

# 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.

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Item	Testing Method (ASTM)	Unit	Material										
			Polyacetal	MC Nylon		Bakelite		Fluororesin Polytetrafluoroethylene	PEEK Polyether Ether Ketone	Epoxy Glass	Polycarbonate		
				Standard	Conductive Grade CDR2	Conductive Grade CDR6	Paper Base					Cloth Base	
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	D790	Vertical	89	110	117	117	189	144	-	170	431	80.4	
		Parallel					182	148					
Flexural Modulus	D790	MPa	2589	3530	4110	4020	9680	8650	550	4021	16300	2200	
Compression Strength	D695	Vertical	103	95	98	93	135	116	11.8	119	266	73.5	
5% Deformation		Parallel					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	
Deflection Temperature under Load	D648	0.45MPa	158				215		-	-	121	-	145
		1.82MPa	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 <sup>-5</sup> /°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 <sup>6</sup> Hz	D150	-	3.7	3.7	-	-	4.24	5.33	18.6	3.3	-	3.0	
Dissipation Factor 10 <sup>6</sup> Hz	D150	-	0.007	0.02	-	-	0.036	0.056	~2x10 <sup>-4</sup>	3x10 <sup>-3</sup>	-	0.0012	
Specific Volume Resistivity	D257	Ω·cm	>10 <sup>14</sup>	4.2x10 <sup>15</sup>	10 <sup>2</sup> ~10 <sup>4</sup>	10 <sup>4</sup> ~10 <sup>6</sup>	-	-	>10 <sup>18</sup>	>10 <sup>16</sup>	10 <sup>11</sup> ~10 <sup>12</sup>	>10 <sup>17</sup>	
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	-	
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	Oil	○: Excellent	-	-	○	○	○	○	-	-	○	○	○
		○: Good	-	-	△~X	X	X	X	-	-	○	○	△
		△: Questionable	-	-	○	○~△	○~△	○~△	-	-	○	○	X
		X: Poor	-	-	○	○	○	○	-	-	○	○	X
Characteristics	Sliding Properties	-	-	○	○	○	○	△	△	○	○	△	
	Heat Resistance	-	-	△	△	△	△	○	○	○	△~○	○	
	Insulation	-	-	○	○	-	-	○	○	○	○	○	
	Abrasion Resistance	-	-	△	○	△	△	X	X	○	○	X	
	Dimension Stability	-	-	○	△	△	△	○	○	X	○	○	
	Machinability	-	-	○	○	○	○	○	○	○	○	○	

- \* 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	MC Nylon				Bakelite		Fluororesin Polytetrafluoroethylene	PEEK Polyether Ether Ketone	Epoxy Glass	Polycarbonate	Polyslider®	Ceramic	Thermal Insulation Material								
			Standard	Conductive Grade		Paper Base	Cloth Base	Natural Color								Natural Color	White	Gray	Green	Transparent	Black	White	White
				CDR2	CDR6	Black	Black																
Standard	P143 O.D. D 4~60 I.D. V 0~55 Thickness T 2~10	•	•	•	•	•	•	•	•	•	•	•	•	•	•								
Flanged Solid	P146 O.D. D 6~60 Nose Dia. V 2~58 Thickness T 3~50	•	•	•	•	•	•	•	•	•	•	•	•	•	•								
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. D 10~60 I.D. P 3~53 Thickness T 3~50	•	•	•	•	•	•	•	•	•	•	•	•	•	•								
Square Resin Washer	P156 Length A 6~25 Width B 6~100 Thickness T 2~10	•	•	•	•	•	•	•	•	•	•	•	•	•	•								
Standard	P147 O.D. D 4~100 I.D. V 2~55 Overall Length L 10~100	•	•	•	•	•	•	•	•	•	•	•	•	•	•								
Flanged	P149 O.D. D 4~100 Flange Dia. H 6~110 I.D. V 0~90 Overall Length L 10~100	•	•	•	•	•	•	•	•	•	•	•	•	•	•								
With Guide	P152 O.D. D 8~30 I.D. V 3~20 Overall Length L 2~50	•	•	•	•	•	•	•	•	•	•	•	•	•	•								

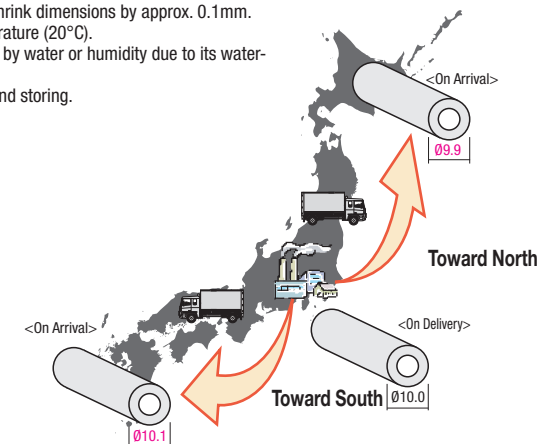
• Product Available - Product Not Available

## 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.