For **Pricing** and **Days to Ship**,Please Configure Online.

Features of Oil Free Bushings and Washers

■Material Properties and Environmental Tolerances (Reference Value)

Page	P.341~346		P.347, 348		P.358~360	P.359	P.361		P.357	
Type	Copper Alloy		Bronze		Multi-Layer LF	High Precision	Resin Type (Polyacetal Resin)	Resin Type (PTFE)	Casting	
Shape										
Material Properties	Composite products with embedded solid lubricant in high-tensile brass.		Porous bronze casting soaked in lubrication.		Composite product consisting of three layers: steel-backed metal layer, sintered bronze layer and filler added PTFE layer.	Fluororesin is bonded on duralumin (2017 Aluminum Alloy).	Polyacetal resin with added lubricant and special fillers.	PTFE to which friction resisting filler and solid lubricant are added.	Molybdenum Disulfide is embedded spirally in Cast Iron Class No.35.	
Lubrication	Regular	Unlubricated	Regular	Oil	Unlubricated	Unlubricated	Unlubricated	Unlubricated	Regular	Unlubricated
Rotation	○		○		○	○	○	○	○	
Oscillating Motion	○		○		○	○	○	○	○	
Reciprocating Motion	○		○		○	○	○	○	○	
Operating Temp. Range (°C)	-40~200	-40~150	-40~150		-195~280	-50~140	-40~80	-200~200	-40~150	
Electrical Conductivity	Provided		Provided		Provided	Not provided	Not provided	Volume Resistivity: $3x10^2\Omega \cdot cm^2$	Provided	
Environmental Conditions: In Air	○		○		○	○	○	○	○	
Environmental Conditions: In Oil	○		○		○	×	○	○	○	
Environmental Conditions: In Water	-	×	×		△	×	△	○	×	
Environmental Conditions: In Seawater	-	×	×		×	×	△	○	×	
Environmental Conditions: In Chemical	-	×	×		△	×	△	○	×	
Environmental Conditions: In Corrosive Atmosphere	△	△	×		△	○	△	○	×	
Maximum Allowable Load	29.0(98.0)N/mm²		10N/mm²		49.0(137)N/mm²	6N/mm²	17.5N/mm²	7N/mm²	8N/mm²	5N/mm²
	296(1,000)kgf/cm²		102kgf/cm²		500(1400)kgf/cm²	61kgf/cm²	179kgf/cm²	71kgf/cm²	82kgf/cm²	51kgf/cm²
Maximum Allowable Velocity	1.00m/s	0.5m/s	1.66m/s	5.0m/s	0.65m/s	3.33m/s	0.85m/s	1.65m/s	0.25m/s	0.15m/s
	60m/min	30m/min	100m/min	300m/min	39m/min	200m/min	51m/min	99m/min	15m/min	9m/min
Maximum Allowable PV Value	3.25 N/mm²·m/s	1.65 N/mm²·m/s	1.65 N/mm²·m/s	3.25 N/mm²·m/s	3.60 N/mm²·m/s	0.98 N/mm²·m/s	2.45 N/mm²·m/s	1 N/mm²·m/s	0.8 N/mm²·m/s	0.5 N/mm²·m/s
	1,990 kgf/cm²·m/min	1,010 kgf/cm²·m/min	1,000 kgf/cm²·m/min	2,000 kgf/cm²·m/min	2,200 kgf/cm²·m/min	600 kgf/cm²·m/min	1,500 kgf/cm²·m/min	612 kgf/cm²·m/min	490 kgf/cm²·m/min	306 kgf/cm²·m/min

Environmental Condition △ - Applicable only under certain conditions. Some values for Casting Type are for reference only. Values for High Precision Type are values for the sliding material.
Values in ( ): Allowable Static Surface Pressure (no sliding motion or sliding at extremely low speed)　　Listed values are not standard values but reference values.

