

**GLOBAL POLYMER INDUSTRIES, INC.**

**DIELECTRIC CONSTANT**

<b>Material</b>	<b>(60HZ)</b>
Teflon (TFE)	2.10
TPX (Methylpentene Polymer)	2.12
Polypropylene Copolymer	2.20— 2.60
Polypropylene Unmodified	2.25
Polyethylene (Low Density)	2.25— 2.35
UHMW	2.30
Polyethylene (High Density)	2.30— 2.35
ABS (High Impact)	2.40— 5.00
Polystyrene (General Purpose)	2.45— 2.65
Halar	2.50
Rulon	2.50— 2.60 <sup>a</sup>
Kel-F	2.60
Noryl	2.64
PVC: Rigid	2.80— 3.10
Ultem (Unfilled Polyetherimide)	3.00
Polysulfone	3.07
Polycarbonate (10% Glass Filled)	3.08
Polyethersulfone (Unfilled)	3.10
ABS (Medium Impact)	3.10
Polycarbonate (Unfilled)	3.17
Mylar	3.30
Polycarbonate (20% Glass Filled)	3.31
PVC: Flexible	3.30— 4.50
Ultem (20% Glass Filled Polyetherimide)	3.50 <sup>b</sup>
Ultem (10% Glass Filled Polyetherimide)	3.50 <sup>b</sup>
Acrylic (Cast)	3.50— 4.50
Polycarbonate (40% Glass Filled)	3.53
Celcon (Unfilled Acetal Copolymer M90)	3.70
Ultem (30% Glass Filled Polyetherimide)	3.70 <sup>b</sup>
CAP	3.70— 4.30
Kydex (PVC/Acrylic Alloy)	3.90
Celcon (25% Glass Filled Acetal Copolymer)	3.90
Nylon 6/6 (Unfilled)	4.00— 4.60
Torlon	4.10— 7.30 <sup>c</sup>
Polyurethane (Urethane Thermoplastic Elastomer)	6.30
Phenolic (Unfilled)	6.50--17.50
Kynar (PVDF)	8.40
Acetal (Copolymer)	Unknown
CAB	Unknown
GG (Extruded Cellulose Acetate)	Unknown
Acculam Glass Mat Reinforced Polyester GPO1	Unknown
Acculam Glass Mat Reinforced Polyester GPO3	Unknown
PEEK (Unfilled)	Unknown

**DIELECTRIC STRENGTH**

<b>Material</b>	<b>volts/mil (short-time, 1/8" thickness)</b>
Phenolic (Unfilled)	250— 400
CAB	250— 400
GG (Extruded Cellulose Acetate)	250— 600
Kynar (PVDF)	260
PVC: Flexible	300--1000
CAP	300— 450
Polyurethane (Urethane Thermoplastic Elastomer)	330— 630
ABS (High Impact)	350— 500
ABS (Medium Impact)	350— 500
Nylon 6/6 (Unfilled)	365— 500
Acculam Glass Mat Reinforced Polyester GPO1	370
Acculam Glass Mat Reinforced Polyester GPO3	400
Polyethersulfone (Unfilled)	400
Polycarbonate (Unfilled)	400
Rulon	400— 500 <sup>d</sup>
Kydex (PVC/Acrylic Alloy)	≥400
Polysulfone	425
PVC: Rigid	425--1300
Polycarbonate (40% Glass Filled)	450
Polycarbonate (10% Glass Filled)	450
Polycarbonate (20% Glass Filled)	450
Polypropylene Copolymer	450
Polyethylene (Low Density)	450--1000
Polyethylene (High Density)	450— 500
Acrylic (Cast)	450— 550
Teflon (TFE)	480
Torlon	495— 827
Celcon (Unfilled Acetal Copolymer M90)	500
Halar	500
Kel-F	500
Noryl	500
Acetal (Copolymer)	500 <sup>e</sup>
Polystyrene (General Purpose)	500— 700
Celcon (25% Glass Filled Acetal Copolymer)	580
Ultem (30% Glass Filled Polyetherimide)	630 <sup>f</sup>
Polypropylene Unmodified	660
Ultem (20% Glass Filled Polyetherimide)	670 <sup>f</sup>
Ultem (10% Glass Filled Polyetherimide)	700 <sup>f</sup>
TPX (Methylpentene Polymer)	700 <sup>g</sup>
Ultem (Unfilled Polyetherimide)	710 <sup>f</sup>
UHMW	900 <sup>h</sup>
Mylar	7500
PEEK (Unfilled)	Unknown

<sup>a</sup>60 x 10<sup>10</sup> cycles. <sup>b</sup>1 kHz 50% RH. <sup>c</sup>10<sup>3</sup> Hz. <sup>d</sup>.080". <sup>e</sup>.090". <sup>f</sup>1/16", in oil. <sup>g</sup>Step-by-step method. <sup>h</sup>kv/cm. <sup>i</sup>Unmodified Homopolymer. <sup>j</sup>10<sup>3</sup>-10<sup>10</sup> cycles. <sup>k</sup>1kHz, 50% RH, 73 °F. <sup>l</sup>cm/cm °C. <sup>m</sup>in/in °F. <sup>n</sup>Per °F -22--86<sup>o</sup>. <sup>o</sup>mu x m/m x k. <sup>p</sup>At 122-185 °F.

