NMB Minebea

Spherical, Rod End and Sleeve Bearings

Since its first production of rod-end bearings back in 1969, Minebea Co., Ltd. (NMB) has amassed technology and experience in this area. The Company now has an advanced line of rod-end bearings, which are used in various areas of industry.

Rod-end bearings are shorter on history than roller bearings. But they are steadily capturing markets as they gain such sophistication as adoption of new materials. Bearing manufacturers rapidly moved into rod-end bearings amid growing demand for aircraft in World War II. In the 1950s, there was a growing trend among the aircraft industry to standardize air frame control bearings as it developed.

In 1962, the U.S. Aircraft Standardization Committee began a standardization study. Upon completion of the initial study, the U.S. Department of Defense took over the standardization process. After that, a series of MIL Standards were issued.

Minebea's Karuizawa plant, which makes rod-end bearings, has developed products that meet the requirements of MIL Standards. The plant has also reflected its technological advances in the products it handles while passing tests required by newly revised MIL Standards. Minebea now has established the technology of supplying its products to leading aircraft manufacturers in the world. Here we enclose a catalog of rod-end bearings in metric sizes, part of our product line. We hope you will make use of this catalog when you design products.

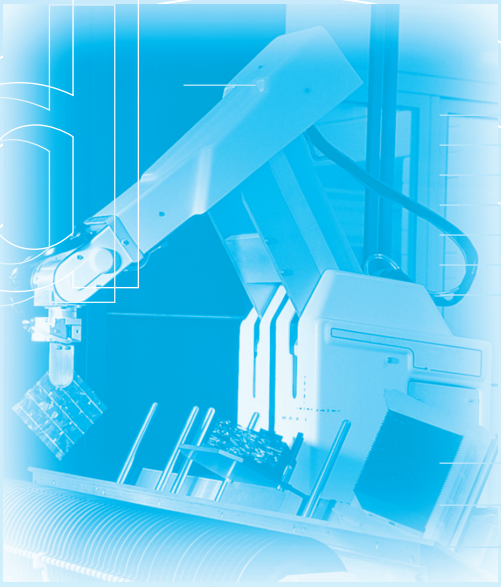
The technical data section explains items about which users inquire frequently.

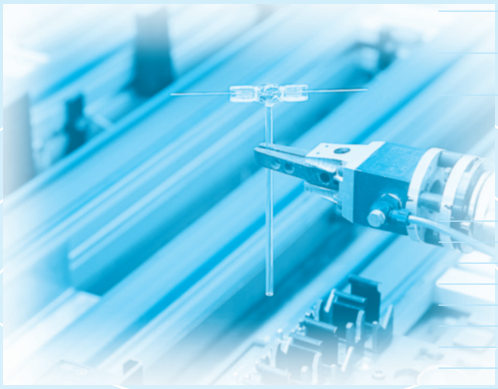
Regarding items not stated in the section, please ask our Rod-End Sales Department.

At Minebea, aircraft rod-end bearings in inch sizes are the mainstream of bearings production. Metric sizes are mostly for civilian use. The catalog omits inch sizes. If you want to use inch sizes, please contact the Rod-End Sales Department.

The Karuizawa factory is also manufacturing products that are not specified in the catalog: special materials such as aluminum and titanium; and specially-shaped products. For more details, please contact the Rod-End Sales Department.

Minebea's basic policy is to comply with the laws and regulations for the products, technologies, etc. controlled by export-related legislation, such as the Foreign Exchange and Foreign Trade Law, the Cabinet Order concerning Foreign Exchange and the Export Trade Control Ordinance.





Minebea

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Bearing

Bearing Classification

Bearings are divided into two basic categories: (1) rolling element or "anti-friction" bearings, (2) sliding surface or "plain" bearings. Except as noted, all bearings in this guide are of the "plain" bearing classification. Table1 below and Table2 on the nextpage classify their configurations and MINEBEA part numbers.

Table 1: Bearing Classification By Construction Elements

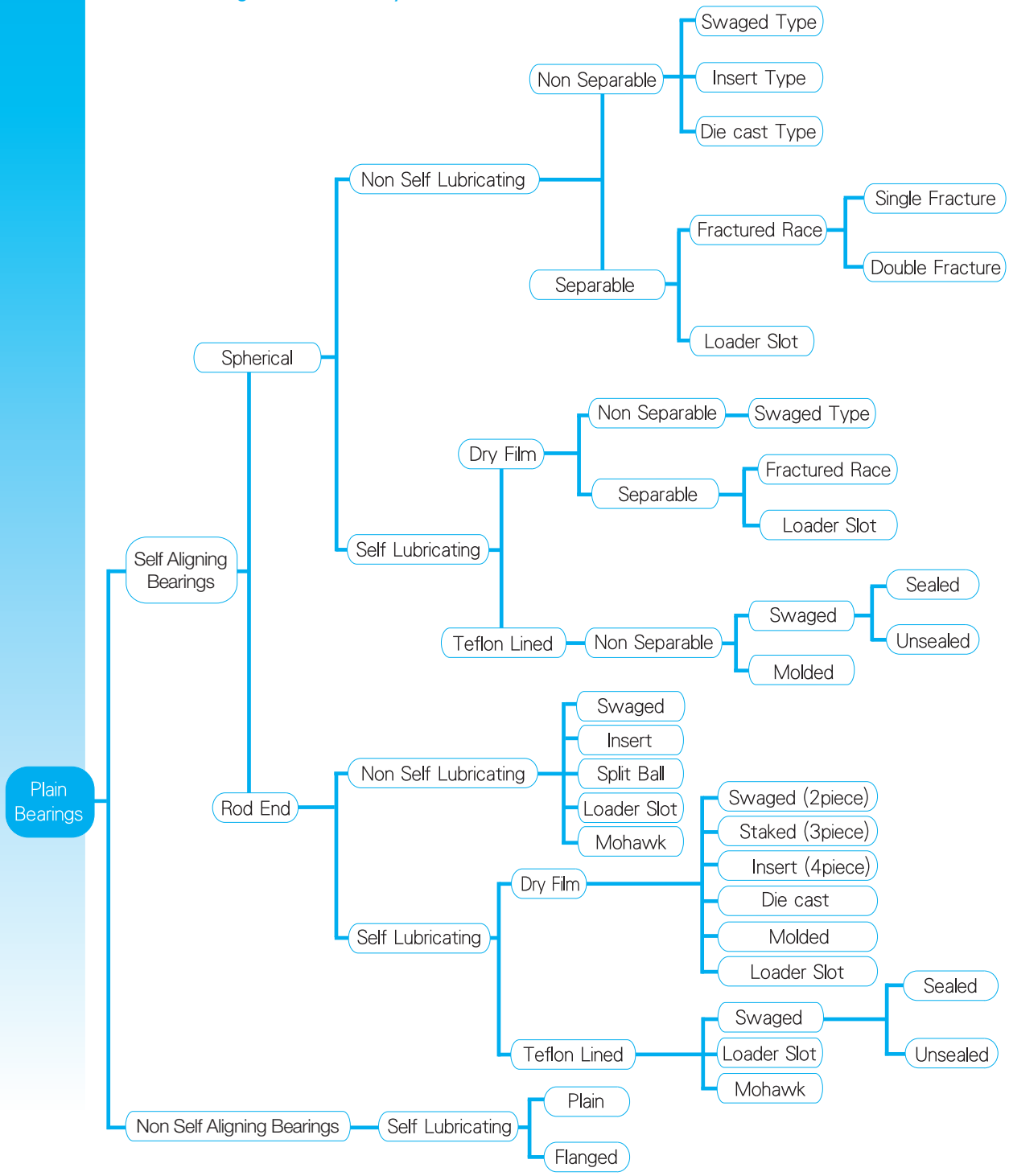


Table 2: Classification of MINEBEA PART NUMBERS

Spherical Bearing	TFE lined	SBT	MBT	(ABT)	(ABT-V)	(ABWT)	(ABWT-V)	(ABYT)
		MBT-V	MBWT	(ABYT-V)	(HT)	(HT-V)	(WHT)	(WHT-V)
		MBWT-V	MBYT					
		MBYT-V						
	Metal/Metal	MBG-CR	MBG-VCR	(ABG)	(ABG-V)	(HABG)	(HABG-V)	(ABW)
		MBW-CR	MBW-VCR	(ABW-V)	(ABY)	(ABY-V)	(ABK)	(ABK-V)
		MBY-CR	MBY-VCR			(ABC)	(ABC-V)	
	Mold Type	BM						
2 Piece Rod End Bearing	TFE lined	RBT-E	RBT	(AHMT)	(AHFT)			
3 Piece Rod End Bearing	TFE lined	HRT-E	HRT	(ART-E)	(ART)	(ARHT-E)	(ARHT)	(ARYT-E)
		HRHT-E	HRHT	(ARYT)	(ANM)	(ANF)		
	Metal/Metal	HR-E	HR	(AR-E)	(AR)	(ARH-E)	(ARH)	(ARYM)
		HRH-E	HRH	(ARYF)				
4 Piece Rod End Bearing	Metal/Metal	PR-E	PR	(CAMR)	(CAFR)	(AMR)	(AFR)	
Molded Rod End Bearing		RBM-E	RBM					
Sleeve Bearing	TFE lined	MJ	MJF	(AJ)	(AJF)	(AHJ)	(AHJF)	
Ball Bearing Rod End		PBR-EFN	PBR-FN	(ABR-M)	(ABR-F)	(ABR-H)	(ABR-S)	

Part numbers in brackets are inch size bearings which are not included in this catalog.

Materials

The basic components of self-aligned bearings are balls, races, and bodies. The materials for these components are basically divided into two types: ferrous materials and non-ferrous materials. Materials are carefully selected and combined based on several requirements such as cost, safety and resistance, in accordance with operating condition. For particular applications, special treatments shall be additionally considered, such as heat treatment, surface treatment and others. The Table 3 shows materials characteristics and major applications.

Table 3 : Commonly used materials

Basic Classification	Types of Material	Typical Material Code		Characteristics	Major Applications
Ferrous Materials	Constructional Low Carbon Steel	S10C S45C	S15C S48C	Usually not hardening Suitable for general strength	Molded Rod End, 4 Piece Rod End bodies and studs
	Constructional Alloy Steel	4340 SCM435H	4130	Good hardenability High toughness and strength	Bodies for 3 Piece Rod End
	Bearing Steel	SUJ2 52100	SUJ3	Possible to obtain high hardness by hardeningStrong against rolling fatigue Good for anti-wear action	Balls for Rod End and Spherical bearing Races & balls for fracture type bearing (typical ball bearing material)
	Stainless Steel	440C		Possible to obtain high hardness (especially balls for Teflon lined bearings) Suitable for fractured type (races and balls)	Balls for Rod End and Spherical bearing
		410		A typical martensitic stainless steel	Races for Spherical bearing Sleeves
		17-4PH SUS630	15-5PH	High strength stainless steel High toughness	Bodies for 3 Piece Rod End Races for Spherical bearing Sleeves
		303		Excellent corrosion resistance Non heat treatable	Bodies for 2 Piece Rod End
	Heat Resisting Steel	A286 INCONEL®	STELLITE®	Good resistance to high temperature creep and corrosion	Bodies, races & balls for Rod End Bearing (aerospace applications)

Basic Classification	Types of Material	Typical Material Code		Characteristics	Major Applications
Non-ferrous Materials	Brass	C-2700	C-4622	Good corrosion resistance	Inserts for 4 Piece Rod End
	Aluminum Bronze (Al-Bz)	C62300	C64200	High strength copper alloy Good resistance to sea water Good for anti-wear action	Races for spherical bearing
	Beryllium Copper (Be-Cu)	C17200		High hardness possible by age-hardening (approx. 40HRC) Good for anti-wear action	Balls for Spherial bearing
	Aluminum Alloy	2024	7075	Light weight provides strength equal to steel	Sleeves Races & balls for spherical bearing
	Titanium Alloy	Ti-6Al-4V		Light weight High toughness and strength	Bodies for Rod End

Self Lubricating Liners, DU Liners & MINELON TN

Spherical and Rod End bearings with Teflon Liner (TFE LINER) were first introduced in the 1950s. As it is referred "self lubricating liners", bearings equipped with Teflon Liner don't require any grease charging at all, since the Teflon Liner itself is self lubricating.
In addition, Teflon Liner has excellent abrasion resistance.

TEFLON

TEFLON is a registered trade name of POLY TETRA FLUORO ETHYLENE, developed by El du Pont de Nemours & Co., Ltd. Teflon Resin is chemically stable and has good heat resistance and high insulation properties. It performs with excellent friction coefficient of 0.03~0.05 under 288 ℃ , however tensile strength is relatively low (34N/mm^2{3.5kgf/mm^2}). Therefore, to reinforce its performance, Teflon Liners (TFE LINER) are utilized which have a tensile strength of 343N/mm^2 {35kgf/mm^2}.

Teflon Liners have a woven textile backing (Glassfibers or other synthetic fibers) with phenolic resin impregnated. With thermosetting bonding agent applied on reverse side, Teflon Liners are bonded with base metal. This process is called CURING. Cured Teflon Liners can accept up to 482N/mm^2 {49.2kgf/mm^2} under static load and 220~275N/mm^2 {22.5~28.1kgf/mm^2} under slow fluctuation velocity. The bonding force can bear minimum of 3.5N/cm {2lbs/inch}. Therefore the Teflon lined bearings advance Metal/Metal type especially where static load is applied.

※ Requirement of AS specification.

■ Summary of Properties

1. Friction coefficient is 0.03~0.15. As shown in Figure 1 & 2, the coefficient decreases with load but increases under low temperature.
2. Under the influence of greases, oil and moisture, Teflon Liners may swell moderately. This can cause slightly high torque before the use of bearing, however load capacity is not affected. Acid or alkaline atmosphere may influence Phenolic resin and reduce its performance quality. In such cases, seals can be considered as an effective prevention.

Figure 1: Load & Friction coefficient

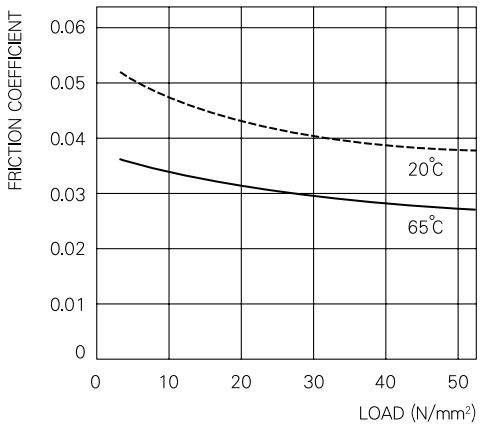
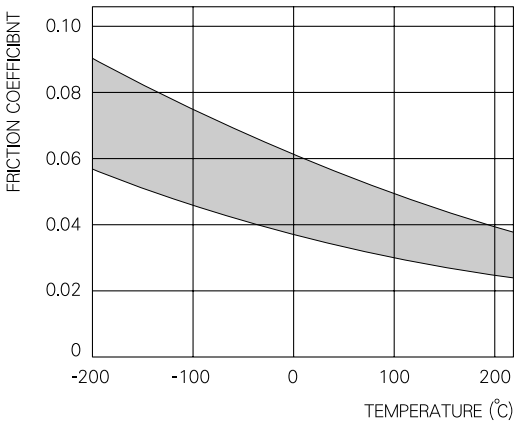


Figure 2: Temperature & Friction coefficient



3. During the first 500~1000 cycles, abrasion may occur. After the first abrasion, however, wear rate becomes quite nominal. AS specification requires that the wear rate shall be under 0.152mm. Depending on customer requirements, this figure may slightly differ, but in general, it is set that 0.150mm is the acceptable maximum wear. For applications where life is particularly critical, wear can be reduced by hard chrome plating of balls. The efficiency of such plating has been proven by several examinations conducted inside the company. Please consult our engineers if there are any particular applications. Besides Table 4 below, NMB can provide other liners as well.

DU Liners

This liner system was developed by Glacier Metal Co., Ltd., in England. Bronze powder is sintered porously with mild steel backing strip. This is impregnated and overlaid with a Teflon-lead mixture. DU Liners can provide very low torque and do not suffer from stick slip effect even after long storage period. Both static and dynamic load capacities are, however, approx. 2/3 of which Teflon Liners can provide. (Table 4)

Table 4 : Characteristics of Principle Liner Systems

	X-1118	X-1276	X-1276F	X-1820	L-1390	DU LINERS
MIL、SAE Spec	MIL-B-8942			AS81820		
Backing Material	Glass Fiber	Dacron	Dacron	Nomex	Glass Fiber	Bronze Composite
Thickness	0.25 ~ 0.29mm	0.30 ~ 0.34mm	0.34 ~ 0.38mm	0.34 ~ 0.38mm	0.30 ~ 0.36mm	※ 2
Temperature range	− 54 ~+ 121 ℃	− 54 ~+ 121 ℃	− 54 ~+ 121 ℃	− 54 ~+ 163 ℃	− 54 ~+ 329 ℃	− 54 ~+ 288 ℃
Static Load Capacity	482N/mm^2 {49.2kgf/mm^2}	482N/mm^2 {49.2kgf/mm^2}	482N/mm^2 {49.2kgf/mm^2}	541N/mm^2 {55.2kgf/mm^2}	482N/mm^2 {49.2kgf/mm^2}	323N/mm^2 {33.0kgf/mm^2}
Dynamic Load Capacity	220N/mm^2 {22.5kgf/mm^2}	220N/mm^2 {22.5kgf/mm^2}	220N/mm^2 {22.5kgf/mm^2}	275N/mm^2 {28.1kgf/mm^2}	※ 1	138N/mm^2 {14.1kgf/mm^2}
Fiction coefficient	0.03 ~ 0.10	0.03 ~ 0.10	0.05 ~ 0.15	0.05 ~ 0.15	0.03 ~ 0.10	0.04 ~ 0.09
Characteristics Application	Most widely utilized liner	Strong under oscillating load Suitable for racing cars	High dynamic load capacity	Strong under high temperature High dynamic load capacity	Strong under high temperature, Suitable for jet engine.	Good torque stability

※ 1 Depending on use conditions.
※ 2 Depending on the LINER types.

Bearing Selection

Metal/Metal type spherical bearing

Metal/Metal type spherical bearings require periodic re-lubrication, both to replenish the used grease and to flush out contamination. Metal/Metal types are suitable for applications where static load applies. Aircraft landing gear is a typical ideal situation for this type of bearing. The high impact load is experienced (take off and landing) when the bearing is stationary, while the extension and retraction movement only takes place during light load.

■Heat treated bearing steel & 440C stainless steel for balls, 410 stainless steel & 4130 alloy steel for races

High static load capacity, suitable when minimum deformation is required under heavy load.

■ Aℓ-Bz race

High seizure resistance under oscillating load and limited lubrication, however, they only have 1/2 the load carrying capacity of steel race.

