Hours ^B	Test Pressure Hoop Stress, ^A psi (kPa) ^B	Minimum Average Time Before Failure, Hours ^B
1	176 (80)	670 (4620)	170	750 (5170)	200
2	176 (80)	650 (4480)	340	730 (5020)	400
3	176 (80)	630 (4345)	510	705 (4870)	600
4	176 (80)	610 (4210)	680	685 (4715)	800
5	176 (80)	590 (4070)	850	660 (4565)	1000
6	176 (80)	580 (4000)	1000	640 (4415)	1200

^A Calculate internal test pressure in accordance with

$$P = \frac{2S}{\left(\frac{D_o}{t} - 1\right)}$$

ENGINEERING GUIDE SPECIFICATIONS

The geothermal U-Bend fitting shall comply with the following requirements:

- Molded from 100% PE4710/PE100 high density virgin polyethylene resin, meeting or exceeding ASTM D3350.
- Fitting must meet or exceed burst pressure requirements per ASTM D3261 for DR9 dimensional requirements.
- The U-Bend shall have no more than 2 fusion joining procedures resulting in a finished U-Bend/loop assembly.
- All fusion joining procedures shall follow a documented assembly protocol citing specific temperatures, time and/or pressure for various steps, which can be verified by a quality control inspection.
- The fitting shall be part of a geothermal loop assembly, thermally fused together and to polyethylene pipes in an environmentally controlled facility by a qualified manufacturer and fabricator of the complete loop/U-Bend assembly (i.e. field assembled is not acceptable).
- The assembled fitting and pipe shall be no wider than two times the outside diameter of the specified loop pipe.
- The internal flow path cross-sectional area through the fitting at the smallest point shall be no smaller than the inside cross-sectional area of DR9 pipe for the specific pipe size.
- The external surface of the U-Bend fitting shall have no fewer than eight protruding protective ribs to offer additional protection from possible damage during the loop insertion process.
- The fitting shall have part number, manufacturer and production date/time stamp molded into the fitting for traceability and quality control purposes.
- The fitting shall include a hole in the end of the fitting for general installation use; the hole shall be no smaller than 0.375 in. inside diameter and no shorter than 0.625 in. with a minimum of 0.25 in. wall thickness.