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**THERMAL CONDUCTIVITY**

<b>Material</b>	<b>(BTU/hr/sp.ft./°f/in)</b>
Torlon	0.02— 0.08
Polyurethane (Urethane Thermoplastic Elastomer)	0.20— 1.00
Kynar (PVDF)	0.70— 0.87
Polystyrene (General Purpose)	0.72— 1.00
Polypropylene Copolymer	0.81
PVC: Flexible	0.86— 1.16
PVC: Rigid	0.86— 2.03
Kydex (PVC/Acrylic Alloy)	1.01
Phenolic (Unfilled)	1.01
Mylar	1.05
Halar	1.09
TPX (Methylpentene Polymer)	1.16
GG (Extruded Cellulose Acetate)	1.16— 2.32
CAB	1.16— 2.32
ABS (Medium Impact)	1.30— 2.30
ABS (High Impact)	1.30— 2.30
Acrylic (Cast)	1.33
Polycarbonate (Unfilled)	1.35
Polycarbonate (10% Glass Filled)	1.41
Polycarbonate (20% Glass Filled)	1.47
Noryl	1.50
Ultem (Unfilled Polyetherimide)	1.50
Polycarbonate (40% Glass Filled)	1.53
Celcon (Unfilled Acetal Copolymer M90)	1.60
Acetal (Copolymer)	1.60
Nylon 6/6 (Unfilled)	1.60
Teflon (TFE)	1.70
CAP	1.74
Polysulfone	1.80
Kel-F	1.80
Rulon	2.30
Polyethylene (Low Density)	2.30
UHMW	2.90
Polyethylene (High Density)	3.20— 3.60
Celcon (25% Glass Filled Acetal Copolymer, GC25A)	Unknown
Acculam Glass Mat Reinforced Polyester GP01	Unknown
Acculam Glass Mat Reinforced Polyester GP03	Unknown
PEEK (Unfilled)	Unknown
Polyethersulfone (Unfilled)	Unknown
Polypropylene Unmodified	Unknown
Ultem (10% Glass Filled Polyetherimide)	Unknown
Ultem (20% Glass Filled Polyetherimide)	Unknown
Ultem (30% Glass Filled Polyetherimide)	Unknown

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**HEAT DEFLECTION TEMPERATURE**

<b>Material</b>	<b>(At 264 PSI, °F)</b>
TPX (Methylpentene Polymer)	80— 100 <sup>d</sup>
Polyethylene (Low Density)	105
CAP	111— 228
CAB	113— 202
Polypropylene Copolymer	115— 140
GG (Extruded Cellulose Acetate)	130— 160
PVC: Rigid	130— 165
Polypropylene Unmodified	135
Polyethylene (High Density)	151
Kydex (PVC/Acrylic Alloy)	160
Acrylic (Cast)	160— 215
Phenolic (Unfilled)	165— 175
Kel-F	167
Halar	169
Kynar (PVDF)	176— 194
Nylon 6/6 (Unfilled)	180— 300 <sup>e</sup>
Polystyrene (General Purpose)	200
ABS (Medium Impact)	200— 220 <sup>f</sup>
Polyethersulfone (Unfilled)	203
UHMW	203 <sup>g</sup>
ABS (High Impact)	205— 215 <sup>f</sup>
Acetal (Copolymer)	230
Celcon (Unfilled Acetal Copolymer M90)	230
Noryl	265
Polycarbonate (Unfilled)	270— 280
Polycarbonate (10% Glass Filled)	288
Polycarbonate (40% Glass Filled)	295
Polycarbonate (20% Glass Filled)	295
Celcon (25% Glass Filled Acetal Copolymer)	325
Polysulfone	345
Ultem (Unfilled Polyetherimide)	392 <sup>h</sup>
Ultem (10% Glass Filled Polyetherimide)	405 <sup>h</sup>
Ultem (20% Glass Filled Polyetherimide)	408 <sup>h</sup>
Ultem (30% Glass Filled Polyetherimide)	410 <sup>h</sup>
PEEK (Unfilled)	500
Torlon	523— 539
Polyurethane (Urethane Thermoplastic Elastomer)	
Teflon (TFE)	550 <sup>e</sup>
Acculam Glass Mat Reinforced Polyester GPO3	Unknown
Acculam Glass Mat Reinforced Polyester GPO1	Unknown
Mylar	Unknown
PVC: Flexible	Unknown
Rulon	Unknown

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## WATER ABSORPTION

Material	(24 hours.%)
Kel-F	0.00
Rulon	0.00
Teflon (TFE)	0.00
UHMW	0.00
TPX (Methylpentene Polymer)	0.01
Polypropylene Copolymer	≤ 0.01
Polypropylene Unmodified	0.02
Polyethylene (High Density)	0.03
Polystyrene (General Purpose)	0.03 — 0.10
Polyethylene (Low Density)	0.04
Kynar (PVDF)	0.04 — 0.06
Noryl	0.06
Kydex (PVC/Acrylic Alloy)	0.06
PVC: Rigid	0.07 — 0.40
Halar	≤ 0.10
Polycarbonate (20% Glass Filled)	0.12
Polycarbonate (10% Glass Filled)	0.12
Polycarbonate (40% Glass Filled)	0.12
Acetal (Copolymer)	0.12
PEEK (Unfilled)	0.15
Polycarbonate (Unfilled)	0.15
PVC: Flexible	0.15 — 0.75
Ultem (30% Glass Filled Polyetherimide)	0.18
ABS (Medium Impact)	0.20 — 0.30
Phenolic (Unfilled)	0.20 — 0.40
Celcon (Unfilled Acetal Copolymer M90)	0.22
ABS (High Impact)	0.24 — 0.45
Ultem (Unfilled Polyetherimide)	0.25
Ultem (20% Glass Filled Polyetherimide)	0.26
Ultem (10% Glass Filled Polyetherimide)	0.28
Celcon (25% Glass Filled Acetal Copolymer)	0.29
Acrylic (Cast)	0.30 — 0.40
Torlon	0.33
Acculam Glass Mat Reinforced Polyester GPO1	0.35
Acculam Glass Mat Reinforced Polyester GPO3	0.40
Polyurethane (Urethane Thermoplastic Elastomer)	0.70 — 0.90
Mylar	≤ 0.80
CAB	0.90 — 2.20
CAP	1.20 — 2.80
Polysulfone	1.24
Nylon 6/6 (Unfilled)	1.50
GG (Extruded Cellulose Acetate)	2.00 — 7.00
Polyethersulfone (Unfilled)	Unknown