■ Be-Cu ball with 17-4PH race

They can provide good performance under high load and slow fluctuation velocity when sufficient lubrication is supplied.

■ Loading slot and fracture type race spherical bearing

No swaging required and therefore they can provide high hardness. They have high load carrying capacity and abrasion resistance. Hydraulic cylinder is one of the typical applications of this type. Very high temperature applications may require nickel alloy steels such as STELLITE, INCONEL, and A286, which can provide high temperature creeping resistance. As they are often applied under impermissible temperature of grease, solid lubrication such as dry film or silver plating are substitutable.

Teflon type spherical bearing

The Teflon Liner is bonded to the inner diameter of the race. The Teflon Liner acts as a lubricant and therefore no other lubrication is necessary. Thus they are eminently suitable to apply where re-lubrication is impractical or impossible. More over, as they don't require any lubrication, they are effective to lower the maintenance cost. They perform well under slow fluctuation velocity and oscillation load. Therefore Teflon type can induce the difficulties of metal/metal type such as high friction, seizure, fatigue destruction and fretting on the fluctuating surface.

2 Piece Rod End Bearing

Consist of ball and body. The body is directly swaged on the ball. Ball material is usually high cold-working performance steel (303 stainless steel), these bearings have lower load carrying capacity compared to 3 Piece/4 Piece Rod End Bearings. However their economic cost and uncomplicated production makes them suitable for commercial applications with spacious construction. They do not require any lubrication, and in addition, stainless materials (303 for bodies, 440C for balls) enable the anti corrosion characteristics.

3 Piece Rod End Bearing

Consist of a spherical bearing staked into the Rod End body. They provide high strength, as main body material is chrome molybdenum steel (hardness 35HRC, tensile strength 980N/mm^2{100kgf/mm^2}). Material selection of spherical race is depending on applications and therefore, they can bear severe requirements.

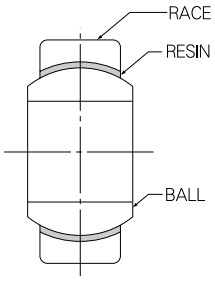
4 Piece Rod End Bearing

As they are referred as insert types, two insert pieces are press-fitted in the body head from both sides. Assembly of 4 Piece types is simple and economical as no spherical bearings are necessary. S48C body material enables high tensile strength (568N/mm^2{58kgf/mm^2}), and copper alloy insert has seizure resistance. They are applied to construction and industrial machinery in general.

Molded Rod End and Spherical Bearing

Self-lubricating resin (Teflon impregnated with nylon resin = MINELON TN) is injection molded either in between ball and race, or ball and body. Unlike to Teflon Liners, injection doesn't require impregnation and bonding processes and can provide lower cost and high productivity. There is no necessity of lubrication, and abrasion resistance is excellent. Durability under dynamic load is also higher than metal/ metal types. Strength of these types is typically demonstrated under unidirectional load tremor movement.

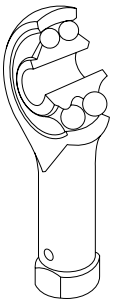
Figure 3: Molded Spherical Bearing



Ball Rod End

Construction consists of several balls in rows interfacing with body inner surface. Although having less load carrying capacity than plain bearings, lower torque can be achieved by reduced contact area. Self-alignment is also possible with these types. Ideal applications are aircraft controls and robot linking areas. (Figure 4)

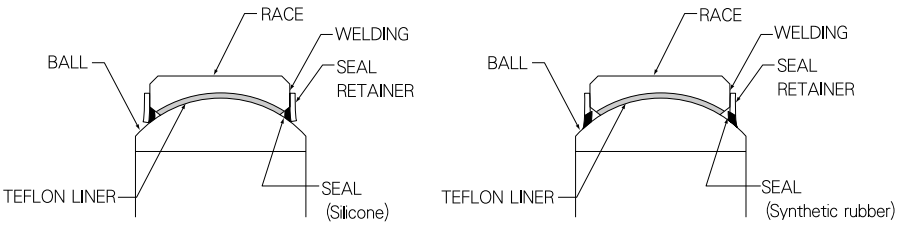
Figure 4: Ball Rod End



Sealed Type Spherical bearing

Constructed with seals fixed with seal retainers on chamfering of spherical edges. Seals prevent ingress of foreign objects or dust and strengthen the life of bearings. Silicon and synthetic rubber are used as seal materials with 304 stainless steel as retainer. Seal retainers are electron beam welded to race edges. Sealed type bearings are originally developed for aircraft applications, however, they are now widely applied in construction machinery and automotive field. (Figure 5)

Figure 5: Sealed type Spherical Bearing



Minebea provides a wide range of custom designed bearings in addition to the standard bearings presented in this catalog. There are numerous customer applications which demand custom-designed bearing assemblies to meet a wide range of enviromental and operating conditions.

Minebea is staffed with an experienced sales and engineering group, ready to assist our custmors with special design requirements. Some of the special products manufactured by Minebea include loader slot bearings, rod and linkages, sealed spherical bearings, miniatures as well as very large swaged bearings.

Please consult Minebea's sales staff or engineering department for any of these special needs.

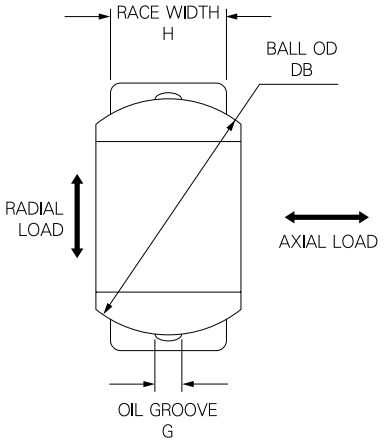
Metal/Metal spherical bearing

Metal/Metal types are mostly applied under static load, which does not require rotating movement, and therefore, the load capacity shall be calculated under the static load. However a spherical bearings with Al-Bz race material, almost no seizure occurs under oscillation or limited lubrication supply. Also, Be-Cu ball and stainless steel race can prevent seizure under heavy load and can provide high dynamic load carrying capacity. From these facts, capacity under slow fluctuation velocity shall be also calculated. When static load capacity is more crucial than oscillation load capacity, steel ball and steel race is the most suitable combination. It is not able to maintain sufficient lubrication in order to bring out most of Metal/Metal type characteristics.

■ Definition of Load

Directions of load application are indicated in Figure 6.

Figure 6: Directions of load applications



● Static Limit Load

Static limit load is the load, which can be applied without disturbing the performance of Spherical Bearings. Minebea specifies that the permanent deformation shall no exceed the value in Table 5 when this load is applied statically.

Table 5 : Permanent deformation under static load

	Maximum value
Radial Static Limit load	0.076mm
Axial Static Limit load	0.102mm

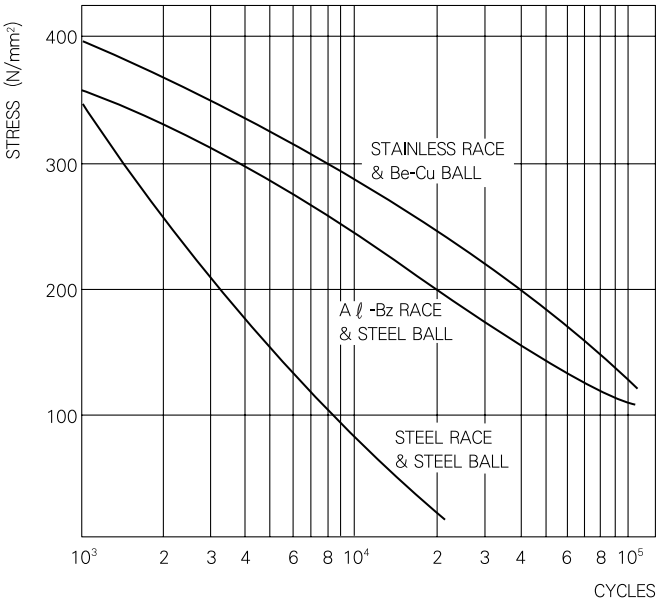
● Static Ultimate Load

This is the load, which can be applied to Spherical Bearings without distracting it. Static ultimate load is 1.5 times the static limit load.

● Oscillating Load

This load can bear the oscillation test condition of : oscillation angle ± 10°, frequency of 10cpm, and alternating load. The radial play including abrasion does not exceed 0.102mm after 20,000 cycles. Figure 7 shows the relation of surface pressure and life cycle of bearing from this test.

Figure 7: Relationship between Stress and Life of Metal/ Metal Spherical Bearings.



■ Calculation of load capacity

Load capacity (W) could be calculated as: race projected areas (SR or SA) multiplied by the race allowable stress (σ)

W = (SR or SA) × σ

● Radial projected area (S_R)

The shaded area in Figure 8 is radial projected area. It can be calculated by the formula: S_R = H x DB. It shall be noted that where there is an oil groove, it should be subtracted from this formula.

● Axial projected area (S_A)

The shaded area in Figure 9 is axial projected area. It can be calculated by the formula: $S_A = \frac{\pi}{4} H^2$

Figure 8: Radial Projected Area

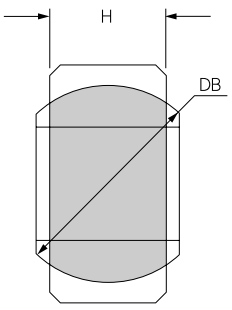
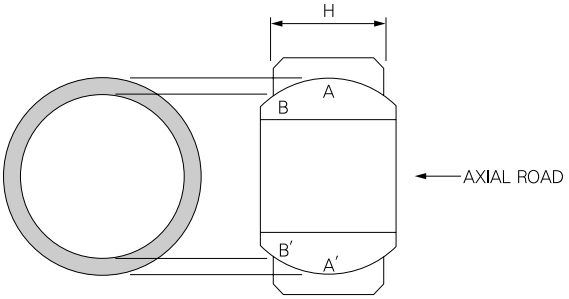


Figure 9 Axial Projected Area



● Allowable stress (σ)

The Allowable stress may vary depending on materials and heat treatment condition. Minebea set the allowable stress as indicated in Table 6 and 7, based on various examinations.

Table 6 : Allowable Static Race Stress

	4130or Stainless Race (30-35HRC)	Al-Bz Race
Radial Static Limit Load	620N/mm^2{63.3kgf/mm^2}	379N/mm^2{38.7kgf/mm^2}
Axial Static Limit Load	551N/mm^2{56.2kgf/mm^2}	275N/mm^2{28.1kgf/mm^2}

Table 7 : Allowable Dynamic Race Stress

	Dynamic Load
Al-Bz Race Steel Ball	193N/mm^2{19.7kgf/mm^2}
Stainless Steel Race Be-Cu Ball	241N/mm^2{24.6kgf/mm^2}

Teflon type Spherical Bearing

Teflon types are mainly targeted where slow fluctuation velocity applies. Under slow fluctuation velocity, Teflon abrasion determines the life of Spherical Bearings. Teflon Liner deformation also decides the performance ability under static load.

■ Definition of Load

● Static Limit Load

This is the load, with which the permanent deformation does not exceed the value in Table 8 below.

Table 8 : Permanent deformation under static load

	Maximum value
Radial Static Limit Load	0.076mm
Axial Static Limit Load	0.127mm

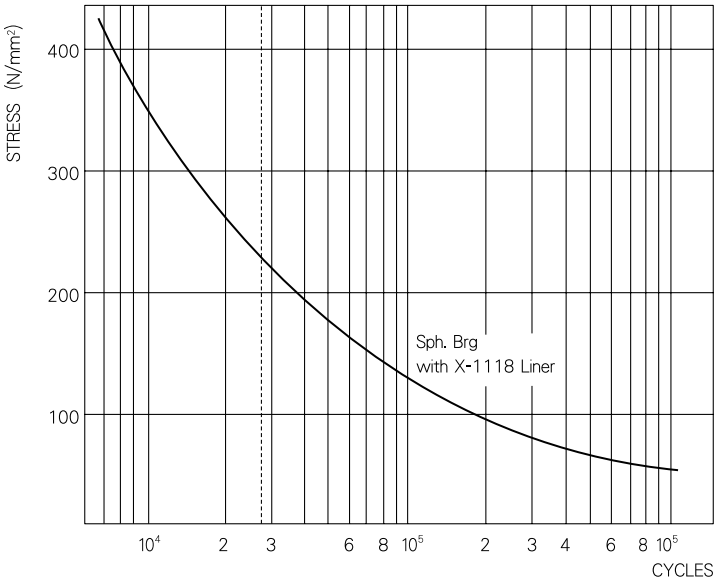
● Static Ultimate Load

The load 1.5 times the static limit load. It can be applied to Spherical Bearings without distracting them.

● Oscillating Load

The test is conducted based on MIL-specification. After 25,000 cycles, the wear shall not exceed 0.152mm under this load. Figure 10 shows the association of surface pressure and life cycle of bearing from this test. Test conditions are ± 25° oscillation angle, 10cpm cycle, and constant load condition. Figure 10 shall be taken as a guideline, as the actual figure may be influenced by other factors such as temperature, load, velocity, oscillation angle, and so on.

Figure 10: Teflon Liner Allowable Stress



■ Calculation of load capacity

● Radial projected area

The projected area is basically the same as of metal/metal types. The edge of Teflon Liner, however, shall be taken into consideration.

● Allowable stress (σ)

Based on several examinations, the allowable stress is set as indicated in Table 9 below.

Table 9 : Teflon Liner Allowable Stress

	X-1118 X-1276 X-1276F		X-1820	
Radial Static Limit Load	482N/mm^2	{49.2kgf/mm^2}	541N/mm^2	{55.2kgf/mm^2}
Axial Static Limit Load	309N/mm^2	{31.6kgf/mm^2}	309N/mm^2	{31.6kgf/mm^2}
Oscillation Load	220N/mm^2	{22.5kgf/mm^2}	275N/mm^2	{28.1kgf/mm^2}

3 Piece Rod End Bearing

The load ratings of Rodend bearing shall be determined by the strength of body, because of it is a critical component compared to the inserted Spherical bearing.

■ Definition of Load

● Static Limit Load

Static limit load is the load, which does not disturb the Rod End performance. It is calculated with the yield strength.

● Static Ultimate Load

Static ultimate load is the radial tensile static load, which can be applied without distracting Rod Ends.

● Axial Proof Load

This is the load, which does not push out spherical bearing when applied statically from axial direction.

● Fatigue Load

The load which is bearable for 50,000 cycles with 100~10 % of continuous tensile load.

■ Calculation of load capacity

When static load is applied, most Rod Ends fail at point A (Figure 11). Under ordinary situations, shank has more strength than point A, however, both the strength at A (B.S.A) and at shank (S.S.A) shall be discussed.

Figure 11: 3 Piece Rod End

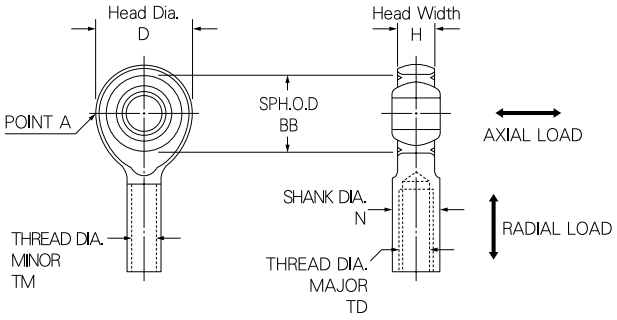
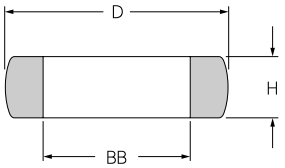


Figure 12: B.S.A.



● Rod End body head minimum cross section

Cross section at Point A in Figure 11 is calculated as follows;

$B.S.A. = 0.008726 \times D^2 \times \sin^{-1}(H/D) + 0.5H\sqrt{D^2-H^2} - BB \times H$

Or approximately: $B.S.A. = (D - BB) \times H$ (Figure 12)

● Shank cross section

Male Rod End $S.S.A. = \pi/4 \times TM^2$

Female Rod End $S.S.A. = \pi/4 \times (N^2 - TD^2)$

● Allowable stress

Minebea uses the allowable stress values given in the table. The allowable values are based on the actual test results. Minebea use figures in Table 10, which are the results of several examinations.

Table 10: The allowable Stress of Common Materials

Body Material	Ultimate Static Load	Static Limit Load	Fatigue Load
4340 39-42HRC	1171N/mm^2 {119.5kgf/mm^2}	937N/mm^2 {95.6kgf/mm^2}	372N/mm^2 {38.0kgf/mm^2}
4130 36-42HRC	1068N/mm^2 {109.0kgf/mm^2}	855N/mm^2 {87.2kgf/mm^2}	309N/mm^2 {31.6kgf/mm^2}
SUS630(17-4PH) 36-42HRC	1068N/mm^2 {109.0kgf/mm^2}	855N/mm^2 {87.2kgf/mm^2}	345N/mm^2 {35.2kgf/mm^2}
SCM435H 35-40HRC	1034N/mm^2 {105.5kgf/mm^2}	827N/mm^2 {84.4kgf/mm^2}	172N/mm^2 ※ {17.6kgf/mm^2}

※ Fatigue strength could be improved up to 275N/mm^2 {28.1kgf/mm^2} by applying extra surface finishing between the head and the shank. They are considered as special items.

● Rod End body fatigue failure

In the same way as distraction occurs under static load, fatigue failure is seen at point A (Figure 11). Depending on the bearing design, however, it may happen at shank or in tangential area between head and shank. Machining ridges and scratches could cause high-tension stress, by which fatigue is remarkably influenced. They can cause cracks and eventually develop to fatigue stress. When fatigue strength is discussed, the bearable cycle calculation may be necessary under a given load. In addition, fatigue is easily influenced by stress wave, stress concentration, and environmental condition. Please consult with our Sales to estimate the fatigue life, as it is a very complex matter without reliable testing results.

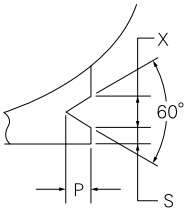
● 3 Piece Rod End axial load capacity

The staking strength determines the axial load capacity of 3 Piece Rod End. The axial proof load of V-staked Rod End can be estimated from Table 11. The actual load which pushes the spherical out of the body is at least 1.5 times higher than axial proof load. When oscillation or shock applies, it may, however, start pushing the spherical out even with lower load than axial proof load. Therefore when dynamic load applies, 1/3 of axial proof load is the recommended maximum load. Axial proof load of body staked Rod Ends is equivalent to V-groove types.

Table 11 : Axial Proof Load

V-Groove	X (mm) 0 − 0.25	P (mm) 0 − 0.40	S (mm) 0 − 0.25	Axial Proof Load (N) {kgf} Steel Race (30 ～ 35HRC)	 Aℓ-Bz Race
A	1	0.7	0.5	298 × D {30.4 × D}	193 × D {19.7 × D}
B	1.4	1	0.7	367 × D {37.5 × D}	239 × D {24.4 × D}
C	2	1.5	0.7	411 × D {42 × D}	267 × D {27.3 × D}

D = spherical bearing outer diameter (mm)



2 and 4 Piece Rod End Bearing

The load capacity is specified by static limit load and static ultimate load.

