

# HZO Guardian Plus™ & Guardian Zero™ Material Properties



Physical and Mechanical Properties	HZO Guardian Plus	HZO Guardian Zero	ASTM Method
Density, g/cm <sup>3</sup>	1.31	1.10	D1505
Tensile modulus, GPa	3.2	2.4	D882
Tensile strength, MPa	55	45	D882
Yield strength, MPa	55	42	D882
Elongation to break, %	220	40	D882
Yield elongation, %	2.9	2.5	D882
Coefficient of friction-static	0.29	0.25	D1894
Coefficient of friction-dynamic	0.29	0.25	D1894
Water absorption, % (24 hr)	< 0.01	0.01	D570
Index of refraction	1.64	1.66	D542

Electrical Properties	HZO Guardian Plus	HZO Guardian Zero	ASTM Method
Dielectric strength @ 25 μm, V/μm	220	276	D149
Dielectric constant @ 60 Hz	3.13	2.65	D150
Dielectric constant @ 1 KHz	3.01	2.65	D150
Dielectric constant @ 1 MHz	2.92	2.65	D150
Dissipation factor @ 60 Hz	0.022	0.0002	D150
Dissipation factor @ 1 kHz	0.017	0.0002	D150
Dissipation factor @ 1 MHz	0.013	0.0006	D150
Volume resistivity @ 23 °C, 50% RH, ohms·cm	6.0 x 10 <sup>16</sup>	1 x 10 <sup>17</sup>	D257
Surface resistivity @ 23 °C, 50% RH, ohms	1.0 x 10 <sup>15</sup>	1 x 10 <sup>13</sup>	D257

Thermal Properties	HZO Guardian Plus	HZO Guardian Zero	ASTM Method
Melting point, °C	290	420	D3417
Linear coefficient of expansion, 10 <sup>-5</sup> /°C	3.3	6.9	D696
Thermal conductivity @25 °C, watts/(meter·Kelvin)	0.084	0.13	C177
Specific heat @ 20 °C, Cal/(g·°C)	0.17	0.20	

Barrier Properties	HZO Guardian Plus	HZO Guardian Zero	ASTM Method
Water vapor transmission @ 38 °C 90% RH, g·mil/100 in <sup>2</sup> ·day	0.25	1.74	F1249
Gas permeability, cm <sup>3</sup> ·mil/100 in <sup>2</sup> ·24 h·atm (23 °C)			
N <sub>2</sub>	0.7	7.7	D3985
O <sub>2</sub>	5.1	30	D3985
CO <sub>2</sub>	5.4	214	D3985
SO <sub>2</sub>	11.0	1,890	D3985
Cl	0.35	74	D3985
H <sub>2</sub> S	13	795	D3985