■Mechanical Properties (Reference Value)

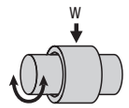
Characteristics	Unit	Copper Alloy		Bronze		Multi-Layer LF		High Precision		Resin Type (Polyacetal Resin)		Resin Type (PTFE)		Casting	
		Value	Testing Method	Value	Testing Method	Value	Testing Method	Value	Testing Method	Value	Testing Method	Value	Testing Method	Value	Testing Method
Density	g/cm³	7.8	-	8.5	-	-	-	-	-	-	-	-	-	-	-
Tensile Strength	N/mm² {kgf/mm²}	755 {77.0}	JIS Z 2241	150 {15.0}	JIS Z 2241	380 {38.7}	JIS Z 2241	12 {1.2}	ASTM D 638	51.0 {5.2}	ASTM D 638	13.1 {1.3}	ASTM D 638	245 (25.0)	-
Tensile Elongation after Fracture	%	12	JIS Z 2241	-	-	-	-	-	-	60	ASTM D 638	150	ASTM D 638	-	-
Elongation	%	-	-	-	-	27	JIS Z 2241	171	ASTM D 638	-	-	-	-	-	-
Flexural Strength	N/mm² {kgf/mm²}	-	-	-	-	-	-	-	-	76.5{7.8}	ASTM D 790	-	-	-	-
Flexural Modulus	N/mm² {kgf/mm²}	-	-	-	-	-	-	-	-	2,650{270.2}	ASTM D 790	-	-	-	-
Compression Strength	N/mm² {kgf/mm²}	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Yield Strength	N/mm² {kgf/mm²}	345 {35.0}	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Stress 1% Deformation	N/mm² {kgf/mm²}	-	-	-	-	-	-	-	-	21.1 {2.2}	ASTM D 695	10.5 {1.1}	ASTM D 695	-	-
Compression Stress 10% Deformation	N/mm² {kgf/mm²}	-	-	-	-	-	-	-	-	81.9 {8.4}	ASTM D 695	23.0 {2.3}	ASTM D 695	-	-
Impact Strength	J/cm {kgfm/cm}	19{1.9}	JIS Z 2242	-	-	-	-	-	-	58.8 {6.0}	ASTM D 256	-	-	-	-
Hardness	-	HB210	JIS Z 2243,2245	HB 60	JIS Z 2243	-	-	HDD62	ASTM D 2240	HRM72	ASTM D 785	HRR25	ASTM D 785	HB240	-
Young's Modulus	N/mm² {kgf/mm²}	105,000 {10,700}	JIS Z 2241	-	-	-	-	-	-	-	-	-	-	-	-
Linear Thermal Expansion Coefficient	x10⁻⁵°C⁻¹	2.2	-	-	-	-	-	9~9.75	ASTM D 696	8~13	ASTM D 696	9~11	ASTM D 696	0.92~1.18	-
Thermal Conductivity	W/m°C (cal/sec°C cm)	0.009 {0.21}	-	-	-	-	-	-	-	-	-	-	-	-	-
Melting Point	°C	-	-	-	-	-	-	-	-	165	DSC	327	DSC	-	-
Specific Gravity	-	-	-	-	-	-	-	1.98	ASTM D 792	1.39	ASTM D 792	2.25	ASTM D 792	7.1	-
UL Flammability	-	-	-	-	-	-	-	-	-	HB	UL94	-	-	-	-

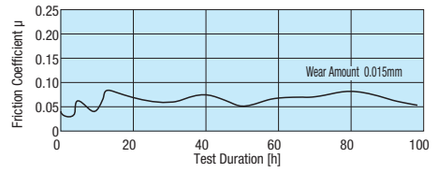
*Data below are for reference, not guaranteed.

■Test Data of Copper Alloy Type

Journal Oscillation Motion Test

<Test Conditions>
Bushing: **MPBZ20-20**
Mating Material: 1045 Carbon Steel HRC46~48
Oscillation Angle: ±45°
Surface Pressure: 24.5N/mm² {250kgf/cm²}
Velocity: 0.5m/min {16cpm}
Lubrication: Unlubricated

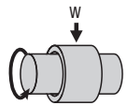


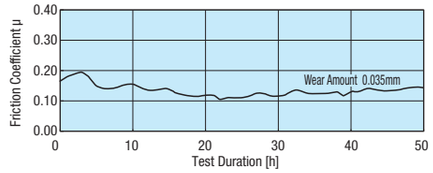


■Test Data of Bronze Type

Journal Rotation Test

<Test Conditions>
Bushing: **SHBZ30-30**
Mating Material: 1045 Carbon Steel HRC50
Surface Pressure: 1.47N/mm² {15kgf/cm²}
Velocity: 0.83m/S (50m/min)
Test Duration: 50h
Lubrication: Apply oil every 1 hour.