■ Definitions for 2 and 4 Piece Rod End Bearing Terminalogy.

● Static Limit Load

That load which can be applied to a bearing without impairing its performance. It is calculated based on the body material yield strength. Permanent body deformation remains when exceeding static limit load, and eventually rotating performance is influenced.

● Static Ultimate Load

That load which can be applied to a bearing without fracturing the ball, race or rod end body.

■ Calculation of load capacity

● 4 Piece Rod End body head cross section

Cross section at Point A in Figure 13 is calculated as follows.

B.S.A. = [D − (DB + 0.17H)] x H

● Shank cross section

Male Rod End S.S.A. = $\pi/4 \times TM^2$

Female Rod End S.S.A. = $\pi/4 \times (N^2 - TD^2)$

● 2 Piece Rod End body head cross section

B.S.A. = (0.93D − DB) x H (Figure 14)

S.S.A. can be calculated in the same formula as of 4 Piece Rod End .

Figure 13: 4 Piece Rod End

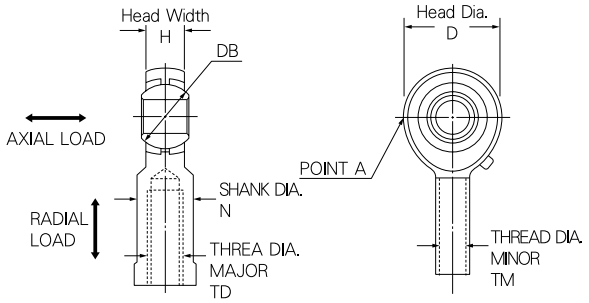
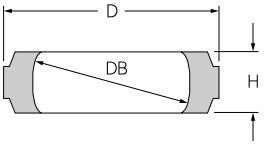


Figure 14: 2 Piece Rod End



● The allowable stress

The allowable stress are shown in Table 12.

Table 12 : Allowable Stress of 2 & 4 Piece Rod End Bearings

Types	Body Material	Static Ultimate Load	Static Limit Load
4 Piece Rod End	S48C	568N/mm^2 {58kgf/mm^2}	362N/mm^2 {37kgf/mm^2}
2 Piece Rod End ※	303	490N/mm^2 {50kgf/mm^2}	122N/mm^2 {12.5kgf/mm^2}

※ As material of 2 Piece Rod End is in the annealing condition, no clear yield phenomenon is confirmed. Therefore the estimation of rigid static limit load is impossible. It is said, however, approx. 1/4 of static load can be applied without impairing the bearing performance.

Sleeve Bearing

Sleeve Bearing life is a function of the load, oscillation angle, velocity, contamination, shaft surface finish, and hardness influence the life expectation of sleeve bearings. Teflon lined sleeves are recommended to be used under slow velocity oscillation of less than 10~20cpm.

● Shaft surface finish

Shaft roughness is specified to be 0.2 μmRa or less. Please refer to Table 13, when shaft surface is rougher than 0.2 μmRa for life factor.

Table 13 : Life factors for roughness of shaft

Surface rughness	Life Factors
less than 0.2 μmRa	1
0.2 μmRa ~ 0.4 μmRa	0.75
0.4 μmRa ~ 0.8 μmRa	0.4

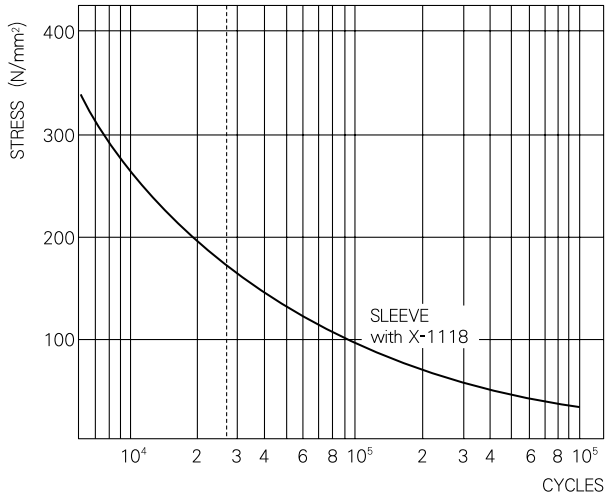
● Shaft hardness

50HRC or harder is the standard shaft hardness. Table 14 shows the life factors which shall be taken into an account when shaft hardness is lower than 50HRC. Figure 15 shows the surface pressure and life cycle at which the wear does not exceed 0.152mm, under oscillation angle ± 25° and frequency 10 cpm.

Table 14 : Life factors for hardness of shaft

Hardness	Life Factors
50HRC and harder	1
50 ~ 40HRC	0.6
40 ~ 30HRC	0.4

Figure 15: Teflon type sleeve stress & life



■ Definitions for Sleeve Bearing Terminology

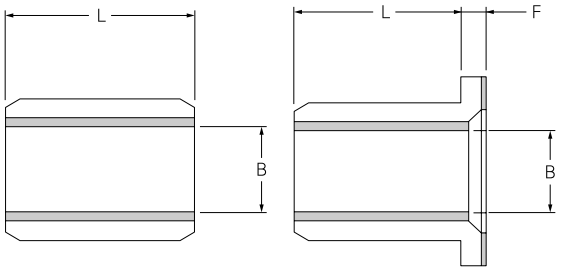
● Static Limit Load

This is the load at which permanent set does not exceed 0.102mm.

● Oscillation Load

With Minebea standard items, wear should not exceed 0.152mm after 25,000 cycles, oscillation angle of ± 25° at a frequency of 10 cpm. Load capacity can be calculated as the race projected areas (S) multiplied by the allowable stress (σ) (Figure 16).

Figure 16: Sleeve



● Projected area (S)

The projected area can be calculated as:
Straight S = B (L − 2.54)
Flange S = B x {(L + F) − 3.3}
Only when sleeve length (L) is bigger than bore (B), shaft bending shall be taken into consideration.
When projected area S is bigger than B^2, B^2 value is used for projected area S.

● Allowable stress (σ)

Table 15 shows the allowable stress.

Table 15 : Allowable Stress of Sleeve Bearings

		X-1118 X-1276 X-1276	X-1820
Static Limit Load	Alumimum	345N/mm^2 {35.2kgf/mm^2}	345N/mm^2 {35.2kgf/mm^2}
	Steel	413N/mm^2 {42.2kgf/mm^2}	482N/mm^2 {49.2kgf/mm^2}
Oscillation Load		172N/mm^2 {17.6kgf/mm^2}	258N/mm^2 {26.4kgf/mm^2}

Torque and Play

Not only for swaged types, but also for other spherical bearings, certain torque and play values are required: no-load breakaway torque for Teflon lined bearings, and both radial and axial play for metal/metal bearings.

Torque for Teflon type

The no load breakaway is measured by fixing the ball aligned with the axis of a torque meter. The race or Rod End body shall be held securely by hand or tool but without any force. Torque value shall be read when ball rotates. Standard torque requirement of Teflon type bearings is 0.049~1.96N ・m {0.5~20kgf ・cm}, which is relatively high comparing with ball bearings. Although it is possible to manufacture Teflon type bearings with 0.02N ・m {0.2kgf ・cm} or less torque, it should allow approx. 0.05mm play as well. The torque value may increace with aging, and this is because:

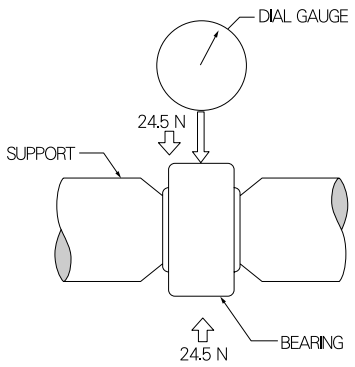
1 Observed moisture changes the thickness of liner, and

2 Residual stress from swaging may cause small deformation of race to change its form.

Radial & Axial Play for metal/metal type

The clearance in radial or axial direction between ball and race, or ball and body is called radial or axial play. Based on MIL-standard, radial/axial play for self-aligning bearings is measured as relative motion of race and ball when 24.5N{2.5kgf} load is applied from two opposite directions. The method of radial play measurement of spherical bearings is shown in Figure 17. Table 16 shows the standard radial play values.

Figure 17: Method of measuring Radial Play



(1) Set the dial to "O" during 24.5N load is applied from one direction.
(2) Release the 24.5N load, and re-apply from opposit direction read the value.

Table 16: Standard Radial Play

	Standard Radial Play
Spherical Bearing	0.051mmMAX
3 Piece Rod End	0.051mmMAX
4 Piece Rod End	0.051mmMAX

Fluid lubrication and Boundary lubrication

It is known that there are fluid type and boundary type lubrications. Minebea's self-aligning bearings are often utilized under high load (surface pressure of 49N/mm^2{5kgf/mm^2} or over), and therefore, boundary lubrication is often applied. With boundary type lubrication, avoiding metal contact is almost impossible, and therefore, the friction coefficient is greater than at fluid lubrication. In addition, the lubricant film developed on the rotating surface may demolish under harsh friction conditions. Insufficient oil flow creates a low cooling effect, and raising temperature could lower the lubrication viscosity. This effect makes the lubricant film to become thinner and eventually distracted. After lubricant film distraction, metal to metal contact occurs, and friction creates wear and possibly seizure as well. With boundary lubrication, continuous friction weakens the lubricant film and moreover, it increases the friction. Thus repairing the lubricant film by re-lubricating is the crucial fact in order to prevent seizure. Under severe application conditions, bearings with oil groove and frequent re-lubricating are both effective.

Figure 18: Friction Coefficient and temperature

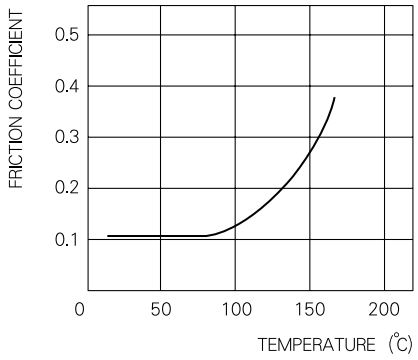
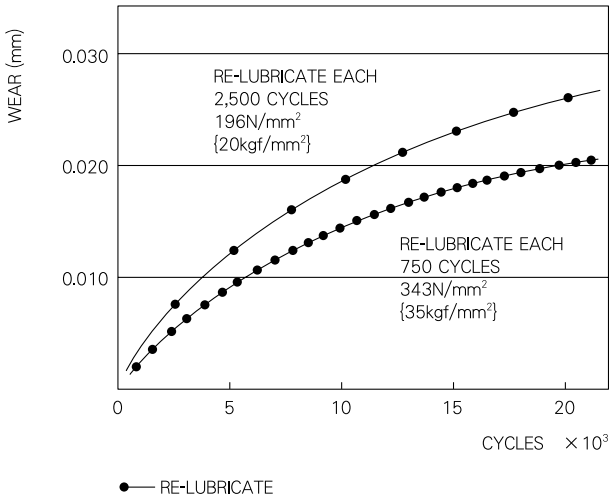


Figure 19: Wear of heavy duty bearing with Be-Cu Ball&Stainless Race



Compared to the rotational movement, oscillation movement is a very harsh condition for bearings to perform, and therefore abrasion and seizure is more likely to occur. Oscillation movement contrives very concentrated pressure on a particular part of the ball surface, which creates partial abrasion. Also the lubricant film is broken down with each reversal of the movement direction. The alternating load condition accelerates the grease fluidity, and therefore there is less seizure occurrence than under the uni-directional load. Chrome plated balls are an effective prevention against abrasion and seizure. Chrome itself is a very hard metal with which hardly any wear occurs. Since its oxide film has an excellent strength, metallic bond of race material and chrome rarely exists. The hard bright chrome plating advances mat and dull type plating. The surface roughness influences abrasion and seizure greatly. Especially rough surface of very hard ball material can cause the adhesion of ball abrasion powder on inner race, which eventually causes wear of ball surface.

Grease

Grease is a solid or semi solid lubrication substance, which is a mixture of lubrication fluid and thickener. Occasionally it is provided with additives to improve special characteristics. Lithium soap is most commonly used as a thickener. Soap molecules form narrow fibrous crystals and spread in oil. It is considered that these narrow fibrous crystals are intertwined and construct net-like forms, and that oil enters in between net. Grease itself does not change its form but requires some outer force, and when this outer force is greater than molecules bounding force, grease begins to flow. The greater the outer force, the higher is the fluidity. The grease's apparent viscosity becomes closer to base oil viscosity. However, after a certain point, outer force distracts the fibrous particles, and the grease remains in the same condition even after the outer force has been removed. This condition is called grease structural destruction.
Table 17 shows various grease types that are applicable to metal/metal types.
As described before, grease normally deteriorates under ordinary usage. Without being used, however, after a certain period of storing, grease also deteriorates. The life span of grease depends on the manufacturer, but it is said to be two years in average.

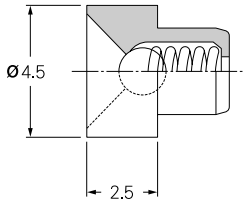
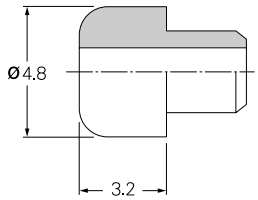
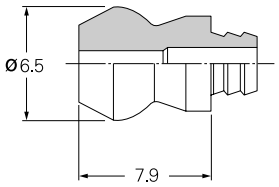
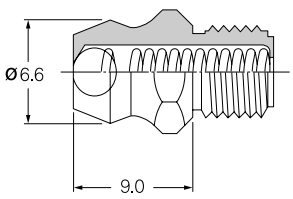
Table 17 : Characteristics of main greases

Grease	Temperature range	Characteristics
MIL-PRF-23827	− 73 ～+ 121 ℃	Generally used for Aircraft application Good water resistance and load capacity (light brown)
MIL-G-21164	− 73 ～+ 121 ℃	MoS_2 added grease. Shows higher load capacity than MIL-PRF-23827. Added MoS_2 reduces seizure even where proper lubrication is impossible (dark gray)
MIL-PRF-81322	− 54 ～+ 177 ℃	Good high temperature stability and low wear rates (light brown)
Shell Alvania S2	− 23 ～+ 121 ℃	Good general industrial grease (light brown)
Shell Alvania RA	− 40 ～+ 130 ℃	Good low temperature characteristics Good for high frequency oscillation (light brown)

Lube Fitting

Metal/metal type Rod End are provided with several types of lube fitting as shown in Table 18. Lube fittings are used for re-lubrication which is done by lubricating gun.

Table 18 : Lube Fitting types and characteristics

Fitting Type	Characteristic and application	Specification code
PB101 	Flush type Brass Compact Back flow can be prevented by check ball Apply to industrial machinery Rod-End	FN
PB102 	Minebea original Free-cutting steel, Zinc Plated Low cost	4 Piece Rod End Standard
B611 	Zerk Type Free-cutting steel, Zinc Plated Apply to industrial machinery Rod End	F
A-M6F 	JIS standard Fitting Supplied with threads and therefore high strength Suitable for chucking lubricating gun Apply to heavy machinery Rod End and High durability use	FAS

Dry-film lubricant

Dry-film lubricant is a solid lubricant. It is applied on a metal surface as a thin film, which helps to prevent corrosion and seizure. Dry-film lubricants are usually made up of molybdenum (MoS_2) or graphite mixed with an organic or inorganic resin. The inorganic resin is especially useful where high temperature and high humidity applies. MoS_2 is very stable under high temperature or vacuum conditions, and its friction coefficient is extremely low. This explains that the structure of molybdenum is stratified and easy to be distracted. Graphite has also a stratified formation, however its lubricating capacity drops dramatically in the vacuum condition. It is considered that water vapor and/or vapor adsorption layers provide the lubricating capacity, which are not available in the vacuum condition. Dry-film lubrication is suitable for conditions exceeding the grease operating temperature. However, when load is heavy enough to cause bearing deformation, the load distribution is not even, and abrasion of dry film may occur partially. On an oscillating surface, the friction coefficient of dry film is 0.05~0.15. The heavier the load, the lower is the friction coefficient. The storage method shall be carefully considered. Otherwise especially oil or other fluid may easily damage the dry film. It is recommended to carefully choose the most suitable dry-film types.

Table 19 : Characteristics of Dry-film lubrication

Dry-film	Temperature range	Characteristics (Bonding substance)
9002	− 73 ~ + 204 ℃	MoS_2 Common dry film (Epoxy)
# 811	− 221 ~ + 399 ℃	MoS_2 + Graphite Good under both extremely high and low temperature (Water glass)
C-200	− 29 ~ + 398 ℃ For Anti-Seizing + 1315 ℃ MAX	MoS_2 + Graphite + lead oxide Good under extremely high temperature and resisting corrosion (Silicon compound)

Surface Treatment

Rust or corrosion can lead to significant damage to bearings. Corrosion is caused by environmental facts such as water, salt water, acid/alkaline solutions or by chemical facts (galvanic action caused by dissimilar metal contact). Minebea applies various surface treatment methods, depending on the materials. It not only prevents corrosion but also advances the anti abrasion ability of bearings. Surface treatment advances overall performance ability of bearings.

Cadmium, Zinc, Chrome Plating

Although zinc plating is most commonly applied for industrial applications, cadmium plating has higher resistance against salt water. The low cost is a great advantage of zinc plating. Usually chromate treatment is applied after both cadmium and zinc plating. The chromate treatment enables to give various types of color. Depending on the purpose, color choices of white, yellow, green or black are possible with zinc plating. Stainless steels can also be plated when anti corrosion is crucial. For instance, the combination of 440C ball with chrome plating and 17-4PH race with cadmium plating are generally chosen for marine applications.

Titanium cadmium plating

0.1~0.5% titanium is mixed with cadmium in the plating fluid. It provides a good support to maintain high tensile strength.

Passivation

The passivation method is useful with stainless steel to maintain its corrosion resistance capability. After cleaning the surfaces with alkali, they are soaked in a nitric acid and dichromate mixture. The substance not only cleans the surface, but also creates an inactive layer on the surface to advance corrosion resistance capacity. It is an effective corrosion prevention especially after cleaning off metal particles, which adhered during the machining process.

Anodizing

Pure aluminum is said to have a high corrosion resistance, as construction of the oxide Al_2O_3 is very elaborate, which prevents the oxidation. Aluminum alloy for sleeves, have a lower corrosion resistance compared with pure aluminum, therefore they are treated with anodizing or chemical conversion coatings. Anodizing means Anodic oxidation coatings, or more generally it is called alumite.

