

Features of Oil Free Bushings and Washers

* Data below are for reference, not guaranteed.

Material Properties and Environmental Tolerances (Reference Value)

Page	P337・338		P331~336		P347		P348~350		P349		P351	
Type	Bronze Type		Copper Alloy Type		Casting Type		Multi-Layer MD Type		High Precision Type		Resin Type (Polyacetal)	
Shape												
Material Properties	Porous bronze casting soaked in lubrication.		Composite products with embedded solid lubricant in high-tensile brass.		Molybdenum Disulfide is embedded spirally in EN-JL 1040/EN-GJL-250.		Composite product consisting of three layers: steel-backed metal layer, sintered bronze layer and filler added PTFE Layer.		Fluororesin is bonded on base material (A2017).		Polyacetal resin with added lubricant and special fillers evenly.	
Lubrication	Regular Oil		Unlubricated Regular		Unlubricated Regular		Unlubricated		Unlubricated		Unlubricated	
Rotation	○		○		○		○		○		○	
Oscillating Motion	○		○		○		○		○		○	
Reciprocating Motion	○		○		○		○		○		○	
Operating Temp. Range	°C -40~150		-40~200 -40~150		-40~150		-195~280		-50~140		-40~80	
Electrical Conductivity	Provided		Provided		Provided		Provided		Not provided		Not provided	
Environmental Conditions	In the air		○		○		○		○		○	
	In Oil		○		○		○		X		○	
	In Water In		X		-		X		X		△	
	In Seawater		X		-		X		X		△	
	In In Chemical		X		-		X		X		△	
	In Corrosive Atmosphere		X		△		X		△		△	

Environmental Conditions △ --- 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.

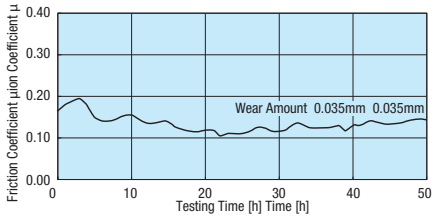
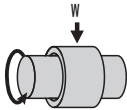
Mechanical Properties (Reference Value)

Characteristics	Unit	Bronze Type		Copper Alloy Type		Casting Type		Multi-Layer MD Type		High Precision Type		Resin Type (Polyacetal)		Resin Type (PTFE)	
		Value	Testing Method	Value	Testing Method	Value	Testing Method	Value	Testing Method	Value	Testing Method	Value	Testing Method	Value	Testing Method
Density	g/cm ³	8.5	-	7.8	-	-	-	-	-	-	-	-	-	-	-
Tensile Strength	N/mm ² (kgf/mm ²)	150(15.0)	JIS Z 2241	755(77.0)	JIS Z 2241	245 (25.0)	-	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
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/mm ² (kgf/mm ²)	-	-	-	-	-	-	-	-	-	-	76.5(7.8)	ASTM D 790	-	-
Flexural Modulus	N/mm ² (kgf/mm ²)	-	-	-	-	-	-	-	-	-	-	2,650(270.2)	ASTM D 790	-	-
Compression Strength	N/mm ² (kgf/mm ²)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Yield Strength	N/mm ² (kgf/mm ²)	-	-	345(35.0)	-	-	-	-	-	-	-	-	-	-	-
Compression Stress (1% Deformation)	N/mm ² (kgf/mm ²)	-	-	-	-	-	-	-	-	-	-	21.1(2.2)	ASTM D 695	10.5(1.1)	ASTM D 695
Impact Strength	J/cm(kgfm/cm)	-	-	19(1.9)	JIS Z 2242	-	-	-	-	-	-	81.9(8.4)	ASTM D 256	23.0(2.3)	ASTM D 695
Hardness	-	HB 60	JIS Z 2243	HB210	JIS Z 2243, 2245	HB240	-	-	-	HDD62	ASTM D 2240	HRM72	ASTM D 785	HRR25	ASTM D 785
Young's Modulus	N/mm ² (kgf/mm ²)	-	-	105,000(10,700)	JIS Z 2241	-	-	-	-	-	-	HRM72	ASTM D 785	HRR25	ASTM D 785
Linear Thermal Expansion Coefficient	X10 ⁻⁵ /°C-1	-	-	2.2	-	0.92~1.18	-	-	-	9~9.75	ASTM D 696	8~13	ASTM D 696	9~11	ASTM D 696
Thermal Conductivity	W/m ² °C(cal/sec°°C cm)	-	-	0.009(0.21)	-	-	-	-	-	-	-	-	-	-	-
Melting Point	°C	-	-	-	-	7.1	-	-	-	-	-	165	DSC	327	DSC
Specific Gravity	-	-	-	-	-	-	-	-	-	1.98	ASTM D 792	1.39	ASTM D 792	2.25	ASTM D 792
UL Flammability	-	-	-	-	-	-	-	-	-	-	-	HB	UL94	-	-