<sup>a</sup>Unmodified Homopolymer. <sup>b</sup>At yield. <sup>c</sup>10% deflection. <sup>d</sup>66 PSI, <sup>0</sup>C. <sup>e</sup>Continuous. <sup>f</sup>Annealed. <sup>G</sup>66 psi. <sup>h</sup>uNANNEALED, 1/4 INCH. <sup>1</sup>1.82 N/MM<sup>2</sup>. <sup>j</sup>Varies over a wide range.

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## COMPRESSIVE STRENGTH

Material	(PSI x 10 <sup>3</sup> )
Teflon (TFE)	0.6
Rulon	1.2
ABS (Medium Impact)	1.8 — 12.5
CAB	2.1 — 22.0
CAP	2.4 — 22.0
Polyethylene (High Density)	2.7 — 3.6
Polypropylene Copolymer	3.7 — 8.0
ABS (High Impact)	4.5 — 8.5
Kel-F	5.0
Polypropylene Unmodified	5.5 — 8.0 <sup>a</sup>
Nylon 6/6 (Unfilled)	6.7 — 12.5
Kynar (PVDF)	8.0 — 10.0
PVC: Rigid	8.0 — 13.0
Kydex (PVC/Acrylic Alloy)	8.4
PVC: Flexible	9.0 — 17.0
Acrylic (Cast)	11.0 — 19.0
Polystyrene (General Purpose)	11.5 — 16.0
Phenolic (Unfilled)	12.0 — 15.0
Polycarbonate (Unfilled)	12.5
Polycarbonate (40% Glass Filled)	13.0 — 21.0
Polycarbonate (20% Glass Filled)	13.0 — 21.0
Polysulfone	13.9 <sup>b</sup>
Polycarbonate (10% Glass Filled)	14.0
Celcon (Unfilled Acetal Copolymer M90)	16.0 <sup>c</sup>
Polyethersulfone (Unfilled)	16.0 — 18.0
Noryl	16.4
Celcon (25% Glass Filled Acetal Copolymer, GC25A)	17.0 <sup>c</sup>
Torlon	17.0 — 38.0
Acetal (Copolymer)	18.0
Polyurethane (Urethane Thermoplastic Elastomer)	20.0
Ultem (Unfilled Polyetherimide)	20.3
Ultem (10% Glass Filled Polyetherimide)	22.5
Ultem (30% Glass Filled Polyetherimide)	23.5
Ultem (20% Glass Filled Polyetherimide)	24.5
Acculam Glass Mat Reinforced Polyester GPO3	30.0
Acculam Glass Mat Reinforced Polyester GPO1	40.0
GG (Extruded Cellulose Acetate)	Unknown
Halar	Unknown
Mylar	Unknown
PEEK (Unfilled)	Unknown
Polyethylene (Low Density)	Unknown
TPX (Methylpentene Polymer)	Unknown
UHMW	Unknown

## FLEXURAL STRENGTH

## SPECIFIC GRAVITY

<b>Material</b>	<b>(PSI x 10<sup>3</sup>)(at yield)</b>
Polyurethane (Urethane Thermoplastic Elastomer)	0.7 — 9.0
CAB	1.8 — 9.3
CAP	2.9 — 11.4
Polyethylene (High Density)	3.2
Polypropylene Copolymer	5.0 — 7.0
GG (Extruded Cellulose Acetate)	6.0 — 10.0
Polypropylene Unmodified	6.4
Halar	7.0
Kel-F	8.0
ABS (High Impact)	8.0 — 11.0
Polystyrene (General Purpose)	8.0 — 14.0
Kynar (PVDF)	8.6 — 10.8
Nylon 6/6 (Unfilled)	9.0 — 16.0
PVC: Rigid	10 — 16
Kydex (PVC/Acrylic Alloy)	10.7
ABS (Medium Impact)	11.0 — 13.0
Phenolic (Unfilled)	11.0 — 17.0
Acrylic (Cast)	12.0 — 17.0
Celcon (Unfilled Acetal Copolymer M90)	13.0
Noryl	13.3
Polycarbonate (Unfilled)	13.5
Acetal (Copolymer)	14.1
Polycarbonate (10% Glass Filled)	15.0
Polysulfone	15.4
Polycarbonate (40% Glass Filled)	17.0 — 32.0
Polycarbonate (20% Glass Filled)	17.0 — 32.0
Polyethersulfone (Unfilled)	18.65
Acculam Glass Mat Reinforced Polyester GPO3	20.0
Ultem (Unfilled Polyetherimide)	21.0
Acculam Glass Mat Reinforced Polyester GPO1	23.0
Torlon	26.4 — 30.7
Celcon (25% Glass Filled Acetal Copolymer)	28.0
Ultem (10% Glass Filled Polyetherimide)	28.0
Ultem (20% Glass Filled Polyetherimide)	30.0
Ultem (30% Glass Filled Polyetherimide)	33.0
Teflon (TFE)	50 — 90
Rulon	75 — 100
UHMW	Unknown
PVC: Flexible	Unknown
PEEK (Unfilled)	Unknown
Polyethylene (Low Density)	Unknown
TPX (Methylpentene Polymer)	Unknown
Mylar	Unknown