Table 20 : List of common surface treatments

Treatment	Spec	Characteristics	Color	Application for Minebea Bearings
Chrome plating	AMS-QQ-C-320	Good surface hardness, Good wear resistance, Thick plating possible	silver white	Ball surface Body I.D.
	JIS H 8615	Same as above Good for industrial robots	silver white	Ball surface
Cadmium plating	AMS-QQ-P-416	Most common for air-craft steel alloy, good resistance against sea water	depending on chromate Type I white Type II yellow	3 Piece body Race for Sph. bearing sleeve
Zinc plating	JIS H 8610	Generally used for industrial applications	depending on chromate, white, yellow, green, or black	4 Piece body 3 Piece body
Titanium cadmium plating	AMS2419	Higher corrosion resistance than cadmium plating good under severe condition	green	
Passivation	AMS2700	Improving corrosion resistance of stainless-steel, especially remarkably effective under 200 ℃ .	No color	3 Piece body
Anodizing	MIL-A-8625	Preventing corrosion of aluminum & Aluminum alloy. Type III is used on sliding surface of bearing	gray white greenish	sleeve aluminum alloy ball
Alodining	MIL-C-5541	Preventing corrosion of Aluminum & Aluminum alloy. Used as primer for bearing to be painted later	yellow or white	sleeve Aluminum alloy race

The installation of bearings is a very important process, because it determines the life and performance of bearings.

Clearance between shaft and bore diameter of Teflon lined sleeve

This clearance should be 0~0.025mm (loose fitting) under oscillation motion, and 0.051~0.102mm (loose fitting) under rotating motion.

Housing fitting

Teflon lined sleeves require 0.013~0.051mm of tight fitting, and spherical bearings require − 0.013mm tight fitting to +0.013mm loose fitting. Excessive tight fitting can influence the torque and clearance and leads to a possible fretting corrosion under dynamic load.

Roughness of Shaft Surface

The surface roughness shall be below 0.2 μmRa. Rougher surface can shorten the sleeve life. Hardness shall be minimum 50HRC, and chrome plating is additionally recommended under extreme application conditions. Since Teflon type sleeves do not use any lubrication, corrosion resistance capacity shall be considered upon choosing the shaft.

Installing shaft in Teflon lined surface

The shaft shall be free of sharp edge and loose particles. The edge of the shaft shall be formed as Figures 20 or 21 with a minimum radius of 0.8mm or a 15° chamfer. Similarly, if a locking thread is to be incorporated in the shaft, extra caution is necessary in order to avoid damaging the Liner. The housing edge shall be also free of burr and sharpness. A hammer shall never be utilized to install a sleeve into a housing.

Figure 20 : R CHAMFER

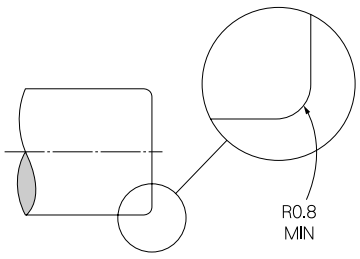
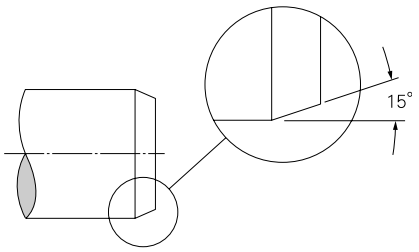


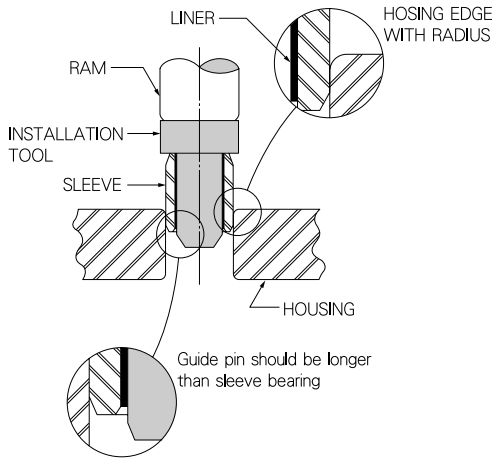
Figure 21 : 15° CHAMFER



Installing sleeve into housing

Appropriate method is shown in Figure 22. The installation tool guide pin should be longer than the sleeve bearing.

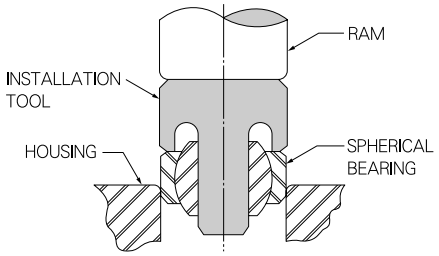
Figure 22: Installation of sleeve bearings



Installing spherical into housing

Figure 23 below shows the appropriate installation method. The ball should NEVER be pressed. The tight fitting spherical should be in a right angle to the housing. Inclining can easily damage spherical bearings.

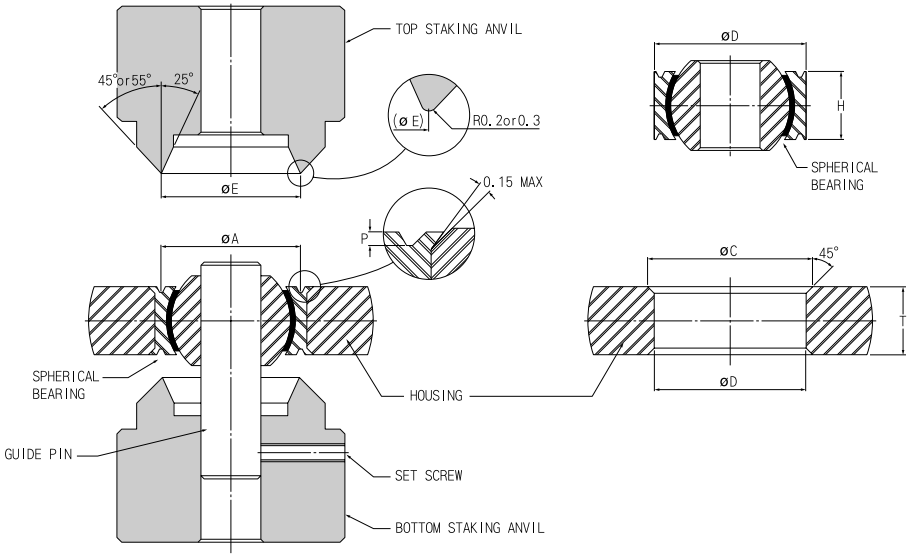
Figure 23: Installation of spherical bearing



V-staking, groove staking

V-staking is one of the method to fix a spherical bearing into a housing. A V-shaped groove is cut round the face of the race and the race material outside of this groove is pressed into a chamfer of housing with staking tool (Figure 24). Appropriate staking pressure is given in Table 21, and the pressure shall be adjusted slightly depend on the staking appearance shown in Figure 26 and the axial proof load required. Excessive pressure reduces performance capacity and shortens the life of a bearing. After staking, a slight gap may occur in between race and housing chamfer. As long as this gap doesn't exceed 0.15mm, axial load capacity is not affected (Figure 24). V-staking does not disturb bearing performance as much as other methods can bear higher axial load. Bearing replacement is also easily done without damaging the housing.

Figure 24: V-staking

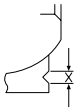


ΦE		(Staking Tool Dia.) ＝ ΦA ＋ 0.1
ΦA	:	V-Groove Dia.
ΦC		(Housing Chamfer Dia.) ＝ ΦD ＋ (T － H ＋ 2P)
ΦD	:	Housing I.D. or Bearing O.D.
T	:	Housing Width
H	:	Race Width
P	:	V-Groove Depth

Table 21 : Staking pressure

V-Groove Type	V-Groove width X (mm)	Staking Load (N) {kgf}	
		Steel Race (30-35HRC)	Al-Bz Race
A	0.6 ～ 1	2647 × D {270 × D}	1569 × D {160 × D}
B	1 ～ 1.4	3138 × D {320 × D}	1961 × D {200 × D}
C	1.6 ～ 2	4412 × D {450 × D}	2745 × D {280 × D}

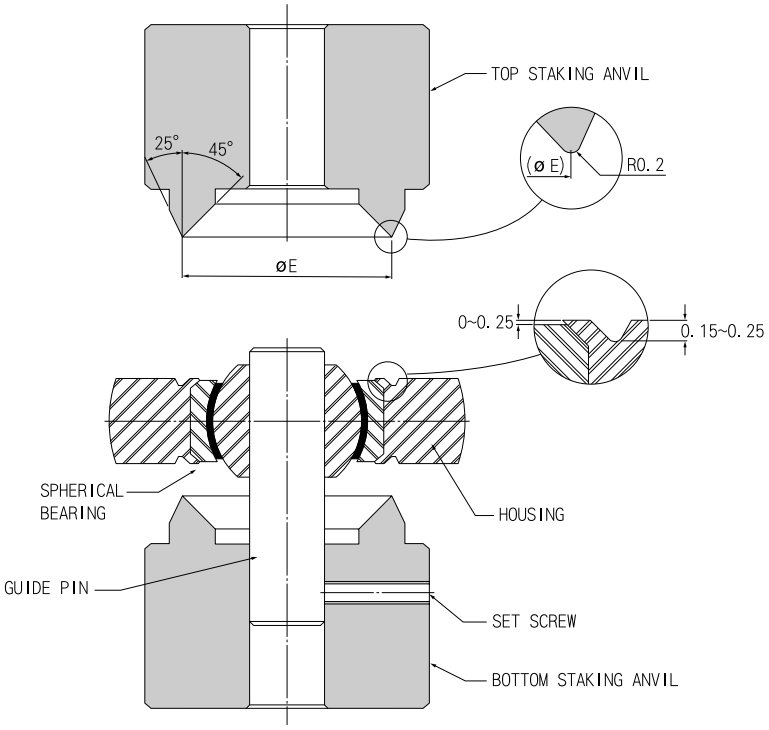
D : Spherical Outer Diameter (mm)



Body staking

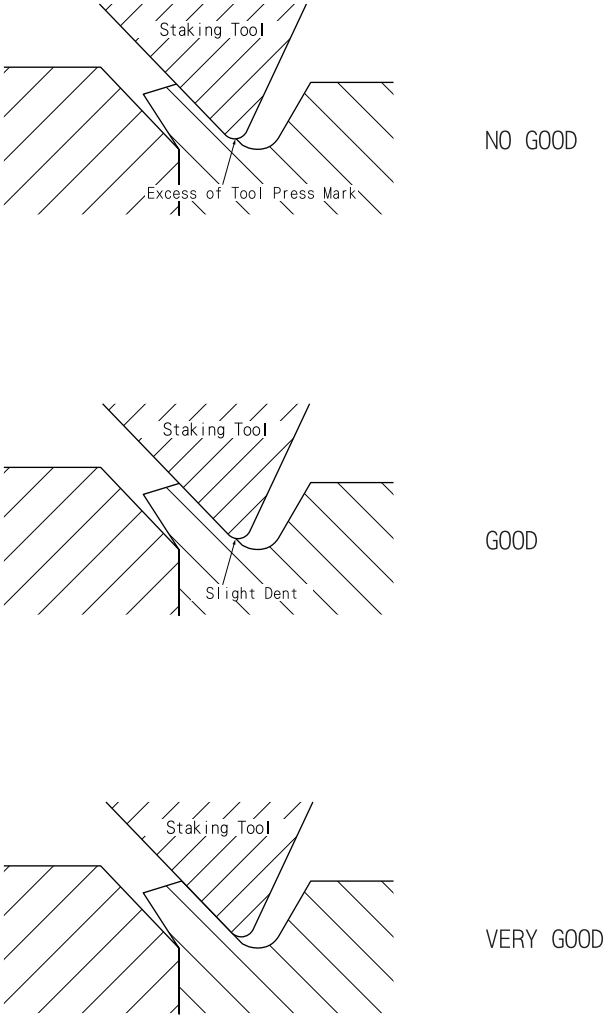
Housing is pressed into race chamfer with staking tool (Figure 25). Body staking can also advance axial load strength, however at the same time torque and clearance can be easily influenced. In addition, the housing needs to be replaced together with the spherical bearing as well. Both V-staking and body staking require large press-machine. There are other staking methods available (Roller staking, and Circumferential-Line staking) which require simple tooling.

Figure 25: Body staking



ΦE	:	(Staking Tool Dia) = ΦD + (1.2 ~ 2.2)
ΦD	:	Housing I.D. or Bearing O.D.

Figure 26: Staking Appearance



SPHERICAL BEARING [SELF-LUBRICATING]

SBT

SPHERICAL | SELF-LUBRICATING | WIDE

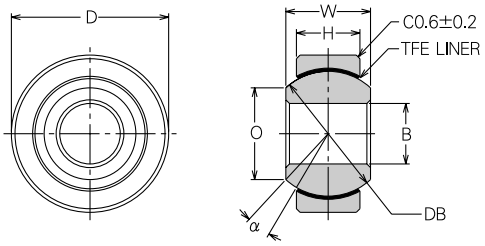
Materials

RACE 410 Stainless Steel
BALL 440C Stainless Steel
LINER Teflon / Fabric

Description of Types

SBT D xx T

- No Leeer Indicates Standard Breakaway Torque
  Letter "T" Indicates Low Breakaway Torque
- Bearing Bore Code
- For X-1276 LINER add suffix "D"
- Basic Part No.



SBT

Dimensions in mm

MINEBEA Part No.	ϕB H7	ϕD 0 −0.013	W 0 −0.13	H ±0.13	α (deg.)	ϕO Ref.	SϕDB Ref.	No Load Rotational Breakaway Torque N・m	Static Limit Load kN		Dynamic Load kN	Approx. Weight g
								Standard	Radial	Axial		
SBT3	3	12	6	4.50	11	6.8	9.042	0.06 ~ 0.57 {0.6 ~ 5.8kgf・cm}	13.72	1.56	6.27	5
SBT4	4	14	7	5.25	12	7.6	10.319		17.65	2.25	8.04	7
SBT5	5	16	8	6.00	11	8.8	11.906	0.12 ~ 0.57 {1.2 ~ 5.8kgf・cm}	24.51	2.94	11.17	10
SBT6	6	18	9	6.75	10	11.1	14.288		36.28	3.72	16.57	14
SBT8	8	22	12	9.00	12	12.7	17.462		58.83	6.76	26.87	26
SBT10	10	26	14	10.50		15.2	20.638		81.39	9.21	37.16	42
SBT12	12	30	16	12.00	11	17.6	23.812		114.73	18.63	52.46	62
SBT14	14	34	19	13.50	14	19.2	26.988		147.09	23.53	67.27	89
SBT16	16	38	21	15.00	13	22.7	30.956		186.32	29.41	85.12	125
SBT18	18	42	23	16.50		24.1	33.338	0.23 ~ 0.90 {2.3 ~ 9.2kgf・cm}	215.74	35.30	98.65	165
SBT20	20	46	25	18.00	12	28.8	38.100		274.58	42.16	125.52	220
SBT22	22	50	28	20.00	13	30.3	41.275		333.42	51.97	152.39	285
SBT25	25	56	31	22.00	14	32.4	44.847	0.33 ~ 1.70 {3.4 ~ 17.3kgf・cm}	404.03	65.21	184.65	380
SBT30	30	66	37	25.00	16	38.2	53.181		545.24	84.33	249.28	605

Notes

1. Teflon liner permanently bonded to race I.D.
2. Made to order only.
3. No Load Rotational Breakaway Torque.
   Low Torque All Size: 0.02N・m MAX
   (Radial Clearance 0.05mm MAX)

○ Please consult Minebea for availability of bearings in this series.

Bore size	~ 3	~ 6	~ 10	~ 18	~ 30
H7 Tolerance (μm)	+ 10 0	+ 12 0	+ 15 0	+ 18 0	+ 21 0

SPHERICAL BEARING 〔SELF-LUBRICATING〕

MBT,MBT-V

SPHERICAL | SELF-LUBRICATING | NARROW

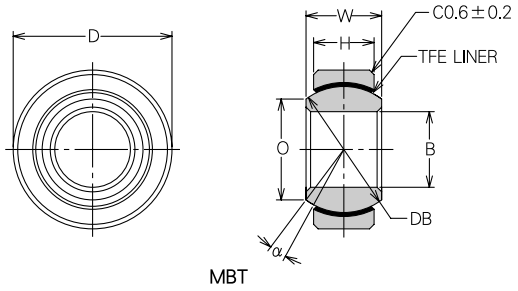
Materials

RACE 410 Stainless Steel
BALL 440C Stainless Steel
LINER Teflon / Fabric

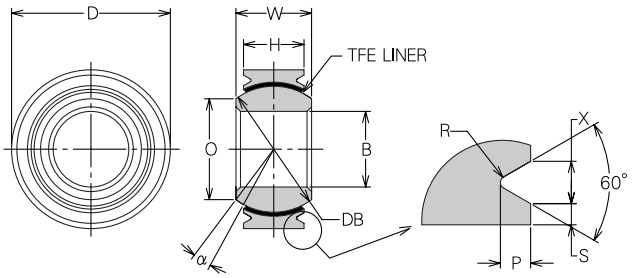
Description of Types

MBT D xx V T

- No Letter Indicates Standard Breakaway Torque / Letter "T" Indicates Low Breakaway Torque
- No Letter Indicates Chamfer Type / Letter "V" Indicates V-Groove Type
- Bearing Bore Code
- For X-1276 LINER add suffix "D"
- Basic Part No.



MBT



MBT-V

Dimensions in mm

MINEBEA Part No.	φB H7	φD 0 −0.013	W 0 −0.13	H ±0.13	α (deg.)	φO Ref.	SφDB Ref.	No Load Rotational Breakaway Torque N・m Standard	Staking Groove S 0 −0.25	Staking Groove X 0 −0.25	Staking Groove R 0 −0.25	Staking Groove P 0 −0.4	Static Limit Load kN Radial	Static Limit Load kN Axial	Dynamic Load kN	Approx. Weight g
MBT3/MBT3V	3	10.0	5.0	3.5	15	5.1	7.144	0.12 ~ 0.57 {1.2 ~ 5.8kgf・cm}	0.5	1.0	0.4	0.7	7.84	0.98	3.43	3
MBT4/MBT4V	4	12.0	6.5	4.5	17	5.8	8.731						12.74	1.56	5.88	4
MBT5/MBT5V	5	14.5	7.0	5.5	10	7.6	10.319						18.63	2.45	8.72	7
MBT6/MBT6V	6	16.5	8.5	6.5	11	9.4	12.700		0.7	1.4	0.5	1.0	30.40	3.43	13.72	11
MBT8/MBT8V	8	19.0	9.5	7.0	12	10.7	14.288						37.26	3.92	16.67	14
MBT10/MBT10V	10	21.0	10.0	8.0	8	13.3	16.669						50.01	5.19	22.55	19
MBT12/MBT12V	12	25.0	13.0	10.0	10	15.0	19.844			2.0		1.5	74.53	8.33	33.34	32
MBT14/MBT14V	14	27.5	14.0	11.0	8	18.3	23.019						101.98	15.69	45.11	42
MBT15/MBT15V	15	29.0	15.0	12.0		19.5	24.606						118.66	18.63	52.95	50
MBT16/MBT16V	16	30.0	16.0	12.5	10	18.7							123.56	20.39	54.91	53
MBT18/MBT18V	18	34.0	18.0	14.0	9	22.2	28.575						161.80	25.49	72.56	78
MBT20/MBT20V	20	36.0	19.0	15.0		23.4	30.162						182.40	29.41	81.39	89
MBT22/MBT22V	22	40.0	22.0	18.0	8	25.0	33.338	0.23 ~ 0.90 {2.3 ~ 9.2kgf・cm}					243.20	42.16	108.85	130
MBT25/MBT25V	25	45.0	25.0	20.0	9	28.8	38.100						308.90	51.97	138.27	185
MBT28/MBT28V	28	50.0	28.0	22.0		34.0	44.053						393.24	63.74	176.51	255
MBT30/MBT30V	30	56.0	30.0	23.0	10	37.0	47.625						444.24	69.62	199.07	350

Notes

1. Teflon liner permanently bonded to race I.D.
2. MBT & MBT-V weights are similar.
3. Made to order only.
4. No Load Rotational Breakaway Torque.
   Low Torque All Size: 0.02N・m MAX
   (Radial Clearance 0.05mm MAX)

○ Please consult Minebea for availability of bearings in this series.

