

Resin Washers / Collars - Properties and Features

Properties of Resin Materials

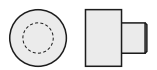
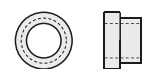
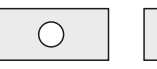
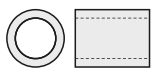
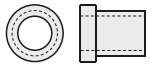
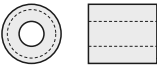
- Polyacetal : This material offers excellent mechanical strength, and is used generally and widely. White color or Black color is selectable.
- MC Nylon : Superior to Polyacetal in abrasion resistance. Conductive Grade Model is also available, and is effective against static electricity.
- Bakelite : Serves as insulating part. In addition to Paper Base Type, Cloth Base Type is also offered with higher strength.
- Fluororesin : Excellent at impact resistance, chemical stability and electrical properties. This material also offers excellent sliding properties, and thus, is used for rotating areas.
- PEEK : Excellent at heat / chemical resistance. This material also offers excellent mechanical properties under high temperature.
- Epoxy Glass : Superior to Bakelite in strength and heat / humidity resistance.
- Polycarbonate : Has the top-level impact strength among transparent resin materials, and also offers excellent heat / cold resistance. Thus, this material is capable of wide application.
- Polyslider® : Excellent at sliding properties and abrasion resistance. This material is suitable for sliding / rotating areas.

Resin Washers / Collars - Properties and Features

Item			Testing Method (ASTM)	Unit	Material									
					Polyacetal	MC Nylon		Bakelite		Fluororesin Polytetrafluoroethylene	PEEK Polyether Ether Ketone	Epoxy Glass	Polycarbonate	
						Standard	Conductive Grade		Paper Base					Cloth Base
						CDR2	CDR6							
Mechanical Properties	Tensile Strength		D638	MPa	61	96	68	74	113	97	13.7~34.3	98	309	59
	Elongation		D638	%	40	30	10	7	2.6	2	200~400	20	4	60~120
	Bending Strength	Vertical	D790	MPa	89	110	117	117	189	144	-	170	431	80.4
		Parallel	D790						182	148				
	Flexural Modulus		D790		2589	3530	4110	4020	9680	8650	550	4021	16300	2200
	Compression Strength	Vertical	D695		103	95	98	93	135	116	11.8	119	266	73.5
	5% Deformation	Parallel	D695						132	115				
Izod Impact Strength (Notched)		D256	J/m	74	50	35	35	-	-	160	77	-	740~980	
Rockwell Hardness		D785	R/M Scale	R119 M78	R120	R119	R117	-	-	-	120	-	M60~70	
Thermal Characteristics	Deflection Temperature under Load	0.45MPa	D648	°C	158	215		-	-	121	-	-	145	
		1.82MPa		°C	110	200		206	230~	55	155	230~	-	
	Ambient Operating Temperature		-	°C	-45~95		-40~120		-50~100		-40~250	-50~250	-150~180	~110
	Ref.: Destruction Temperature * Carbonization Start, Collapse, Dissolution Temperature		-	°C	165	222	215	215	-	-	327	340	-	-
Linear Expansion Coefficient		D696	10 ⁻⁵ /°C	9.0	9.0	8.0	7.5	-	-	9.9	5.0	1.55	6.0~7.0	
Thermal Conductivity		D177	W/m · k	0.233	0.233	0.512	0.709	0.21	0.38	0.25	0.25	0.47	0.19	
Dielectric Constant 10 ⁶ Hz		D150	-	3.7	3.7	-	-	4.24	5.33	18.6	3.3	-	3.0	
Dissipation Factor 10 ⁶ Hz		D150	-	0.007	0.02	-	-	0.036	0.056	~2x10 ⁻⁴	3x10 ⁻³	-	0.0012	
Specific Volume Resistivity		D257	Ω · cm	>10 ¹⁴	4.2×10 ¹⁵	10 ² ~10 ⁴	10 ⁴ ~10 ⁶	-	-	>10 ¹⁸	>10 ¹⁶	10 ¹¹ ~10 ¹²	>10 ¹⁷	
Dielectric Breakdown Strength (Breakdown Voltage)		D149	kV/mm	20	20	-	-	29.5	18.6	19	19	23	15	
Arc Resistance		D495	sec	-	-	-	-	-	-	>300	23	180	-	
Others	Specific Gravity		D792	-	1.41	1.16	1.2	1.23	1.4	1.4	2.14~2.2	1.32	1.8~1.85	1.2
	Moisture Absorption (At 23°Cx24h)		D570	%	0.22	0.8	-	-	0.5~1.3	1.6~1.8	<0.01	0.14	0.4	0.24
	Glass Fiber Content		-	-	-	-	-	-	-	-	-	-	Contain	-
Food Sanitation Laws		-	-	Compliant	Compliant*	Compliant*		-	-	Compliant	Compliant	-	-	
Flame Resistance		[UL94]	-	(HB Equiv.)	(HB Equiv.)	(HB Equiv.)	(HB Equiv.)	-	-	(V-0 Equiv.)	(V-0 Equiv.)	-	-	
Chemical Resistance	◎: Excellent ○: Good △: Questionable ×: Poor	Oil	-	-	○	○	○	-	-	○	◎	-	○	
		Acid	-	-	△~×	×	×	×	-	-	○	◎	-	△
		Alkali	-	-	○	○~△	○~△	○~△	-	-	○	◎	-	×
		Organic Solvent	-	-	○	○	○	○	-	-	○	◎	-	×
Characteristics	◎: Excellent ○: Good △: Questionable ×: Poor	Sliding Properties	-	-	○	○	○	○	△	△	◎	○	△	△
		Heat Resistance	-	-	△	△	△	△	○	○	○	○	△~○	○
		Insulation	-	-	○	○	-	-	○	○	○	○	◎	◎
		Abrasion Resistance	-	-	△	○	△	△	×	×	○	○	×	×
		Dimension Stability	-	-	○	△	△	△	○	○	×	◎	○	○
		Machinability	-	-	◎	○	○	○	○	○	○	○	△	○