<b>Material</b>	<b>Specific Gravity</b>
TPX (Methylpentene Polymer)	0.84
Polypropylene Copolymer	0.90 — 0.91
Polypropylene Unmodified	0.90 — 0.92
Polyethylene (Low Density)	0.91 — 0.93
UHMW	0.94
Polyethylene (High Density)	0.94 — 0.97
ABS (High Impact)	1.01 — 1.02
ABS (Medium Impact)	1.04 — 1.07
Polystyrene (General Purpose)	1.04 — 1.09
Polyurethane (Urethane Thermoplastic Elastomer)	1.05 — 1.25
Noryl	1.06
Nylon 6/6 (Unfilled)	1.13 — 1.15
CAB	1.15 — 1.22
PVC: Flexible	1.16 — 1.35
Acrylic (Cast)	1.17 — 1.20
CAP	1.17 — 1.24
Polycarbonate (Unfilled)	1.20
Polysulfone	1.24
Phenolic (Unfilled)	1.24 — 1.32
Polycarbonate (10% Glass Filled)	1.25
PEEK (Unfilled)	1.26 — 1.32
Ultem (Unfilled Polyetherimide)	1.27
GG (Extruded Cellulose Acetate)	1.28 — 1.32
Ultem (10% Glass Filled Polyetherimide)	1.34
Polycarbonate (20% Glass Filled)	1.35
Kydex (PVC/Acrylic Alloy)	1.35
PVC: Rigid	1.35 — 1.45
Polyethersulfone (Unfilled)	1.36
Torlon	1.38 — 1.66
Celcon (Unfilled Acetal Copolymer M90)	1.41
Ultem (20% Glass Filled Polyetherimide)	1.42
Acetal (Copolymer)	1.43
Ultem (30% Glass Filled Polyetherimide)	1.51
Polycarbonate (40% Glass Filled)	1.52
Celcon (25% Glass Filled Acetal Copolymer)	1.59
Halar	1.68
Kynar (PVDF)	1.75
Acculam Glass Mat Reinforced Polyester GPO1	1.80
Acculam Glass Mat Reinforced Polyester GPO3	1.85
Kel-F	2.10
Teflon (TFE)	2.13 — 2.22
Rulon	2.24
Mylar	Unknown

<sup>a</sup>1/2 X 1/2" bar. <sup>b</sup>1/2 X 1/2" Notched Bar. <sup>c</sup>.5 — no break. <sup>d</sup>.25" specimen. <sup>e</sup>For 1.8" samples. <sup>f</sup>Varies depending on type and amt. Of plasticizer. <sup>g</sup>nd. <sup>h</sup>Cycolac 67B: transparent.

**GLOBAL POLYMER INDUSTRIES, INC.**

## IMPACT STRENGTH

Material	(Izod at 73 °F)(ft.lb./in. Of notch)(Notched R.T.)
Phenolic (Unfilled)	0.24 — 0.40 <sup>a</sup>
Acrylic (Cast)	0.30
TPX (Methylpentene Polymer)	0.37
Polystyrene (General Purpose)	0.4
PVC: Rigid	0.4 — 20.0 <sup>b</sup>
CAP	0.50 <sup>c</sup>
Polypropylene Unmodified	0.6 — 1.2
Polyethylene (High Density)	0.8 — 7.0
Ultem (Unfilled Polyetherimide)	1.0
Acetal (Copolymer)	1.0 — 1.5
Nylon 6/6 (Unfilled)	1.0 — 2.0
Ultem (10% Glass Filled Polyetherimide)	1.1
Polypropylene Copolymer	1.1 — 20.0
Polysulfone	1.3
Celcon (Unfilled Acetal Copolymer M90)	1.5
PEEK (Unfilled)	1.6
Celcon (25% Glass Filled Acetal Copolymer)	1.6
Ultem (20% Glass Filled Polyetherimide)	1.6
Polyethersulfone (Unfilled)	1.6 <sup>d</sup>
Polycarbonate (40% Glass Filled)	2.0
Polycarbonate (20% Glass Filled)	2.0
Polycarbonate (10% Glass Filled)	2.0
Ultem (30% Glass Filled Polyetherimide)	2.0
Teflon (TFE)	3.0
ABS (Medium Impact)	3.0 — 6.0
Kynar (PVDF)	3.5 — 10.3
Noryl	5.0
Kel-F	5.0
Rulon	6.0
ABS (High Impact)	6.5 — 7.5
Acculam Glass Mat Reinforced Polyester GPO1	10.0
Acculam Glass Mat Reinforced Polyester GPO3	10.0
Polycarbonate (Unfilled)	12.0 — 16.0
Kydex (PVC/Acrylic Alloy)	15.0
Polyethylene (Low Density)	≥ 16.0
UHMW	> 21.0
Torlon	47.0—142.0 <sup>e</sup>
Polyurethane (Urethane Thermoplastic Elastomer)	No Break
Halar	No Break
PVC: Flexible	Unknown
GG (Extruded Cellulose Acetate)	Unknown
CAB	Unknown
Mylar	Unknown