Bore size	~3	~6	~10	~18	~30
H7 Tolerance (μm)	+10 0	+12 0	+15 0	+18 0	+21 0

MBWT,MBWT-V

SPHERICAL | SELF-LUBRICATING | WIDE

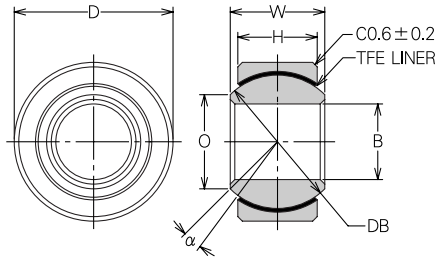
Materials

RACE 410 Stainless Steel
BALL 440C Stainless Steel
LINER Teflon / Fabric

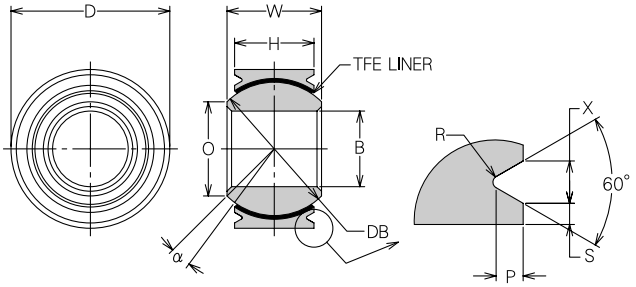
Description of Types

MBWT D xx V T

- No Letter Indicates Standard Breakaway Torque / Letter "T" Indicates Low Breakaway Torque
- No Letter Indicates Chamfer Type / Letter "V" Indicates V-Groove Type
- Bearing Bore Code
- For X-1276 LINER add suffix "D"
- Basic Part No.



MBWT



MBWT-V

Dimensions in mm

MINEBEA Part No.	φB H7	φD 0 −0.013	W 0 −0.13	H ±0.13	α (deg.)	φO Ref.	SφDB Ref.	No Load Rotational Breakaway Torque N・m Standard	Staking Groove S 0 −0.25	Staking Groove X 0 −0.25	Staking Groove R 0 −0.25	Staking Groove P 0 −0.4	Static Limit Load kN Radial	Static Limit Load kN Axial	Dynamic Load kN	Approx. Weight g
MBWT5/MBWT5V	5	16.0	11.0	8.5	15	7.8	13.494	0.06 ~ 0.57 {0.6 ~ 5.8kgf・cm}	0.5	1.0	0.4	0.7	43.14	5.98	18.63	14
MBWT6/MBWT6V	6															13
MBWT8/MBWT8V	8	17.5		8.0	14	10.9	15.478	0.12 ~ 0.57 {1.2 ~ 5.8kgf・cm}					46.09	5.29	20.59	14
MBWT10/MBWT10V	10	21.0	12.5	10.5	8	12.2	17.462		0.7	1.4	0.5	1.0	68.64	9.21	30.40	23
MBWT12/MBWT12V	12	26.0	16.0	13.0	10	15.4	22.225						116.69	21.57	51.97	46
MBWT14/MBWT14V	14	28.0	17.0	14.0	8	18.9	25.400						143.17	25.49	63.74	55
MBWT15/MBWT15V	15	29.0	18.0		11	19.0	26.194						148.08		65.70	59
MBWT16/MBWT16V	16	30.0	19.0	15.0	10	19.2	26.988			2.0		1.5	163.77	29.41	73.54	65
MBWT18/MBWT18V	18	33.0	20.0	16.0		20.4	28.575						184.36	33.34	82.37	80
MBWT20/MBWT20V	20	35.0	22.0		13	22.9	31.750						204.95		92.18	91
MBWT22/MBWT22V	22	41.0		19.0	6	27.1	34.925	0.23 ~ 0.90 {2.3 ~ 9.2kgf・cm}					268.70	47.07	120.62	150
MBWT25/MBWT25V	25	54.0	35.0	25.0	15	32.3	47.625						483.46	82.37	216.72	400
MBWT28/MBWT28V	28	60.0			14	36.8	50.800						515.82		231.43	490
MBWT30/MBWT30V	30	64.0	37.0	26.0		40.4	54.769						578.59	89.24	258.89	590
MBWT35/MBWT35V	35	65.0		29.0	9	44.7	58.000	0.33 ~ 1.70 {3.4 ~ 17.3kgf・cm}					682.54	109.83	303.02	
MBWT40/MBWT40V	40	68.0	38.0	31.0	8	46.9	60.325						759.03	125.52	337.34	615
MBWT45/MBWT45V	45	76.0	41.0	33.0		54.1	67.866						909.07	142.19	404.03	825
MBWT50/MBWT50V	50	82.0	44.0	35.0		60.3	74.612						1059.11	156.90	470.71	995

Notes

1. Teflon liner permanently bonded to race I.D.
2. MBWT & MBWT-V weights are similar.
3. Made to order only.
4. No Load Rotational Breakaway Torque.
   Low Torque All Size: 0.02N・m MAX
   (Radial Clearance 0.05mm MAX)

○ Please consult Minebea for availability of bearings in this series.

Bore size	~3	~6	~10	~18	~30	~50
H7 Tolerance (μm)	+10 0	+12 0	+15 0	+18 0	+21 0	+25 0

SPHERICAL BEARING 〔SELF-LUBRICATING〕

MBYT,MBYT-V

Minebea
eMINEBEA.COM

SPHERICAL | **SELF-LUBRICATING** | **HIGH MISALIGNMENT**

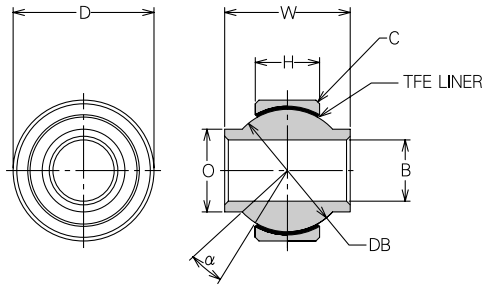
Materials

RACE 410 Stainless Steel
BALL 440C Stainless Steel
LINER Teflon / Fabric

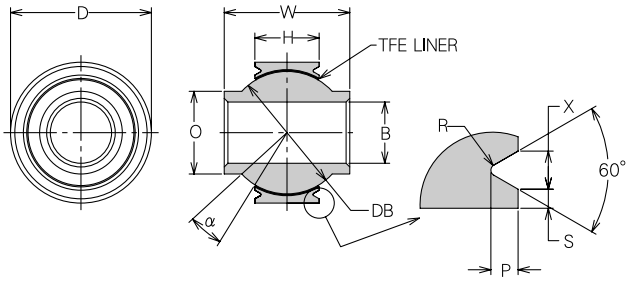
Description of Types

MBYT D xx V T

- No Letter Indicates Standard Breakaway Torque
  Letter "T" Indicates Low Breakaway Torque
- No Letter Indecates Chamfer Type
  Letter "V" Indicates V-Groove Type
- Bearing Bore Code
- For X-1276 LINER add suffix "D"
- Basic Part No.



MBYT



MBYT-V

Dimensions in mm

MINEBEA Part No.	φB H7	φD 0 −0.013	W 0 −0.13	H ±0.13	α (deg.)	φO Ref.	SφDB Ref.	No Load Rotational Breakaway Torque N・m Standard	Chamfer C ±0.2	Staking Groove S 0 −0.25	Staking Groove X 0 −0.25	Staking Groove R 0 −0.25	Staking Groove P 0 −0.4	Static Limit Load kN Radial	Static Limit Load kN Axial	Dynamic Load kN	Approx. Weight g
MBYT5/MBYT5V	5	14	12.5	5.0	17	8.0	11.1	0.06 ~ 0.57 {0.6 ~ 5.8kgf・cm}	0.5	0.5	1.0	0.4	0.7	18.63	1.96	7.84	8
MBYT6/MBYT6V	6	19	15.0	6.5	23	10.0	15.1	0.12 ~ 0.57 {1.2 ~ 5.8kgf・cm}	0.6					36.26	3.43	14.70	18
MBYT8/MBYT8V	8	18	16.0		20	10.5											15
MBYT10/MBYT10V	10	23	20.5	8.5	22	13.5	20.0			0.7	1.4	0.5	1.0	63.70	5.97	28.42	32
MBYT12/MBYT12V	12	26	22.0			16.0	22.5							72.03		32.34	42
MBYT14/MBYT14V	14	29	23.5	10.0	20	19.0	26.0							98.00	8.33	44.10	60
MBYT15/MBYT15V	15	33	26.0	12.0	19	20.0	28.0							135.24	18.62	60.76	86
MBYT16/MBYT16V	16	35	30.5	14.0	21	21.5	31.8							179.34	25.48	80.36	120
MBYT18/MBYT18V	18	38	33.0	14.5	15	23.5	32.0		0.8		2.0		1.5	187.18	27.44	83.30	135
MBYT20/MBYT20V	20	40	35.5	15.5	18	25.0	35.0	0.23 ~ 0.90 {2.3 ~ 9.2kgf・cm}	1.0					219.52	31.36	98.00	155
MBYT22/MBYT22V	22	44				29.0	38.8							243.04		108.78	200

Notes

1. Teflon liner permanently bonded to race I.D.
2. MBYT & MBYT-V weights are similar.
3. Made to order only.
4. No Load Rotational Breakaway Torque.
   Low Torque All Size: 0.02N・m MAX
   (Radial Clearance 0.05mm MAX)

○ Please consult Minebea for availability of bearings in this series.

Bore size	~3	~6	~10	~18	~30
H7 Tolerance (μm)	+10 0	+12 0	+15 0	+18 0	+21 0

SPHERICAL BEARING 〔METAL TO METAL〕

MBG-CR,MBG-VCR

SPHERICAL | METAL TO METAL | STANDARD

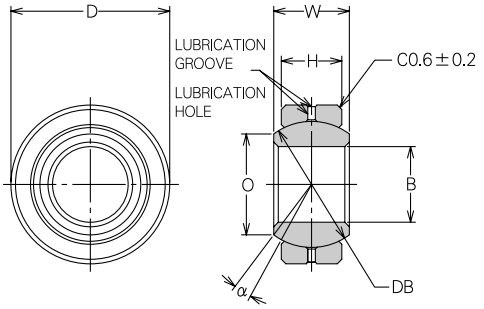
Materials

RACE 410 Stainless Steel
BALL 440C Stainless Steel

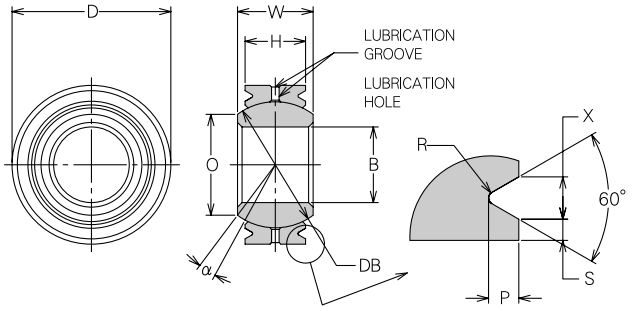
Description of Types

MBG xx V CR A

- No Letter Indicates No lubrication hole and groove on Ball I.D.
  Letter "A" Indicates lubrication hole and groove on Ball I.D.
- No Letter Indicates Chamfer Type
  Letter "V" Indicates V-Groove Type
- Bearing Bore Code
- Basic Part No.



MBG-CR



MBG-VCR

Dimensions in mm

MINEBEA Part No.	ϕB H7	ϕD 0 −0.013	W 0 −0.13	H ±0.13	α (deg.)	ϕO Ref.	SϕDB Ref.	Staking Groove S 0 −0.25	Staking Groove X 0 −0.25	Staking Groove R 0 −0.25	Staking Groove P 0 −0.4	Static Limit Load kN Radial	Static Limit Load kN Axial	Approx. Weight g
MBG3CR/MBG3VCR	3	10.0	5.0	3.5	15	5.1	7.144	0.5	1.0	0.4	0.7	6.17	1.76	3
MBG4CR/MBG4VCR	4	12.0	6.5	4.5	17	5.8	8.731					12.16	2.94	4
MBG5CR/MBG5VCR	5	14.5	7.0	5.5	10	7.6	10.319					19.90	4.41	7
MBG6CR/MBG6VCR	6	16.5	8.5	6.5	11	9.4	12.700	0.7	1.4	0.5	1.0	31.08	6.27	11
MBG8CR/MBG8VCR	8	19.0	9.5	7.0	12	10.7	14.288					35.30	7.25	14
MBG10CR/MBG10VCR	10	21.0	10.0	8.0	8	13.3	16.669					49.81	9.51	19
MBG12CR/MBG12VCR	12	25.0	13.0	10.0	10	15.0	19.844		2.0		1.5	79.43	14.80	32
MBG14CR/MBG14VCR	14	27.5	14.0	11.0	8	18.3	23.019					103.95	28.34	42
MBG15CR/MBG15VCR	15	29.0	15.0	12.0		19.5	24.606					118.66	33.73	50
MBG16CR/MBG16VCR	16	30.0	16.0	12.5	10	18.7						124.54	36.67	53
MBG18CR/MBG18VCR	18	34.0	18.0	14.0	9	22.2	28.575					166.71	45.99	78
MBG20CR/MBG20VCR	20	36.0	19.0	15.0		23.4	30.162					192.21	52.75	89
MBG22CR/MBG22VCR	22	40.0	22.0	18.0	8	25.0	33.338					263.79	76.00	130
MBG25CR/MBG25VCR	25	45.0	25.0	20.0	9	28.8	38.100					340.29	93.84	185
MBG28CR/MBG28VCR	28	50.0	28.0	22.0		34.0	44.053					439.33	112.77	255
MBG30CR/MBG30VCR	30	56.0	30.0	23.0	10	37.0	47.625					500.13	123.56	350

Notes

1. MBG - CR & MBG - VCR weights are similar.
2. Made to order only.
3. Radial Clearance All Size: 0.051mm MAX

◯ Please consult Minebea for availability of bearings in this series.

Bore size	~3	~6	~10	~18	~30
H7 Tolerance (μm)	+10 0	+12 0	+15 0	+18 0	+21 0

SPHERICAL BEARING 〔METAL TO METAL〕

MBW-CR,MBW-VCR

SPHERICAL | METAL TO METAL | WIDE

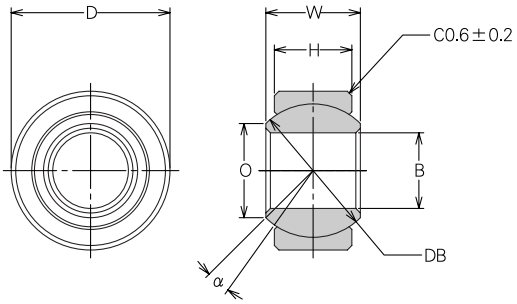
Materials

RACE 410 Stainless Steel
BALL 440C Stainless Steel

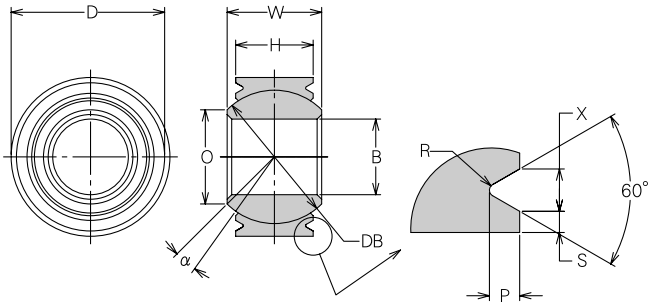
Description of Types

MBW xx V CR G A

- No Letter Indicates No lubrication hole and groove on Ball I.D. Letter "A" Indicates lubrication hole and groove on Baii I.D.
- No Letter Indicates No lubrication hole and groove on Race O.D. Letter "G" Indicates lubrication hole and groove on Race O.D.
- Letter "V" Indicates V-Groove Type No Letter Indicates Chamfer Type
- Bearing Bore Code
- Basic Part No.



MBW-CR



MBW-VCR

Dimensions in mm

MINEBEA Part No.	ϕB H7	ϕD 0 −0.013	W 0 −0.13	H ±0.13	α (deg.)	ϕO Ref.	SϕDB Ref.	Staking Groove S 0 −0.25	Staking Groove X 0 −0.25	Staking Groove R 0 −0.25	Staking Groove P 0 −0.4	Static Limit Load kN Radial	Static Limit Load kN Axial	Approx. Weight g
MBW5CR/MBW5VCR	5	16.0	11.0	8.5	15	7.8	13.494	0.5	1.0	0.4	0.7	59.03	10.68	14
MBW6CR/MBW6VCR	6													13
MBW8CR/MBW8VCR	8	17.5		8.0	14	10.9	15.478					63.74	9.51	14
MBW10CR/MBW10VCR	10	21.0	12.5	10.5	8	12.2	17.462	0.7	1.4	0.5	1.0	94.43	16.37	23
MBW12CR/MBW12VCR	12	26.0	16.0	13.0	10	15.4	22.225					148.08	39.61	46
MBW14CR/MBW14VCR	14	28.0	17.0	14.0	8	18.9	25.400					182.40	45.99	55
MBW15CR/MBW15VCR	15	29.0	18.0		11	19.0	26.194					188.28		59
MBW16CR/MBW16VCR	16	30.0	19.0	15.0	10	19.2	26.988		2.0		1.5	207.90	52.75	65
MBW18CR/MBW18VCR	18	33.0	20.0	16.0		20.4	28.575					235.35	60.11	80
MBW20CR/MBW20VCR	20	35.0	22.0		13	22.9	31.750					260.85		91
MBW22CR/MBW22VCR	22	41.0		19.0	6	27.1	34.925					341.27	84.72	150
MBW25CR/MBW25VCR	25	54.0	35.0	25.0	15	32.3	47.625					612.91	146.11	400
MBW28CR/MBW28VCR	28	60.0			14	36.8	50.800					654.10		490
MBW30CR/MBW30VCR	30	64.0	37.0	26.0		40.4	54.769					733.53	157.88	590

Notes

1. MBW - CR & MBW - VCR weights are similar.
2. Made to order only.
(3) For below 4mm in Bore size, bearings are without lubrication grooves.
4. Radial Clearance All Size: 0.051mm MAX
◯ Please consult Minebea for availability of bearings in this series.