- ⦿: Excellent
○: Good
△: Questionable
×: Poor
- * In compliance with Food Sanitation Laws (MC Nylon, Standard: After boiling for 1.5hrs.; Conductive Grade: After boiling for 2hrs.) Listed values are for reference, not guaranteed.
Do not store resin materials for prolonged duration to avoid dimensional deformation due to water absorption (Material with a higher moisture absorption rate will be deformed more.).
Property values of Polycarbonate are obtained by JIS test (for reference).
Bakelite may be discolored over time, but its properties do not change.
For Properties of PolysliderR, see P.145.

Washers / Collars

Shape	Material	Polyacetal		Standard		MC Nylon		Bakelite		Fluororesin Polytetra- fluoroethylene	PEEK Polyether Ether Ketone	Epoxy Glass	Polycarbonate	Polyslider®	Ceramic	Thermal Insulation Material	
						Conductive Grade CDR2 CDR6	Paper Base	Cloth Base									
	Standard Size	Color	White	Black	Blue	Ivory	Black		Brown	Light Brown	White	Gray	Green	Transparent	Black	White	White
Washer	Standard 	P143 O.D. D 4~60 I.D. V 0~55 Thickness T 2~10	● T0.2 ~ 1.0 Available (White) P145		●			●		● T0.1 ~ 1.0 Available P145	●	●	● T0.1 ~ 1.0 only P145		● T0.13 ~ 1.0 only P145	● D10~45 V 3~20 T 3~5	● D10~25 V 3~10 T 3~5
	Flanged Solid 	P146 O.D. D 6~60 Nose Dia. V 2~58 Thickness T 3~50	●		●		● D6~50	●	●	● D6~50	● D6~50	● D6~50	-	-	-	-	
	Flanged 	P146 O.D. D 4~60 Flange Dia. H 6~70 I.D. V 0~55 Overall Length L 2~10	●		●		●	●	●	●	●	●	-	-	-	-	
	Counterbored 	P151 O.D. D10~60 I.D. P 3~53 Thickness T 3~50	●		●		● D10~50	●	●	● D10~50	● D10~50	● D10~50	-	-	-	-	
	Square Resin Washer 	P156 Length A 6~25 Width B 6~100 Thickness T 2~10	●	-	●	-	-	-	-	-	-	-	-	-	-	-	
Collar	Standard 	P147 O.D. D 4~100 I.D. V 2~55 Overall Length L10~100	●		●		● D4~50	●	●	● D4~50	● D4~50	● D4~50	-	-	● D6~25 V 3~20 L 5~100	● D8~20 V 3~10 L 10~30	
	Flanged 	P149 O.D. D 4~100 Flange Dia. H 6~110 I.D. V 0~90 Overall Length L10~100	●		●		● D4~50	●	●	● D4~50	● D4~50	● D4~50	-	-	● D6~25 H10~45 V 3~20 L 8~25	● D8~20 H12~30 V 3~10 L 10~20	
	With Guide 	P152 O.D. D 8~30 I.D. V 3~20 Overall Length L 2~50	●	-	●	-	-	-	-	-	-	-	-	-	-	-	
● Product Available - Product Not Available																	

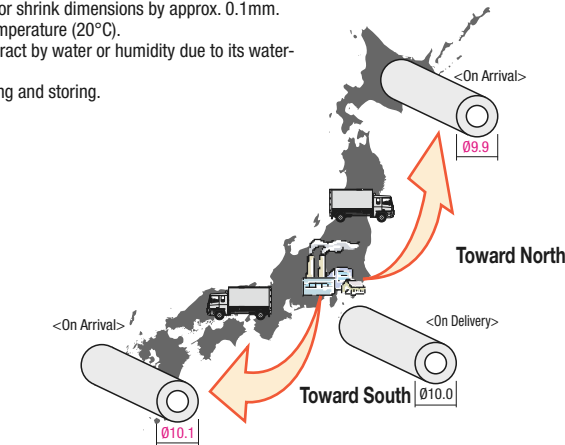
• Product Available - Product Not Available

About Designing of Resin Parts

Unlike metals, resin is the most likely to deform or change in dimensions due to temperature or humidity. Upon designing, pay attention to the following.

Alteration of Dimensions

- 1 °C level temperature change may expand or shrink dimensions by approx. 0.1mm.
Be sure to store purchased parts at room temperature (20°C).
MC Nylon especially tends to expand or contract by water or humidity due to its water-absorbing property.
Pay extra attention to the dimension designing and storing.



⦿ If dimensions-changed parts are put in room temperature for a while, they may be brought back to their original dimensions state in some degree.