## REFRACTIVE INDEX

Material	(Sodium D)
Kynar (PVDF)	1.42
Kel-F	1.42
TPX (Methylpentene Polymer)	1.46
CAB	1.46 — 1.49
CAP	1.46 — 1.49
Celcon (Unfilled Acetal Copolymer M90)	1.48
Acrylic (Cast)	1.48 — 1.50 <sup>e</sup>
Polypropylene Unmodified	1.49
GG (Extruded Cellulose Acetate)	1.49 — 1.50
Polyurethane (Urethane Thermoplastic Elastomer)	1.50 — 1.60
Polyethylene (Low Density)	1.51
PVC: Rigid	1.52 — 1.55
Nylon 6/6 (Unfilled)	1.53
ABS (Medium Impact)	1.54 <sup>h</sup>
Polyethylene (High Density)	1.54
Polycarbonate (20% Glass Filled)	1.58
Phenolic (Unfilled)	1.58 — 1.66
Polycarbonate (Unfilled)	1.59
Polycarbonate (10% Glass Filled)	1.59
Polystyrene (General Purpose)	1.59 — 1.60
Polysulfone	1.63
Polyethersulfone (Unfilled)	1.65
ABS (High Impact)	Unknown
Acculam Glass Mat Reinforced Polyester GPO1	Unknown
Acculam Glass Mat Reinforced Polyester GPO3	Unknown
Acetal (Copolymer)	Unknown
Celcon (25% Glass Filled Acetal Copolymer)	Unknown
Halar	Unknown
Kydex (PVC/Acrylic Alloy)	Unknown
Mylar	Unknown
Noryl	Unknown
PEEK (Unfilled)	Unknown
Polycarbonate (40% Glass Filled)	Unknown
Polypropylene Copolymer	Unknown
PVC: Flexible	Unknown
Rulon	Unknown
Teflon (TFE)	Unknown
Torlon	Unknown
UHMW	Unknown
Ultem (10% Glass Filled Polyetherimide)	Unknown
Ultem (20% Glass Filled Polyetherimide)	Unknown
Ultem (30% Glass Filled Polyetherimide)	Unknown
Ultem (Unfilled Polyetherimide)	Unknown

GLOBAL POLYMER INDUSTRIES, INC.

## TENSILE STRENGTH

<b>Material</b>	<b>(PSI x 10<sup>3</sup>)(yield strength at 73<sup>0</sup> F)</b>
UHMW	0.7
Rulon	1.2
Polyethylene (Low Density)	1.4 — 2.0
Teflon (TFE)	1.5
PVC: Flexible	1.5 — 3.5
CAP	2.0 — 7.8
Polyurethane (Urethane Thermoplastic Elastomer)	2.0 — 8.4
CAB	2.6 — 6.9
Polyethylene (High Density)	2.8 — 5.5
Polypropylene Copolymer	2.9 — 4.5
Polystyrene (General Purpose)	4.0
ABS (High Impact)	4.0 — 5.5
Polypropylene Unmodified	4.3 — 6.0
Halar	4.5
GG (Extruded Cellulose Acetate)	4.5 — 8.0
PVC: Rigid	5 — 9
Kel-F	5.0
ABS (Medium Impact)	5.0 — 6.0
Phenolic (Unfilled)	5.0 — 9.0
Kynar (PVDF)	5.9 — 6.1
Kydex (PVC/Acrylic Alloy)	6.5
Polycarbonate (10% Glass Filled)	8.0
Acrylic (Cast)	8.0 — 11.0
Polycarbonate (Unfilled)	8.0 — 9.5
Noryl	8.0 — 9.6
Celcon (Unfilled Acetal Copolymer M90)	8.8
Nylon 6/6 (Unfilled)	9.0 — 15.0
Acetal (Copolymer)	10.0
Polysulfone	10.2
TPX (Methylpentene Polymer)	10.2
Acculam Glass Mat Reinforced Polyester GPO3	11.0
Acculam Glass Mat Reinforced Polyester GPO1	12.0
Polyethersulfone (Unfilled)	12.2
PEEK (Unfilled)	14.5
Ultem (Unfilled Polyetherimide)	15.2
Polycarbonate (20% Glass Filled)	16.0
Torlon	16.2 — 36.2
Ultem (10% Glass Filled Polyetherimide)	16.6
Celcon (25% Glass Filled Acetal Copolymer)	18.5
Ultem (20% Glass Filled Polyetherimide)	20.1
Polycarbonate (40% Glass Filled)	23.0
Ultem (30% Glass Filled Polyetherimide)	24.5

Mylar Unknown

Physical properties represented on these charts are for comparative purposes only. Values can vary greatly from supplier to supplier and in different environments.