Bore size	~3	~6	~10	~18	~30
H7 Tolerance (μm)	+10 0	+12 0	+15 0	+18 0	+21 0

MBY-CR,MBY-VCR

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SPHERICAL | METAL TO METAL | HIGH MISALIGNMENT

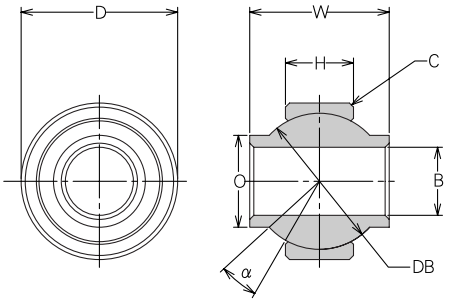
Materials

RACE 410 Stainless Steel
BALL 440C Stainless Steel

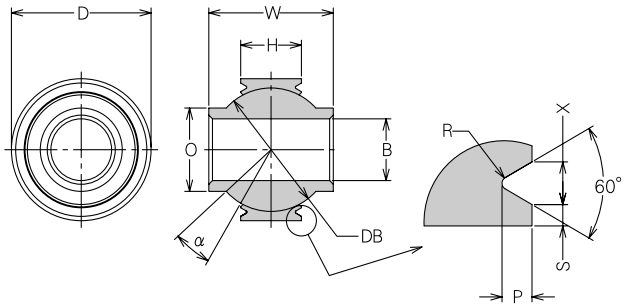
Description of Types

MBY xx V CR G A

- No Letter Indicates no lubrication hole and groove on Ball I.D.
  Letter "A" Indicates lubrication hole and groove on Ball I.D.
- No Letter Indicates nooooo lubrication hole and groove on Race O.D.
  Letter "G" Indicates lubrication hole and groove on Race O.D.
- No Letter Indicates Chamfer Type
  Letter "V" Indicates V-Groove Type
- Bearing Bore Code
- Basic Part No.



MBY-CR



MBY-VCR

Dimensions in mm

MINEBEA Part No.	ϕB H7	ϕD 0 −0.013	W 0 −0.13	H ±0.13	α (deg.)	ϕO Ref.	SϕDB Ref.	Chamfer C ±0.2	Staking Groove S 0 −0.25	Staking Groove X 0 −0.25	Staking Groove R 0 −0.25	Staking Groove P 0 −0.4	Static Limit Load kN Radial	Static Limit Load kN Axial	Approx. Weight g
MBY3CR	3	10.0	8.0	3.0	29	5.0	8.00	0.3	0.5	1.0	0.4	0.7	11.76	1.27	3
MBY4CR	4	12.0	10.5	4.0		6.0	10.00						20.49	2.35	5
MBY5CR/MBY5VCR	5	14.0	12.5	5.0	17	8.0	11.10	0.5					28.43	3.62	8
MBY6CR/MBY6VCR	6	19.0	15.0	6.5	23	10.0	15.10						50.50	6.27	18
MBY8CR/MBY8VCR	8	18.0	16.0		20	10.5									15
MBY10CR/MBY10VCR	10	23.0	20.5	8.5	22	13.5	20.00	0.6	0.7	1.4	0.5	1.0	87.57	10.68	32
MBY12CR/MBY12VCR	12	26.0	22.0			16.0	22.50						98.06	42	42
MBY14CR/MBY14VCR	14	29.0	23.5	10.0	20	19.0	26.00						133.37	14.80	60
MBY15CR/MBY15VCR	15	33.0	26.0	12.0	19	20.0	28.00						172.59	33.73	86
MBY16CR/MBY16VCR	16	35.0	30.5	14.0	21	21.5	31.80						228.49	45.99	120
MBY18CR/MBY18VCR	18	38.0	33.0	14.5	15	23.5	32.00	0.8		2.0		1.5	238.30	49.32	135
MBY20CR/MBY20VCR	20	40.0	35.5	15.5	18	25.0	35.00	1.0					279.48	56.38	155
MBY22CR/MBY22VCR	22	44.0				29.0	38.80						308.90		200

Notes

1. MBY - CR & MBY - VCR weights are similar.
2. Made to order only.
(3) For below 4mm in Bore size, bearings are without lubrication grooves.
4. Radial Clearance All Size: 0.051mm MAX
◯ Please consult Minebea for availability of bearings in this series.

Bore size	~3	~6	~10	~18	~30
H7 Tolerance (μm)	+10 0	+12 0	+15 0	+18 0	+21 0

SPHERICAL BEARING [MOLD TYPE]

BM

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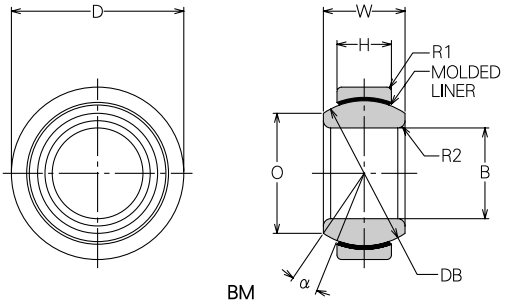
SPHERICAL | **MOLD TYPE** | **MINELON TN**

Materials

RACE	Bearing Steel / Black Oxide Treated
BALL	Bearing Steel / Chrome Plated
MOULDED LINER	Minelon TN



Dimensions in mm

MINEBEA Part No.	φB	φD	W 0 −0.12	H 0 −0.24	φO Ref.	R1 ±0.2	R2 ±0.2	α (deg.)	SφDB Ref.	No Load Rotational Breakaway Torque N・m	Radial Clearance mm	Radial Static Limit Load kN	Axial Static Limit Load kN	Dynamic Load kN	Approx. Weight g
BM10	10	19	9	6	13.1	0.5	0.8	12	16.0	0	0.03MAX	22.55	8.38	0.50	10
BM12	12	22	10	7	15.3	0.8		10	18.0	0.03MAX {0.35kgf・cmMAX}		30.89	11.47	0.72	15
BM15	15	26	12	9	18.7			8	22.0	0.06MAX {0.58kgf・cmMAX}	0.05MAX	46.77	17.35	1.15	25
BM17	17	30	14	10	21.2	1.0		10	25.0			59.03	21.86	1.36	40
BM20	20	35	16	12	23.7			9	29.0			72.47	26.87	1.58	62
BM25	25	42	20	16	29.3			7	35.5	0.11MAX {1.15kgf・cmMAX}		103.26	38.24	1.93	102

Notes

① Operating temperature range: − 50 ℃～+ 100 ℃

② Dynamic Load Ratings: Cd

1. Reversing & Alternating Load
   Dynamic Load Ratings shall be reduced by half from the values given in the table under the use of reversing and alternating load condition.
2. Factor of Operating Temperature and Sliding Speed
   Dynamic Load Ratings shall be determined by formula below under the use of High-Temperature and Sliding-Speed condition.
   Cdt・v=ft・fv・Cd
   Cdt・v: Dynamic Load Ratings under the use of High-Temperature and Sliding speed.
   ft: Coefficient of Temperature
   fv: Coefficient of Sliding speed

Table 1

Temp. ℃	～40	～60	～80	～100
ft	1.0	0.95	0.8	0.6

Table 2

Sliding Speed m/min	～0.3	～0.4	～0.5	～0.6	～0.7	～0.8	～0.9	～1.1	～1.5	～2.5
fv	1	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1

③ Static Load Ratings: Cs

1. Dynamic Load Ratings shall be reduced to one-thirds of the values given in the table under the use of that High-Load will be applied continiously or periodically and be reduced to one-sixth of the values given under Reversing and Alternating Load and Impact Load conditions.
2. Factor of Operating Temperature
   Dynamic Load Ratings shall be determined by formula below under the use of High-Temperature conditions.
   Cs・t=ft・Cs
   Cs・t: Dynamic Load Ratings under the use of High-Temperature condition.
   ft: Coefficient of Temperature
   Cs: Static Load given in the table

Table 3

Temp. ℃	～30	～40	～60	～80	～90	～100
ft	1.0	0.95	0.85	0.6	0.5	0.3

④ Thrust Load: Pt
Please use thrust load in the range, which does not exceed the thrust load (Table 1 application under temperature environment) from catalogue, and "1/3 of Actual radial Load."

○ Please consult Minebea for availability of bearings in this series.

Tolerances

Measure range		Ball permitted tolerances				Race permitted tolerances				permitted tolerances of Ball width		permitted tolerances of Race width	
		Bm		B		Dm		D		W		H	
Over	Under	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
—	10	0	−0.008	+0.002	−0.010	—	—	—	—	0	−0.120	0	−0.240
10	18	0	−0.008	+0.003	−0.011	—	—	—	—	0	−0.120	0	−0.240
18	30	0	−0.010	+0.003	−0.013	0	−0.009	+0.005	−0.014	0	−0.120	0	−0.240
30	50	0	−0.012	+0.003	−0.015	0	−0.011	+0.008	−0.019	0	−0.120	0	−0.240

Bm & Dm indicate averages of I.D. & O.D..

2 PIECE ROD END BEARING 〔SELF-LUBRICATING〕

RBT-E

ROD END MALE	SELF-LUBRICATING	2 PIECE

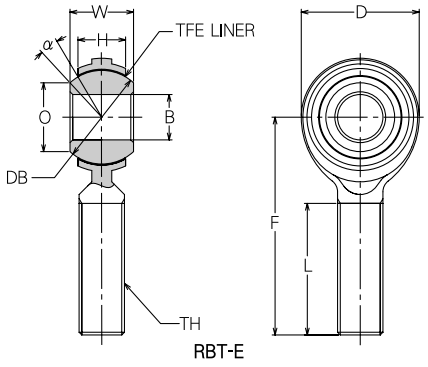
Materials

BODY 303 Stainless Steel
BALL 440C Stainless Steel
LINER Teflon / Fabric

Description of Types

RBT D L xx E T

- T: No Letter Indicates Standard Breakaway Torque / Letter "T" Indicates Low Breakaway Torque
- xx: Bearing Bore Code
- L: No Letter Indicates Right Hand Thread / Letter "L" Indicates Left Hand Thread
- D: For X-1276 LINER add suffix "D"
- RBT: Basic Part No.



RBT-E

Dimensions in mm

MINEBEA Part No.	ϕB H7	ϕD ± 0.50	W 0 −0.13	H ± 0.3	F ± 0.5	TH JIS Class 2	L ± 0.7	α (deg.)	ϕO Ref.	SϕDB Ref.	Radial Static Limit Load kN	Static Ultimate Load kN	Approx. Weight g
RBT3E	3	12	6	4.50	27	M3 × 0.5	15	11	6.8	9.04	0.41	1.66	6
RBT4E	4	14	7	5.25	30	M4 × 0.7	17	12	7.6	10.32	0.60	2.45	10
RBT5E	5	16	8	6.00	33	M5 × 0.8	20		8.8	11.91	0.98	3.92	12
RBT6E	6	18	9	6.75	36	M6 × 1.0	22	10	11.1	14.29	1.44	5.78	19
RBT8E	8	22	12	9.00	42	M8 × 1.25	25	12	12.7	17.46	2.69	10.78	32
RBT10E	10	26	14	10.50	48	M10 × 1.5	29		15.2	20.64	4.16	16.67	54
RBT12E	12	30	16	12.00	54	M12 × 1.75	33		17.6	23.81	5.88	23.53	85
RBT14E	14	34	19	13.50	60	M14 × 2.0	36	14	19.2	26.99	6.61	26.47	126
RBT15E	15	36	20	14.50	63		38	13	21.5	29.37	8.09	32.36	150
RBT16E	16	38	21	15.00	66	M16 × 2.0	40	15	19.4	28.58	8.33	33.34	185
RBT18E	18	42	23	16.50	72	M18 × 1.5	44		21.9	31.75	11.52	46.09	258
RBT20E	20	46	25	18.00	78	M20 × 1.5	47	14	24.4	34.93	12.01	48.05	340
RBT22E	22	50	28	20.00	84	M22 × 1.5	51	15	25.8	38.10	13.48	53.93	435
RBT25E	25	56	31	22.00	94	M24 × 2.0	57		29.6	42.86	17.40	69.62	730
RBT28E	28	62	35	24.00	103	M27 × 2.0	62	17	32.3	47.63	20.83	83.35	1000
RBT30E	30	66	37	25.00	110	M30 × 2.0	66		34.8	50.80	24.76	99.04	1320

Notes

1. Teflon liner permanently bonded to Body I.D.
2. Oscillation load shall be kept within the static load range, as Teflon liner load endurance is greater than body breaking load.
3. Made to order only. (from RBT15E to RBT30E)
4. No Load Rotational Breakaway Torque.
   Standard All Size: 0.02 ~ 0.34N・m
   Low Torque All Size: 0.02N・m MAX
   (Radial Clearance 0.05mm MAX)

○ Please consult Minebea for availability of bearings in this series.

Bore size	~ 3	~ 6	~ 10	~ 18	~ 30
H7 Tolerance (μm)	+ 10 0	+ 12 0	+ 15 0	+ 18 0	+ 21 0

2 PIECE ROD END BEARING [SELF-LUBRICATING]

RBT

ROD END FEMALE | **SELF-LUBRICATING** | **2 PIECE**

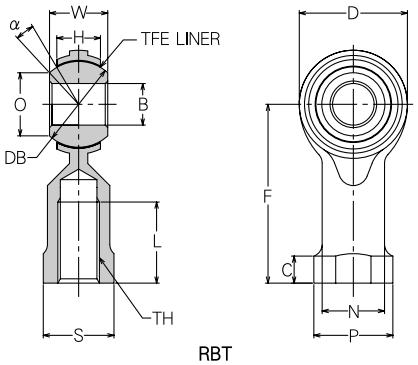
Materials

BODY 303 Stainless Steel
BALL 440C Stainless Steel
LINER Teflon / Fabric

Description of Types

RBT D L xx T

- No Letter Indicates Standard Breakaway Torque
  Letter "T" Indicates Low Breakaway Torque
- Bearing Bore Code
- No Letter Indicates Right Hand Thread
  Letter "L" Indicates Right Hand Thread
- For X-1276 LINER add suffix "D"
- Basic Part No.



RBT

Dimensions in mm

MINEBEA Part No.	ϕB H7	ϕD ± 0.5	W 0 −0.13	H ± 0.3	F ± 0.5	TH JIS Class 2	L ± 0.7	ϕN ± 0.5	ϕP ± 0.5	C ± 0.7	S ± 0.25	α (deg.)	ϕO Ref.	SϕDB Ref.	Radial Static Limit Load kN	Static Ultimate Load kN	Approx. Weight g
RBT3	3	12	6	4.50	21	M3 × 0.5	10.0	6.5	8.0	3.0	7	11	6.8	9.04	0.41	1.66	10
RBT4	4	14	7	5.25	24	M4 × 0.7	12.0	8.0	9.5	4.0	8	12	7.6	10.32	0.60	2.45	12
RBT5	5	16	8	6.00	27	M5 × 0.8	12.5	9.0	11.0		9		8.8	11.91	0.98	7.84	16
RBT6	6	18	9	6.75	30	M6 × 1.0	13.5	10.0	13.0	5.0	11	10	11.1	14.29	1.44	8.62	25
RBT8	8	22	12	9.00	36	M8 × 1.25	16.0	12.5	16.0		14	12	12.7	17.46	2.69	11.76	43
RBT10	10	26	14	10.50	43	M10 × 1.5	19.5	15.0	19.0	6.5	17		15.2	20.64	4.16	16.67	72
RBT12	12	30	16	12.00	50	M12 × 1.75	24.0	17.5	22.0		19		17.6	23.81	5.88	23.53	107
RBT14	14	34	19	13.50	57	M14 × 2.0	27.0	20.0	25.0	8.0	22	14	19.2	26.99	6.61	26.47	160
RBT15	15	36	20	14.50	61		30.0	21.0	26.0			13	21.5	29.37	8.09	32.36	185
RBT16	16	38	21	15.00	64	M16 × 2.0	33.0	22.0	27.0			15	19.4	28.58	8.33	33.34	210
RBT18	18	42	23	16.50	71	M18 × 1.5	36.0	25.0	31.0	10.0	27	15	21.9	31.75	11.52	46.09	295
RBT20	20	46	25	18.00	77	M20 × 1.5	40.0	27.5	34.0		30	14	24.4	34.93	12.01	48.05	380
RBT22	22	50	28	20.00	84	M22 × 1.5	43.0	30.0	37.0	12.0	32	15	25.8	38.10	13.48	53.93	490
RBT25	25	56	31	22.00	94	M24 × 2.0	48.0	33.5	42.0		36		29.6	42.86	17.40	69.62	870
RBT28	28	62	35	24.00	103	M27 × 2.0	53.0	37.5	46.0		41	17	32.3	47.63	20.83	83.35	1180
RBT30	30	66	37	25.00	110	M30 × 2.0	56.0	40.0	50.0	15.0			34.8	50.80	24.76	99.04	1450

Notes

1. Teflon liner permanently bonded to Body I.D.
2. Oscillation load shall be kept within the static load range, as Teflon liner load endurance is greater than body breaking load.
3. Made to order only. (from RBT15 to RBT30)
4. No Load Rotational Breakaway Torque.
   Standard All Size: 0.02 ~ 0.34N・m
   Low Torque All Size: 0.02N・m MAX
   (Radial Clearance 0.05mm MAX)

◯ Please consult Minebea for availability of bearings in this series.

Bore size	~ 3	~ 6	~ 10	~ 18	~ 30
H7 Tolerance (μm)	+ 10 0	+ 12 0	+ 15 0	+ 18 0	+ 21 0

HRT-E

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ROD ENDS MALE | **SELF-LUBRICATING** | **3 PIECE**

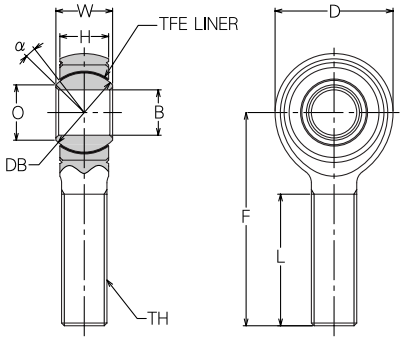
Materials

	HRT-E	HRT-ECR
BODY	Chromium-Molybdenum Steel Zinc Plated	SUS630 Stainless Steel Passivated
RACE	410 Stainless Steel	410 Stainless Steel
BALL	440C Stainless Steel	440C Stainless Steel
LINER	Teflon / Fabric	Teflon / Fabric

Description of Types

HRT D L xx E CR T

- No Letter Indicates Standard Breakaway Torque / Letter "T" Indicates Low Breakaway Torque
- No Letter Indicates Chromium-Molybdenum Steel / Letter "CR" Indicates SUS630 for Body
- Basic Part No.
- Bearing Bore Code
- No Letter Indicates Right Hand Thread / Letter "L" Indicates Left Hand Thread
- For X-1276 LINER add suffix "D"
- Basic Part No.