Test Data of Bronze Type

Journal Rotation Test

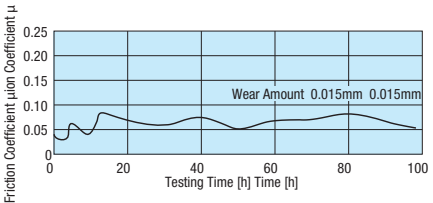
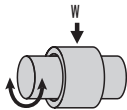
<Test Conditions>
Bushings : **SHBZ30-30**
Mating Material : 1.1191/C45E HRC50
Surface Pressure : 1.47N/mm²{15kgf/cm²}
Velocity : 0.83m/s (50m/min)
Testing Time : 50h
Lubrication : Apply oil every 1 hour.



Test Data of Copper Alloy Type

Journal Oscillation Motion Test

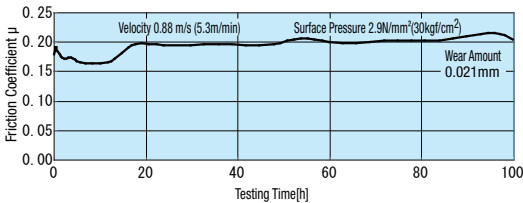
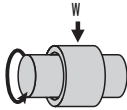
<Test Conditions>
Bushings : **MPBZ20-20**
Mating Material : 1.1191/C45E HRC46~48
Oscillation Angle : ±45°
Surface Pressure : 24.5N/mm²{250kgf/cm²}
Velocity : 0.5m/min{16cpm}
Lubrication : Unlubricated



Test Data of Multi-Layer MD Type

Journal Rotation Test

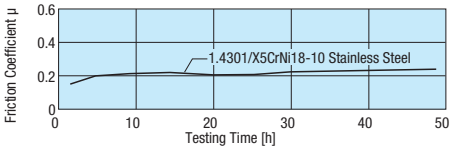
<Test Conditions>
Bushings : **MDZB40-30**
Mating Material : 1.1191/C45E
Surface Pressure : 2.9N/mm² {30kgf/cm²}
Velocity : 0.088m/s (5.3m/min)
Lubrication : Unlubricated



Test Data of High Precision BFLB Bushing

Ring on Disk Test

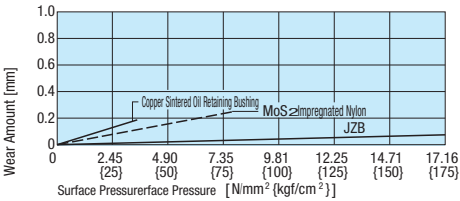
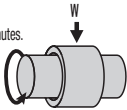
<Test Conditions>
Mating Material Surface : 1.4301/X5CrNi18-10
Pressure : 0.41MPa
Velocity : 1.833m/s{110m/min}
Lubrication : Unlubricated



Test Data of JZ Resin Bushing

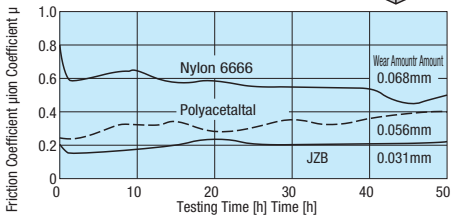
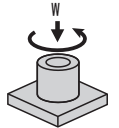
Journal Rotation Test

<Test Conditions>
Bushings : **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

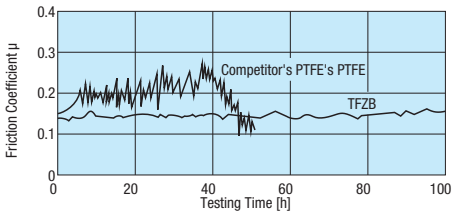
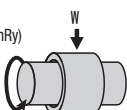
<Test Conditions>
Mating Material : 1.1191/C45E (Surface Roughness 3μmRy)
Surface Pressure : 2.94N/mm²{30kgf/cm²}
Velocity : 0.167m/s{10m/min}
Testing Time : 50h
Lubrication : Unlubricated



Test Data of TF Resin Bushing

Journal Rotation Test

<Test Conditions>
Bushings : **TFZB10-10**
Mating Material : 1.4305/X10CrNiS18-9 (Surface Roughness 1.2μmRy)
Surface Pressure : 1.96N/mm²{20kgf/cm²}
Velocity : 0.500m/s(30m/min)
Testing Time : 100h
Lubrication : Unlubricated



Journal Rotation Test

<Test Conditions>
Bushings : **TFZB10-10**
Mating Material : 1.4305/X10CrNiS18-9 (Surface Roughness 1.2μmRy)
Surface Pressure : 0.49~1.96N/mm²{5~20kgf/cm²}
Velocity : 0.667m/s(40m/min)
Lubrication : Unlubricated