<sup>c</sup> 1990 Engineered Plastic Products Corporation

**GLOBAL POLYMER INDUSTRIES, INC.**

**VOLUME RESISTIVITY**

<b>Material</b>	<b>(ohm/cm)</b>
PVC: Flexible	10 <sup>11</sup> — 10 <sup>13</sup>

**ROCKWELL HARDNESS**

<b>Material</b>	<b>Rockwell Hardness</b>
Rulon	27 — 29

Polyurethane (Urethane Thermoplastic Elastomer)	$10^{11} - 10^{14}$	PVC: Flexible	50 — 100 <sup>e</sup>
CAB	$10^{11} - 10^{15}$	Polyethylene (Low Density)	D42 — 50
GG (Extruded Cellulose Acetate)	$10^{11} - 10^{15}$	Polyurethane (Urethane Thermoplastic Elastomer)	M28
Phenolic (Unfilled)	$10^{12} - 10^{13}$	Polysulfone	M69
CAP	$10^{12} - 10^{16}$	Polycarbonate (Unfilled)	M70
Torlon	$8.0 \times 10^{13} - 2.0 \times 10^{15a}$	Polystyrene (General Purpose)	M75
Celcon (Unfilled Acetal Copolymer M90)	$10^{14}$	Celcon (Unfilled Acetal Copolymer M90)	M78 — 80
Celcon (25% Glass Filled Acetal Copolymer)	$10^{14}$	Celcon (25% Glass Filled Acetal Copolymer)	M79
Kynar	$2.0 \times 10^{14}$	Acrylic (Cast)	M80 — 100
Acetal (Copolymer)	$6.0 \times 10^{14}$	Polycarbonate (10% Glass Filled)	M85
Polypropylene Unmodified	$8.5 \times 10^{14}$	Polyethersulfone (Unfilled)	M88
Nylon 6/6 (Unfilled)	$10^{14} - 10^{15}$	Polycarbonate (20% Glass Filled)	M91
Kydex (PVC/Acrylic Alloy)	$10^{14} - 10^{16}$	Polycarbonate (40% Glass Filled)	M93
Halar	$10^{15}$	Phenolic (Unfilled)	M 93 — M120
Rulon	$10^{15b}$	Acetal (Copolymer)	M94, R118
Acrylic (Cast)	$\geq 10^{15}$	Ultem (Unfilled Polyetherimide)	M109
ABS (Medium Impact)	$10^{16}$	Kel-F	M110
ABS (High Impact)	$10^{16}$	Ultem (10% Glass Filled Polyetherimide)	M114
Mylar	$10^{16}$	Ultem (20% Glass Filled Polyetherimide)	M118
Ultem (30% Glass Filled Polyetherimide)	$3.0 \times 10^{16}$	Ultem (30% Glass Filled Polyetherimide)	M125
Polycarbonate (40% Glass Filled)	$4.0 - 5.6 \times 10^{16}$	CAP	R10 — 122
Polycarbonate (10% Glass Filled)	$4.0 - 5.6 \times 10^{16}$	Teflon (TFE)	R15 — 17
Polycarbonate (20% Glass Filled)	$4.0 - 5.6 \times 10^{16}$	Torlon	R27 — 29
Polysulfonee	$5.0 \times 10^{16}$	CAB	R31 — 116
Polypropylene Copolymer	$6.2 \times 10^{16}$	TPX (Methylpentene Polymer)	R35
Ultem (20% Glass Filled Polyetherimide)	$7.0 \times 10^{16}$	Polypropylene Copolymer	R50 — 96
Polycarbonate (Unfilled)	$8.2 \times 10^{16}$	UHMW	R64
Polyethylene (High Density)	$\geq 10^{16}$	Polyethylene (High Density)	R67
Polyethylene (Low Density)	$\geq 10^{16}$	ABS (High Impact)	R85 — 105
Polystyrene (General Purpose)	$\geq 10^{16}$	GG (Extruded Cellulose Acetate)	R85 — 120
PVC: Rigid	$\geq 10^{16}$	Halar	R93
TPX (Methylpentene Polymer)	$\geq 10^{16}$	Polypropylene Unmodified	R95
Noryl	$10^{17}$	Kydex (PVC/Acrylic Alloy)	R99 — 105
Ultem (10% Glass Filled Polyetherimide)	$1.0 \times 10^{17}$		
Ultem (Unfilled Polyetherimide)	$6.7 \times 10^{17}$	Acculam Glass Mat Reinforced Polyester GPO1	Unknown
Polyethersulfone (Unfilled)	$10^{17} - 10^{18}$	Mylar	Unknown
Teflon (TFE)	$10^{18}$	PEEK (Unfilled)	Unknown
Kel-F	$1.2 \times 10^{18}$	Acculam Glass Mat Reinforced Polyester GPO3	Unknown
UHMW	$\geq 10^{18}$		
Acculam Glass Mat Reinforced Polyester GPO3	Unknown		
PEEK (Unfilled)	Unknown		
Acculam Glass Mat Reinforced Polyester GPO1	Unknown		

## GLOBAL POLYMER INDUSTRIES, INC.

### DISSIPATION FACTOR

Material	( $10^6$ cycles)
TPX (Methylpentene Polymer)	.000025
Teflon (TFE)	.0002
Polypropylene Unmodified	.0005 — .0018 <sup>j</sup>

### COEFFICIENT OF LINEAR THERMAL EXPANSION

Material	( $\times 10^{-6}$ in/in/ <sup>o</sup> C)
TPX (Methylpentene Polymer)	$1.17 \times 10^{-41}$
Kel-F	$4.80 \times 10^{-5m}$
Rulo	$3.3 \times 10^{-5n}$