HRT-E

Dimensions in mm

MINEBEA Part No.	ϕB H7	ϕD ± 0.50	W 0 −0.13	H ± 0.13	F ± 0.5	TH JIS Class 2	L ± 0.7	α (deg.)	ϕO Ref.	SϕDB Ref.	No Load Rotational Breakaway Torque N・m Standard	Static Limit Load kN(3) Radial	Static Limit Load kN(3) Axial (2)	Radial Static Ultimate Load (3) kN	Fatigue Load (3) kN	Approx. Weight g
HRT3E	3	16.0	7.0	5.25	30.0	M3 × 0.5	10.0	18	5.2	8.73	0.06 ~ 0.68 {0.6 ~ 6.9kgf・cm}	3.62	1.96	4.51	0.73	25
HRT4E	4	18.0	9.5	7.75	35.0	M4 × 0.7	16.0	16	5.8	11.11		6.27	3.53	7.84	1.27	30
HRT5E	5	20.5	11.0	8.75	39.5	M5 × 0.8	22.0	15	7.8	13.49		10.29	5.09	12.84	2.10	35
HRT6E	6					M6 × 1.0						14.51		18.14	2.99	
HRT8E	8	23.0		8.25	46.0	M8 × 1.25	29.0	14	10.9	15.48	0.12 ~ 1.13 {1.2 ~ 11.5kgf・cm}	26.77	5.29	33.44	5.54	40
HRT10E	10	26.0	12.5	10.75	47.0	M10 × 1.5		8	12.2	17.46		37.65	6.76	47.07	7.84	65
HRT12E	12	34.0	16.0	13.25	62.0	M12 × 1.75	37.0	10	15.4	22.22		62.46	8.33	78.06	12.94	126
HRT14E	14	36.0	17.0	14.25	64.0	M14 × 2.0	38.0	8	18.9	25.40		82.96	9.02	103.65	17.25	140
HRT15E	15	38.0	18.0		65.0			11	19	26.19		100.71	9.70	125.81	20.98	165
HRT16E	16	39.0	19.0	15.25	66.5	M16 × 2.0	39.5	10	19.2	26.99						195
HRT17E	17	41.0	20.0		72.5	M16 × 1.5	42.0	12	20.4	28.58		101.40	10.29	126.70	21.08	220
HRT18E	18	43.0		16.30	79.5	M18 × 1.5	46.0	10				120.62	12.16	150.72	25.10	250
HRT20E	20	45.0	22.0		83.0	M20 × 1.5	50.0	13	22.9	31.75		121.30	12.84	151.61	25.20	290
HRT22E	22	52.0		19.30	86.0	M22 × 1.5	51.0	6	27.1	34.92	0.23 ~ 1.80 {2.3 ~ 18.4kgf・cm}	156.21	15.10	195.25	32.55	450
HRT25E	25	70.0	35.0	25.30	105.0	M24 × 2.0	59.0	15	32.3	47.62		300.08	20.88	375.10	62.56	1150
HRT28E	28	75.0			110.0	M27 × 2.0	62.0	14	36.8	50.80		283.70	23.24	354.60	59.13	1500
HRT30E	30	78.0	37.0	26.30	120.0	M30 × 2.0	65.0		40.4	54.77		271.93	24.81	339.89	56.68	1800

Notes

1. Teflon liner permanently bonded to race I.D.
2. Axial load indicates either the smaller value of static load or proof load.
3. Special specification can bare higher fatigue load.
4. Made to order only.
5. No Load Rotational Breakaway Torque.
   Low Torque All Size: 0.02N・m MAX
   (Radial Clearance 0.05mm MAX)

◯ Please consult Minebea for availability of bearings in this series.

Bore size	~ 3	~ 6	~ 10	~ 18	~ 30
H7 Tolerance (μm)	+ 10 0	+ 12 0	+ 15 0	+ 18 0	+ 21 0

HRT

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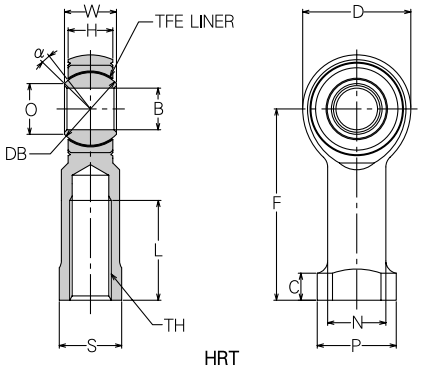
ROD END FEMALE | **SELF-LUBRICATING** | **3 PIECE**

Materials

	HRT	HRT-CR
BODY	Chromium-Molybdenum Steel Zinc Plated	SUS630 Stainless Steel Passivated
RACE	410 Stainless Steel	410 Stainless Steel
BALL	440C Stainless Steel	440C Stainless Steel
LINER	Teflon / Fabric	Teflon / Fabric



HRT

Description of Types

HRT D L xx CR T

- No Letter Indicates Standard Breakaway Torque / Letter "T" Indicates Low Breakaway Torque
- No Letter Indicates Chromium-Molybdenum Steel / Letter "CR" Indicates SUS630 for Body
- Bearing Bore Code
- No Letter Indicates Right Hand Thread / Letter "L" Indicates Left Hand Thread
- For X-1276 LINER add suffix "D"
- Basic Part No.

Dimensions in mm

MINEBEA Part No.	φB H7	φD ± 0.5	W 0 / −0.13	H ± 0.13	F ± 0.5	TH JIS Class 2	L ± 0.7	φN ± 0.5	φP ± 0.5	C +0.2 / −0.7	S ± 0.25	α (deg.)	φO Ref.	S φDB Ref.	No Load Rotational Breakaway Torque N・m Standard	Static Limit Load kN(3) Radial	Static Limit Load kN(3) Axial (2)	Radial Static Ultimate Load (3) kN	Fatigue Load (3) kN	Approx. Weight g
HRT3	3	16.0	7.0	5.25	30.0	M3 × 0.5	16	7.0	9	3.5	8	18	5.2	8.73	0.06 ~ 0.68 {0.6 ~ 6.9kgf・cm}	14.70	1.96	30.89	5.14	29
HRT4	4	18.0	9.5	7.75	32.0	M4 × 0.7		8.5	11		10	16	5.8	11.11		31.38	3.53	43.34	7.15	35
HRT5	5	20.5	11.0	8.75	35.0	M5 × 0.8	19	10.8	15	4.5	12	15	7.8	13.49		27.94	5.09	34.91	5.78	40
HRT6	6	20.5			37.0	M6 × 1.0														
HRT8	8	23.0		8.25	41.0	M8 × 1.25	22	12.5	17	6.5	14	14	10.9	15.48	0.12 ~ 1.13 {1.2 ~ 11.5kgf・cm}	34.02	5.29	42.46	7.06	51
HRT10	10	26.0	12.5	10.75	46.0	M10 × 1.5	24	14.0	19		15	8	12.2	17.46		37.65	6.76	47.07	7.84	73
HRT12	12	34.0	16.0	13.25	57.0	M12 × 1.75	32	18.5	24		20	10	15.4	22.22		78.06	8.33	97.57	16.18	150
HRT14	14	36.0	17.0	14.25	60.0	M14 × 2.0	33	19.0		7.5		8	18.9	25.40		82.96	9.02	103.65	17.25	165
HRT15	15	38.0	18.0		62.0		34	20.0	25	8.5	21	11	19.0	26.19		95.32	9.31	119.15	19.80	189
HRT16	16	39.0	19.0	15.25	63.5	M16 × 2.0	35	22.0	27	9.5	23	10	19.2	26.99		100.71	9.70	125.81	20.98	218
HRT17	17	41.0	20.0		68.0	M16 × 1.5	37	23.0	28		24	12	20.4	28.58		101.40	10.29	126.70	21.08	241
HRT18	18	43.0		16.30	74.0	M18 × 1.5	40	24.0	30	10.0	26	10				120.62	12.16	150.72	25.10	283
HRT20	20	45.0	22.0		76.0	M20 × 1.5	41	25.0			26	13	22.9	31.75		121.30	12.84	151.61	25.20	330
HRT22	22	52.0		19.30	85.0	M22 × 1.5	47	28.0	36	12.0	30	6	27.1	34.92	0.23 ~ 1.80 {2.3 ~ 18.4kgf・cm}	156.21	15.10	195.25	32.55	580
HRT25	25	70.0	35.0	25.30	105.0	M24 × 2.0	54	42.0	50	14.0	43	15	32.3	47.62		302.43	20.88	378.04	63.05	1230
HRT28	28	75.0			110.0	M27 × 2.0	58	44.0	56	15.0	47	14	36.8	50.80		283.70	23.24	354.60	59.13	1620
HRT30	30	78.0	37.0	26.30	120.0	M30 × 2.0	62	48.0	60	16.0	51		40.4	54.77		271.93	24.81	339.89	56.68	1930

Notes

1. Teflon liner permanently bonded to race I.D.
(2) Axial load indicates either the smaller value of static load or proof load.
(3) Select Type "CR" for higher load capability.
4. Made to order only.
5. No Load Rotational Breakaway Torque.
Low Torque All Size: 0.02N・m MAX
(Radial Clearance 0.05mm MAX)

◯ Please consult Minebea for availability of bearings in this series.

Bore size	~ 3	~ 6	~ 10	~ 18	~ 30
H7 Tolerance (μm)	+ 10 0	+ 12 0	+ 15 0	+ 18 0	+ 21 0

HR-E

ROD ENDS MALE | METAL TO METAL | 3 PIECE

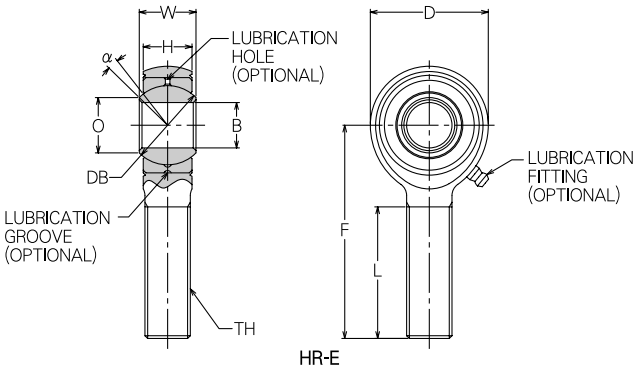
Materials

	HR-E	HR-ECR
BODY	Chromium-Molybdenum Steel Zinc Plated	SUS630 Stainless Steel Passivated
RACE	410 Stainless Steel	410 Stainless Steel
BALL	Bearing Steel / Chrame Plated	440C Stainless Steel

Description of Types

HR L xx E CR F

- F: For Zerk Type Lubrication Fitting Add Suffix "F" to Part No. e.g.HR5EF
For Flush Type Lubrication Fitting Add Suffix "FN" to Part No. e.g. HR5EFN
For JIS ST'D Type (A-M6F) Lubriltion Fitting Add Suffix "FAS" to Part No.
e.g. HR5EFAS
- CR: No Letter Indicates Chromium-Molybdenum Steel
Letter "CR" Indicates SUS630 for Body
- xx: Bearing Bore Code
- L: No Letter Indicates Right Hand Thread
Letter "L" Indicates Left Hand Thread
- HR: Basic Part No.



Dimensions in mm

MINEBEA Part No.	φB H7	φD ± 0.5	W 0 −0.13	H ± 0.13	F ± 0.5	TH JIS Class 2	L ± 0.7	α (deg.)	φO Ref.	SφDB Ref.	Static Limit Load kN		Radial Static Ultimate Load kN	Fatigue Load (2) kN	Approx. Weight g
											Radial	Axial (1)			
HR3E	3	16.0	7.0	5.25	30.0	M3 × 0.5	10.0	18	5.2	8.73	3.62	2.94	4.51	0.73	25
HR4E	4	18.0	9.5	7.75	35.0	M4 × 0.7	16.0	16	5.8	11.11	6.27	3.53	7.84	1.27	30
HR5E	5	20.5	11.0	8.75	39.5	M5 × 0.8	22.0	15	7.8	13.49	10.29	5.09	12.84	2.10	35
HR6E	6					M6 × 1.0					14.51		18.14	2.99	
HR8E	8	23.0		8.25	46.0	M8 × 1.25	29.0	14	10.9	15.48	26.77	5.58	33.44	5.54	40
HR10E	10	26.0	12.5	10.75	47.0	M10 × 1.5		8	12.2	17.46	37.65	6.76	47.07	7.84	65
HR12E	12	34.0	16.0	13.25	62.0	M12 × 1.75	37.0	10	15.4	22.22	62.46	8.33	78.06	12.94	126
HR14E	14	36.0	17.0	14.25	64.0	M14 × 2.0	38.0	8	18.9	25.40	82.96	9.02	103.65	17.25	140
HR15E	15	38.0	18.0		65.0			11	19.0	26.19	85.90	9.31	107.38	17.84	165
HR16E	16	39.0	19.0	15.25	66.5	M16 × 2.0	39.5	10	19.2	26.99	100.71	9.70	125.81	20.98	195
HR17E	17	41.0	20.0		72.5	M16 × 1.5	42.0	12	20.4	28.58	101.40	10.29	126.70	21.08	220
HR18E	18	43.0		16.30	79.5	M18 × 1.5	46.0	10			120.62	12.16	150.72	25.10	250
HR20E	20	45.0	22.0		83.0	M20 × 1.5	50.0	13	22.9	31.75	121.30	12.84	151.61	25.20	290
HR22E	22	52.0		19.30	86.0	M22 × 1.5	51.0	6	27.1	34.92	156.21	15.10	195.25	32.55	450
HR25E	25	70.0	35.0	25.30	105.0	M24 × 2.0	59.0	15	32.3	47.62	300.08	20.88	375.10	62.56	1150
HR28E	28	75.0			110.0	M27 × 2.0	62.0	14	36.8	50.80	283.70	23.24	354.60	59.13	1500
HR30E	30	78.0	37.0	26.30	120.0	M30 × 2.0	65.0		40.4	54.77	271.93	24.81	339.89	56.68	1800

Notes

(1) Axial load indicates either the smaller value of static load or proof load.

(2) Special specification can bare higher fatigue load.

3. Made to order only.

4. Radial clearance All Size: 0.051mm MAX

◯ Please consult Minebea for availability of bearings in this series.

Bore size	~ 3	~ 6	~ 10	~ 18	~ 30
H7 Tolerance (μm)	+ 10 0	+ 12 0	+ 15 0	+ 18 0	+ 21 0

HR

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ROD END FEMALE	METAL TO METAL	3 PIECE

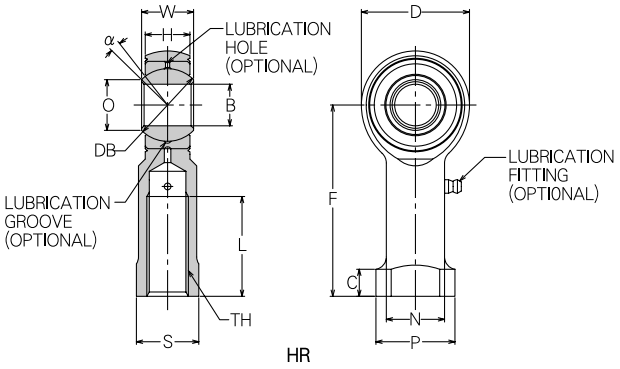
Materials

	HR	HR-CR
BODY	Chromium-Molybdenum Steel Zinc Plated	SUS630 Stainless Steel Passivated
RACE	410 Stainless Steel	410 Stainless Steel
BALL	Bearing Steel / Chrome Plated	440C Stainless Steel

Description of Types

HR L xx CR F

- For Zerk type lubrication fitting add suffix "F" to part No. e.g. HR5F
  For Flush type lubrication fitting add suffix "FN" to part No. e.g. HR5FN
  For JIS ST'D type(A-M6F) lubrication fitting add suffx "FAS" to part No. e.g. HR5FAS
- No Letter Indicates Chromium-Molybdenum Steel
  Letter "CR" Indicates SUS630 for Body
- Bearing Bore Code
- No Letter Indicates Right Hand Thread
  Letter "L" Indicates Left Hand Thread
- Basic Part No.



HR

Dimensions in mm

MINEBEA Part No.	φB H7	φD ± 0.5	W 0 / − 0.13	H ± 0.13	F ± 0.5	TH JIS Class 2	L ± 0.7	φN ± 0.5	φP ± 0.5	C + 0.2 / − 0.1	S ± 0.25	α (deg.)	φO Ref.	SφDB Ref.	Static Limit Load kN Radial	Static Limit Load kN Axial (1)	Radial Static Ultimate Load kN	Fatigue Load (2) kN	Approx. Weight g
HR3	3	16.0	7.0	5.25	30.0	M3 × 0.5	16	7.0	9	3.5	8	18	5.2	8.73	22.45	2.94	30.89	5.14	29
HR4	4	18.0	9.5	7.75	32.0	M4 × 0.7		8.5	11		10	16	5.8	11.11	34.71	3.53	43.34	7.15	35
HR5	5	20.5	11.0	8.75	35.0	M5 × 0.8	19	10.8	15	4.5	12	15	7.8	13.49	27.94	5.09	34.91	5.78	40
HR6	6				37.0	M6 × 1.0													
HR8	8	23.0		8.25	41.0	M8 × 1.25	22	12.5	17	6.5	14	14	10.9	15.48	34.02	5.58	43.44	7.06	51
HR10	10	26.0	12.5	10.75	46.0	M10 × 1.5	24	14.0	19		15	8	12.2	17.46	37.65	6.76	47.07	7.84	73
HR12	12	34.0	16.0	13.25	57.0	M12 × 1.75	32	18.5	24		20	10	15.4	22.22	78.06	8.33	97.57	16.18	150
HR14	14	36.0	17.0	14.25	60.0	M14 × 2.0	33	19.0		7.5		8	18.9	25.40	82.96	9.02	103.65	17.25	165
HR15	15	38.0	18.0		62.0		34	20.0	25	8.5	21	11	19.0	26.19	95.32	9.31	119.15	19.80	189
HR16	16	39.0	19.0	15.25	63.5	M16 × 2.0	35	22.0	27	9.5	23	10	19.2	26.99	100.71	9.70	125.81	20.98	218
HR17	17	41.0	20.0		68.0	M16 × 1.5	37	23.0	28	9.5	24	12	20.4	28.58	101.40	10.29	126.70	21.08	241
HR18	18	43.0		16.30	74.0	M18 × 1.5	40	24.0	30	10.0	26	10			120.62	12.16	150.72	25.10	283
HR20	20	45.0	22.0		76.0	M20 × 1.5	41	25.0				13	22.9	31.75	121.30	12.84	151.61	25.20	330
HR22	22	52.0		19.30	85.0	M22 × 1.5	47	28.0	36	12.0	30	6	27.1	34.92	156.21	15.10	195.25	32.55	580
HR25	25	70.0	35.0	25.30	105.0	M24 × 2.0	54	42.0	50	14.0	43	15	32.3	47.62	300.08	20.88	378.04	63.05	1230
HR28	28	75.0			110.0	M27 × 2.0	58	44.0	56	15.0	47	14	36.8	50.80	283.70	23.24	354.60	59.13	1620
HR30	30	78.0	37.0	26.30	120.0	M30 × 2.0	62	48.0	60	16.0	51		40.4	54.77	271.93	24.81	339.89	56.68	1930

Notes

(1) Axial load indicates either the smaller value of static load or proof load.