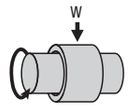


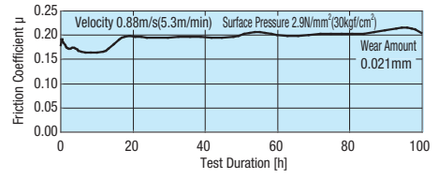


■Test Data of Multi-Layer LF Type

Journal Rotation Test

<Test Conditions>
Bushing: **MDZB40-30**
Mating Material: 1045 Carbon Steel
Surface Pressure: 2.9N/mm² {30kgf/cm²}
Velocity: 0.088m/s {5.3m/min}
Lubrication: Unlubricated

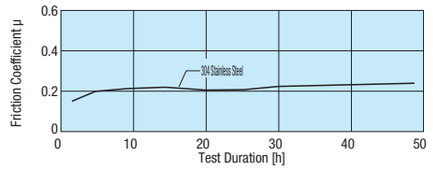




■Test Data of High Precision BFLB Bushing

Ring on Disk Test

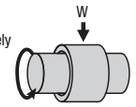
<Test Conditions>
Mating Material: 304 Stainless Steel
Surface Pressure: 0.41MPa
Velocity: 1.833m/s {110m/min}
Lubrication: Unlubricated

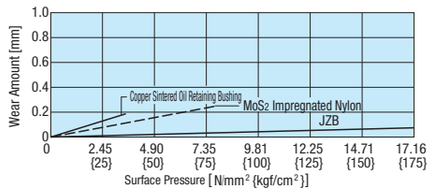


■Test Data of Resin (Polyacetal Resin)

Journal Rotation Test

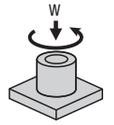
<Test Conditions>
Bushing: **JZB35-20**
Surface Pressure: 0.42N/mm² {4.0kgf/cm²} is cumulatively loaded every 5 minutes.
Velocity: 1.133m/s {68m/min}
Lubrication: Greased at assembly

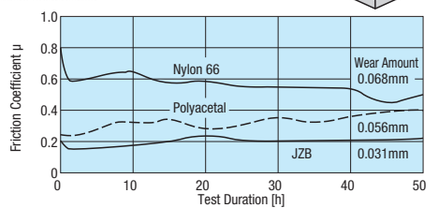




Thrust Rotation Test

<Test Conditions>
Mating Material: 1045 Carbon Steel (Surface Roughness 3μmRy)
Surface Pressure: 2.94N/mm² {30kgf/cm²}
Velocity: 0.167m/s {10m/min}
Test Duration: 50h
Lubrication: Unlubricated

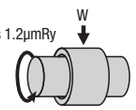


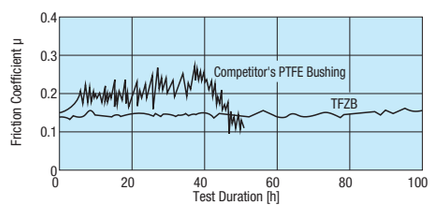


■Test Data of Resin (PTFE)

Journal Rotation Test

<Test Conditions>
Bushing: **TFZB10-10**
Mating Material: 303 Stainless Steel (Surface Roughness 1.2μmRy
Surface Pressure: 1.96N/mm² {20kgf/cm²}
Velocity: 0.500m/s {30m/min}
Test Duration: 100h
Lubrication: Unlubricated





Journal Rotation Test

<Test Conditions>
Bushing: **TFZB10-10**
Mating Material: 303 Stainless Steel (Surface Roughness 1.2μmRy)
Surface Pressure: 0.49~1.96N/mm²{5~20kgf/cm²}
Velocity: 0.667m/s{40m/min}
Lubrication: Unlubricated