UHMW	≤ .0005	Polycarbonate (40% Glass Filled)	9
Polyethylene (Low Density)	≤ .0005	Torlon	9 — 30.6 <sup>0</sup>
Polyethylene (High Density)	≤ .0005	Ultem (30% Glass Filled Polyetherimide)	11
Noryl	.0009	Ultem (20% Glass Filled Polyetherimide)	14
Polystyrene (General Purpose)	.001 — .0004	Polycarbonate (20% Glass Filled)	15
Polypropylene Copolymer	.001 — .0018	Polycarbonate (10% Glass Filled)	18
Rulon	.001 — .004 <sup>j</sup>	Ultem (10% Glass Filled Polyetherimide)	18
Ultem (Unfilled Polyetherimide)	.0013 <sup>k</sup>	Celcon (25% Glass Filled Acetal Copolymer)	22
Ultem (10% Glass Filled Polyetherimide)	.0014 <sup>k</sup>	Polysulfone	31
Ultem (20% Glass Filled Polyetherimide)	.0015 <sup>k</sup>	Noryl	33
Ultem (30% Glass Filled Polyetherimide)	.0015 <sup>k</sup>	Ultem (Unfilled Polyetherimide)	35
Polysulfone	.0034	Polyethersulfone (Unfilled)	37
Celcon (Unfilled Acetal Copolymer M90)	.006	Kydex (PVC/Acrylic Alloy)	38 — 45
Acetal (Copolymer)	.006	Kynar (PVDF)	44 — 79
Polyethersulfone (Unfilled)	.006	Celcon (Unfilled Acetal Copolymer M90)	47
PVC: Rigid	.006 — .019	PVC: Rigid	50 — 185
Polycarbonate (40% Glass Filled)	.0067 — .0075	Acrylic (Cast)	50 — 90
Polycarbonate (20% Glass Filled)	.0067 — .0075	ABS (High Impact)	53
Polycarbonate (10% Glass Filled)	.0067 — .0075	ABS (Medium Impact)	53
Celcon (25% Glass Filled Acetal Copolymer)	.007	Polystyrene (General Purpose)	63
ABS (Medium Impact)	.007 — .015	Polycarbonate (Unfilled)	66 — 70
ABS (High Impact)	.007 — .015	Phenolic (Unfilled)	68
Halar	.009	PVC: Flexible	73
Kel-F	.01	Nylon 6/6 (Unfilled)	80
Polycarbonate (Unfilled)	.010	Polypropylene Copolymer	80 — 95
CAB	.01 — .04	Acetal (Copolymer)	85
CAP	.01 — .05	Polypropylene Unmodified	96.0
Mylar	.016	Teflon (TFE)	100
Kynar (PVDF)	.019	Halar	100 <sup>p</sup>
Acrylic (Cast)	.02 — .03	GG (Extruded Cellulose Acetate)	100 — 150
Torlon	.02 — .07	Polyurethane (Urethane Thermoplastic Elastomer)	100 — 200
Kydex (PVC/Acrylic Alloy)	.03	CAP	110 — 170
GG (Extruded Cellulose Acetate)	.03 — .04	CAB	110 — 170
Nylon 6/6 (Unfilled)	.04	Polyethylene (High Density)	120
PVC: Flexible	.04 — .014	Polyethylene (Low Density)	180
Phenolic (Unfilled)	.04 — .05	UHMW	200
Polyurethane (Urethane Thermoplastic Elastomer)	.05 — .100	Acculam Glass Mat Reinforced Polyester GPO1	Unknown
Acculam Glass Mat Reinforced Polyester GPO1	Unknown	Acculam Glass Mat Reinforced Polyester GPO3	Unknown
Acculam Glass Mat Reinforced Polyester GPO3	Unknown	Mylar	Unknown
PEEK (Unfilled)	Unknown	PEEK (Unfilled)	Unknown

## GLOBAL POLYMER INDUSTRIES, INC.

### CHEMICAL RESISTANCE

Test specimens . . . . . dumb-bell type

Duration of test. . . . . 30 days

/ = limited resistance . . . . . decrease in yield stress and ultimate tensile



+ = resistant . . . . . mechanical properties not appreciably affected

- = not resistant . . . . . decrease in yield stress and ultimate tensile strength greater than 20%

REAGENT	TEMPERATURE			REAGENT	TEMPERATURE		
	20 <sup>0</sup> C	50 <sup>0</sup> C	80 <sup>0</sup> C		20 <sup>0</sup> C	50 <sup>0</sup> C	80 <sup>0</sup> C
<b>I. Inorganic Acids</b>				<b>V. Hydrocarbons and Halogenated</b>			
Chromic Acid (80%)	+	+	/	<b>Hydrocarbons</b>			
Hydrochloric Acid (conc.)	+	+	+	Benzene	/	/	
Hydrochloric Acid	+	+		Carbon Tetrachloride	/		
Hydrofluoric Acid	+	+		Cyclohexane	+	+	
Nitric Acid (conc.)	--	--	--	Dichloroethylene	--	--	
Nitric Acid (50%)	/	--	--	Diesel Oil	+	+	/
Nitric Acid (20%)	+	+	/	n-Heptane	+	+	
Phosphoric Acid (85%)	+	+	+	Petroleum Ether	+		
Sulphuric Acid (conc.)	+	--	--	Trichloroethylene	/	--	
Sulphuric Acid (75%)	+	/	/	Toluene	/	--	
Sulphuric Acid (50%)	+	+	+	White Spirit	+	/	
				Zylene	/	/	--
<b>II. Alkalis</b>				<b>VI. Alcohols, Ketones, Ester and Amines</b>			
Aqueous Ammonia	+	+		Acetone	+	+	
Potassium Hydroxide Solution	+	+	+	Aniline	+	+	/
Sodium Hydroxide Solution	+	+	+	Benzyl Alcohol	+	+	+
<b>III. Aqueous Solutions of Inorganic Salts</b>				Butyl Alcohol	+	+	+
Aluminum Chloride	+	+	+	Cyclohexanol	+	+	+
Ammonium Nitrate	+	+	+	Ethanol	+	+	
Bleaching Powder	+	+	+	Ethyl Acetate	+	+	
Calcium Chloride	+	+	+	Ehylene Glycol	+	+	+
Sodium Carbonate	+	+	+	Glycerine	+	+	+
Sodium Chloride	+	+	+	Lauryl Alcohol	+	+	+
Sodium Hypochlorite	+	+	+	Propyl Alcohol	+	+	+
Zinc Chloride	+	+	+				
<b>IV. Organic Acids</b>				<b>VII. Miscellaneous</b>			
Acetic Acid (99%)	+	+	/	Beer/Wine	+	+	+
Acetic Acid (10%)	+	+	+	Detergents in Aqueous Solution	+	+	+
Butyric Acid	+	+		Distilled Water	+	+	+
Citric Acid	+	+	+	Hydrogen Peroxide 30% (Perhydrol)	+	+	
Formic Acid	+	+		Linseed Oil/Olive Oil	+	+	+
Oleic Acid	+	+	/	Milk	+	+	+
				Sea Water	+	+	+

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## HOSTALEN GUR UH MW POLYMER PROPERTY TABLES MECHANICAL PROPERTIES

PROPERTY	ASTM TEST	UNITS METRIC (US)	TYPICAL VALUES
Density	D792	gm/cm <sup>3</sup>	0.926-0.934
Tensile Strength @ Yield	D638	MPa (psi)	21(3100)
Tensile Strength @ Break	D638	Mpa (psi)	48(7000)
Elongation @ Break	D638	%	350
Youngs ("E") Modulus (23 <sup>0</sup> C)	D638	Mpa (psi x 10 <sup>5</sup> )	690(1.0)
Youngs ("E") Modulus (-269 <sup>0</sup> C)	D638	Mpa (psi x 10 <sup>5</sup> )	2970(4.3)
Izod Impact Strength (23 <sup>0</sup> C)	D256(1)	J/m (ft-11/in notch)	140(30)
Izod Impact Strength (-40 <sup>0</sup> C)	D256(1)	J/m (ft-11/in notch)	100(21)
Hardness, shore "D"	D2240	--	62-66
Abrasion Resistance	(2)	--	100

Water Absorption	D570	%	Nil
Relative Solution Viscosity	D4020	dl/gm	2.3-3.5

(1) Izod Impact Strength: Samples have two ( $15^0 \pm 1/2^0$ ) notches on opposite sides to a depth of 5 mm.

(2) See description of test method on page 2 of text.

### THERMAL PROPERTIES

PROPERTY	ASTM TEST	UNITS METRIC (US)	TYPICAL VALUES
Crystalline Melting Range, Powder	Polarizing Microscope	$^{\circ}\text{C}(^{\circ}\text{F})$	138-142 (280-289)
Coefficient of Linear Expansion 20 to 100 $^{\circ}\text{C}$	D696	$\text{K}^{-1}$	$\sim 2 \times 10^{-4}$
-200 to 100 $^{\circ}\text{C}$	D696	$\text{K}^{-1}$	$\sim 0.5 \times 10^{-4}$

### ELECTRICAL PROPERTIES

PROPERTY	ASTM TEST	UNITS METRIC (US)	TYPICAL VALUES
Volume Resistivity	D257	$\Omega\text{cm}$	$> 5 \times 10^{16}$
Dielectric Strength	D149	KV/cm (V/mil)	900(2300)
Dielectric Constant ( $\epsilon_r$ )	D150	--	2.30
Dissipation Factor ( $\tan \delta$ )	D150		
at 50 Hz		--	$1.9 \times 10^{-4}$
at 10 $^3$ Hz		--	$.05 \times 10^{-4}$
at 10 $^5$ Hz		--	$2.5 \times 10^{-4}$
Surface Resistivity, wt. % carbon black			
0.2% for Color	D257	Ohms	$> 10^{14}$
2.5% for UV protection	D257	Ohms	$10^{13}$
6.5% for Antistatic applications	D257	Ohms	$10^5$
16.7% for Conductive applications	D257	Ohms	$10^3$

### COMPARISON OF DYNAMIC COEFFICIENT OF FRICTION ON POLISHED STEEL

PROPERTY	UHME-PE	NYLON 6	NYLON 6/6	NYLON/MoS <sub>2</sub>	PTFE	ACETAL COPOLYMER
Dry	.10-.22	.15-.40	.15-.40	.12-.20	.04-.25	.15-.35
Water	.05-.10	.14-.19	.14-.19	.10-.12	.04-.08	.10-.20
Oil	.05-.08	.02-.11	.02-.11	.08-.10	.04-.05	.05-.10

### GENERAL MACHINING GUIDELINES

**Cutting:** Band saws: 3,300-6,600 ft./min. Circular saws: 10,000-13,000 ft./min.

**Turning:** Up to 2,000 ft./min.

**Note:** Higher cutting, turning and drilling speeds may require compressed air, water, or cutting oils for cooling.