(2) Special specification can bare higher fatigue load.

3. Made to order only.

4. Radial Clearance All Size: 0.051mm MAX

◯ Please consult Minebea for availability of bearings in this series.

Bore size	~ 3	~ 6	~ 10	~ 18	~ 30
H7 Tolerance (μm)	+ 10 0	+ 12 0	+ 15 0	+ 18 0	+ 21 0

PR-E

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ROD END MALE	METAL TO METAL	4 PIECE

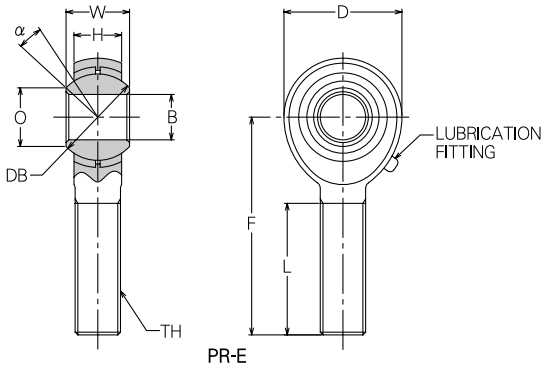
Materials

BODY Low Carbon Steel / Zinc Plated
INSERT Copper Alloy
BALL Bearing Steel / Chrome Plated

Description of Types

PR L xx E N Y

- No Letter indicates standard radial clearance
  Letter "Y" indicates low radial clearance
- No Letter Indicates standard
  Rod ends without lubrication fitting are available
  Specify by adding suffix "N" to part No.
- Bearing Bore Code
- No Letter Indicates Right Hand Thread
  Letter "L" Indicates Left Hand Thread
- Basic Part No.



PR-E

Dimensions in mm

MINEBEA Part No.	ϕB H7	ϕD ± 0.5	W 0 −0.13	H ± 0.13	F ± 0.5	TH JIS Class 2	L ± 0.7	α (deg.)	ϕO Ref.	SϕDB Ref.	Radial Static Limit Load kN	Static Ultimate Load kN	Approx. Weight g
PR3E (1)	3	12	6	4.50	27	M3 × 0.5	15	14	5.2	7.94	1.56	2.45	7
PR4E (1)	4	14	7	5.25	30	M4 × 0.7	17		6.5	9.52	2.25	3.53	10
PR5E	5	16	8	6.00	33	M5 × 0.8	20	13	7.7	11.11	4.51	7.06	13
PR6E	6	18	9	6.75	36	M6 × 1.0	22		9.0	12.70	6.37	9.90	19
PR8E	8	22	12	9.00	42	M8 × 1.25	25	14	10.4	15.88	13.72	21.47	32
PR10E	10	26	14	10.50	48	M10 × 1.5	29	13	12.9	19.05	18.82	29.41	54
PR12E	12	30	16	12.00	54	M12 × 1.75	33		15.4	22.22	25.20	39.42	85
PR14E	14	34	19	13.50	60	M14 × 2.0	36	16	16.9	25.40	30.49	47.75	126
PR16E	16	38	21	15.00	66	M16 × 2.0	40	15	19.4	28.58	38.04	59.64	185
PR18E	18	42	23	16.50	72	M18 × 1.5	44		21.9	31.75	46.28	72.47	258
PR20E	20	46	25	18.00	78	M20 × 1.5	47	14	24.4	34.92	53.83	84.33	340
PR22E	22	50	28	20.00	84	M22 × 1.5	51	15	25.8	38.10	63.93	100.22	435

Notes

(1) Lubrication fitting are not available for PR3E, PR4E.

2. Radial Clearance
   Standard Clearance: 0.051mm MAX
   Low Clearance: 0.030mm MAX

◯ Please consult Minebea for availability of bearings in this series.

Bore size	~ 3	~ 6	~ 10	~ 18	~ 30
H7 Tolerance (μm)	+ 10 0	+ 12 0	+ 15 0	+ 18 0	+ 21 0

PR

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ROD END FEMALE	METAL TO METAL	4 PIECE

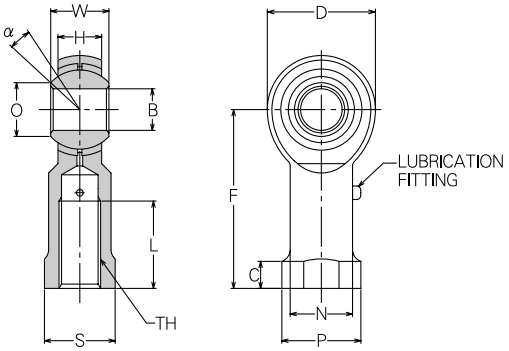
Materials

BODY Low Carbon Steel / Zinc Plated
INSERT Copper Alloy
BALL Bearing Steel / Chrome Plated

Description of Types

PR L xx N Y

- No Letter indicates standard radial clearance
  Letter "Y" indicates low radial clearance
- Rod ends without lubrication fitting are available
  Specify by adding suffix "N" to part No.
- Bearing Bore Code
- No Letter Indicates Right Hand Thread
  Letter "L" Indicates Left Hand Thread
- Basic Part No.



PR

Dimensions in mm

MINEBEA Part No.	φB H7	φD ± 0.5	W 0 − 0.13	H ± 0.13	F ± 0.5	TH JIS Class 2	L ± 0.7	φN ± 0.5	φP ± 0.5	C + 0.2 − 0.7	S ± 0.25	α (deg.)	φO Ref.	SφDB Ref.	Radial Static Limit Load kN	Static Ultimate Load kN	Approx. Weight g
PR3 (1)	3	12	6	4.50	21	M3 × 0.5	10	6.5	8.0	3.0	7	14	5.2	7.94	4.60	7.15	9
PR4 (1)	4	14	7	5.25	24	M4 × 0.7	12	8.0	9.5	4.0	8	13	6.5	9.52	5.68	8.82	13
PR5	5	16	8	6.00	27	M5 × 0.8	14	9.0	11.0		9		7.7	11.11	7.84	12.25	17
PR6	6	18	9	6.75	30	M6 × 1.0		10.0	13.0	5.0	11		9.0	12.70	8.82	13.82	25
PR8	8	22	12	9.00	36	M8 × 1.25	17	12.5	16.0		14	14	10.4	15.88	13.63	21.28	43
PR10	10	26	14	10.50	43	M10 × 1.5	21	15.0	19.0	6.5	17	13	12.9	19.05	18.82	29.41	72
PR12	12	30	16	12.00	50	M12 × 1.75	24	17.5	22.0		19		15.4	22.22	25.20	39.42	107
PR14	14	34	19	13.50	57	M14 × 2.0	27	20.0	25.0	8.0	22	16	16.9	25.40	30.49	47.75	160
PR16	16	38	21	15.00	64	M16 × 2.0	33	22.0	27.0			15	19.4	28.58	38.04	59.64	210
PR18	18	42	23	16.50	71	M18 × 1.5	36	25.0	31.0	10.0	27		21.9	31.75	46.28	72.47	295
PR20	20	46	25	18.00	77	M20 × 1.5	40	27.5	34.0		30	14	24.4	34.92	53.83	84.33	380
PR22	22	50	28	20.00	84	M22 × 1.5	43	30.0	37.0	12.0	32	15	25.8	38.10	63.93	100.22	490

Notes

(1) Lubrication fitting are not available for PR3, PR4.

2. Radial Clearance
   Standard Clearance: 0.051mm MAX
   Low Clearance: 0.030mm MAX

◯ Please consult Minebea for availability of bearings in this series.

Bore size	~ 3	~ 6	~ 10	~ 18	~ 30
H7 Tolerance (μm)	+ 10 0	+ 12 0	+ 15 0	+ 18 0	+ 21 0

MOLDED ROD END BEARING 〔SELF-LUBRICATING〕

RBM-E

ROD END MALE | MOLDED | MINELON TN

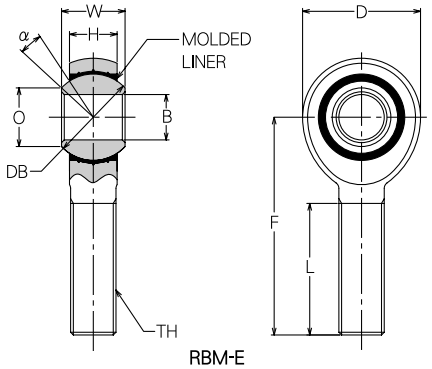
Materials

BODY	Low Carbon Steel / Zinc Plated
BALL	Bearing Steel / Chrome Plated
LINER	Minelon TN

Description of Types

RBM L xx E

- Bearing Bore Code
- No Letter Indicates Right Hand Thread
  Letter "L" Indicates Left Hand Thread
- Basic Part No.



RBM-E

Dimensions in mm

MINEBEA Part No.	φB H7	φD ± 0.5	W 0 −0.13	H ± 0.13	F ± 0.5	TH JIS Class 2	L ± 0.7	α (deg.)	φO Ref.	SφDB Ref.	No Load Rotational Breakaway Torque N・m	Radial Clearance mm	Radial Static Limit Load kN	Dynamic Load kN	Approx. Weight g
RBM5E	5	16	8	6.00	33	M5 × 0.8	20	13	7.7	11.11	0.04MAX {0.4kgf・cmMAX}	0.03MAX	3.62	1.90	12
RBM6E	6	18	9	6.75	36	M6 × 1.0	22	13	9.0	12.70			5.05	2.17	20
RBM8E	8	22	12	9.00	42	M8 × 1.25	25	14	10.4	15.88	0.06MAX {0.6kgf・cmMAX}	0.05MAX	9.16	3.48	35
RBM10E	10	26	14	10.50	48	M10 × 1.5	29		12.9	19.05			14.61	5.14	55
RBM12E	12	30	16	12.00	54	M12 × 1.75	33	13	15.4	22.22	0.12MAX {1.2kgf・cmMAX}		18.14	6.52	90
RBM14E	14	34	19	13.50	60	M14 × 2.0	36	16	16.9	25.40	0.34MAX {3.5kgf・cmMAX}		24.02	8.72	130
RBM16E	16	38	21	15.00	66	M16 × 2.0	40	15	19.4	28.58			28.43	10.49	185
RBM18E	18	42	23	16.50	72	M18 × 1.5	44		21.9	31.75			35.79	13.23	250
RBM20E	20	46	25	18.00	78	M20 × 1.5	47		24.4	34.92	0.57MAX {5.8kgf・cmMAX}		41.18	15.39	310
RBM22E	22	50	28	20.00	84	M22 × 1.5	51		25.9	38.10			50.01	18.73	400

Notes

① Operating temperature range: − 50 ℃～+ 100 ℃

② Dynamic Load Ratings: Cd

1. Reversing & Alternating Load
   Dynamic Load Ratings shall be reduced by half from the values given in the table under the use of reversing and alternating load condition.
2. Factor of Operating Temperature and Sliding Speed
   Dynamic Load Ratings shall be determined by formula below under the use of High-Temperature and Sliding-Speed condition.
   Cdt・v=ft・fv・Cd
   Cdt・v: Dynamic Load Ratings under the use of High-Temperature and Sliding speed.
   ft: Coefficient of Temperature
   fv: Coefficient of Sliding speed

③ Static Load Ratings: Cs

1. Dynamic Load Ratings shall be reduced to one-thirds of the values given in the table under the use of that High-Load will be applied continiously or periodically and be reduced to one-sixth of the values given under Reversing and Alternating Load and Impact Load conditions.
2. Factor of Operating Temperature
   Dynamic Load Ratings shall be determined by formula below under the use of High-Temperature conditions.
   Cs・t=ft・Cs
   Cs・t: Dynamic Load Ratings under the use of High-Temperature condition.
   ft: Coefficient of Temperature
   Cs: Static Load given in the table

Table 1

Temp. ℃	～40	～60	～80	～100
ft	1.0	0.95	0.8	0.6

Table 2

Sliding Speed m/min	～0.3	～0.4	～0.5	～0.6	～0.7	～0.8	～0.9	～1.1	～1.5	～2.5
fv	1	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1

Table 3

Temp. ℃	～30	～40	～60	～80	～90	～100
ft	1.0	0.95	0.85	0.6	0.5	0.3

○ Please consult MINEBEA for availability of bearings in this series.

Bore size	～3	～6	～10	～18	～30
H7 Tolerance (μm)	+ 10 0	+ 12 0	+ 15 0	+ 18 0	+ 21 0

RBM

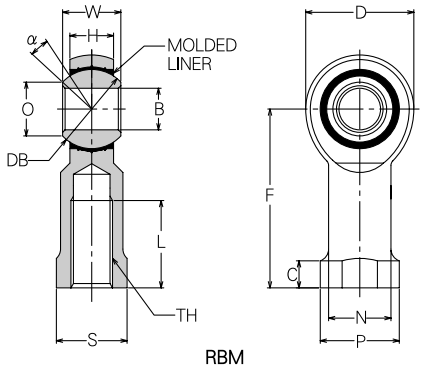
ROD END FEMALE | MOLDED | MINELON TN

Materials

BODY Low Carbon Steel / Zinc Plated
BALL Bearing Steel / Chrome Plated
LINER Minelon TN

Description of Types

RBM L xx
- xx: Bearing Bore Code
- L: No Letter Indicates right hands / Letter "L" Indicates left hands
- RBM: Basic Part No.



RBM

Dimensions in mm

MINEBEA Part No.	φB H7	φD ± 0.5	W 0 / − 0.13	H ± 0.13	F ± 0.5	TH JIS Class 2	L ± 0.7	φN ± 0.5	φP ± 0.5	C + 0.2 / − 0.7	S ± 0.25	α (deg.)	φO Ref.	S φDB Ref.	No Load Rotational Breakaway Torque N・m	Radial Clearance mm	Radial Static Limit Load kN	Dynamic Load kN	Approx. Weight g
RBM5	5	16	8	6.00	27	M5 × 0.8	14	9.0	11	4.0	9	13	7.7	11.11	0.04MAX {0.4kgf・cmMAX}	0.03MAX	5.98	1.90	16
RBM6	6	18	9	6.75	30	M6 × 1.0		10.0	13	5.0	11		9.0	12.70			7.55	2.17	25
RBM8	8	22	12	9.00	36	M8 × 1.25	17	12.5	16		14	14	10.4	15.88	0.06MAX {0.6kgf・cmMAX}	0.05MAX	10.29	3.48	45
RBM10	10	26	14	10.50	43	M10 × 1.5	21	15.0	19	6.5	17		12.9	19.05			14.61	5.14	75
RBM12	12	30	16	12.00	50	M12 × 1.75	24	17.5	22		19	13	15.4	22.22	0.12MAX {1.2kgf・cmMAX}		18.14	6.52	120
RBM14	14	34	19	13.50	57	M14 × 2.0	27	20.0	25	8.0	22	16	16.9	25.40	0.34MAX {3.5kgf・cmMAX}		24.02	8.72	160
RBM16	16	38	21	15.00	64	M16 × 2.0	33	22.0	27			15	19.4	28.58			28.43	10.49	220
RBM18	18	42	23	16.50	71	M18 × 1.5	36	25.0	31	10.0	27		21.9	31.75			35.79	13.23	300
RBM20	20	46	25	18.00	77	M20 × 1.5	40	27.5	34		30		24.4	34.92	0.57MAX {5.8kgf・cmMAX}		41.18	15.39	380
RBM22	22	50	28	20.00	84	M22 × 1.5	43	30.0	37	12.0	32		25.9	38.10			50.01	18.73	480

Notes

① Operating temperature range: − 50 ～+ 100 ℃

② Dynamic Load Ratings: Cd

1. Reversing & Alternating Load
Dynamic Load Ratings shall be reduced by half from the values given in the table under the use of reversing and alternating load condition.

2. Factor of Operating Temperature and Sliding Speed
Dynamic Load Ratings shall be determined by formula below under the use of High-Temperature and Sliding-Speed condition.
Cdt・v=ft・fv・Cd
Cdt・v: Dynamic Load Ratings under the use of High-Temperature and Sliding speed.
ft: Coefficient of Temperature
fv: Coefficient of Sliding speed

③ Static Load Ratings: Cs

1. Dynamic Load Ratings shall be reduced to one-thirds of the values given in the table under the use of that High-Load will be applied continiously or periodically and be reduced to one-sixth of the values given under Reversing and Alternating Load and Impact Load conditions.

2. Factor of Operating Temperature
Dynamic Load Ratings shall be determined by formula below under the use of High-Temperature conditions.
Cs・t=ft・Cs
Cs・t: Dynamic Load Ratings under the use of High-Temperature condition.
ft: Coefficient of Temperature
Cs: Static Load given in the table

Table 1

Temp. ℃	～40	～60	～80	～100
ft	1.0	0.95	0.8	0.6

Table 2

Sliding Speed m/min	～0.3	～0.4	～0.5	～0.6	～0.7	～0.8	～0.9	～1.1	～1.5	～2.5
fv	1	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1

Table 3

Temp. ℃	～30	～40	～60	～80	～90	～100
ft	1.0	0.95	0.85	0.6	0.5	0.3

○ Please consult MINEBEA for availability of bearings in this series.

Bore size	～3	～6	～10	～18	～30
H7 Tolerance (μm)	+ 10 0	+ 12 0	+ 15 0	+ 18 0	+ 21 0

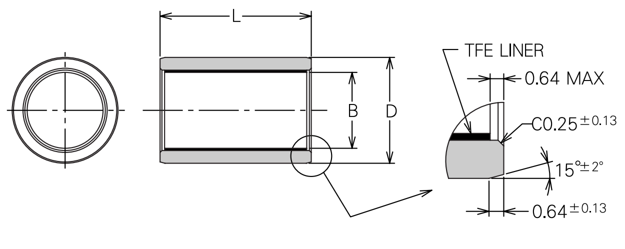
SLEEVE BEARING 〔SELF-LUBRICATING〕

MJ-A,MJ-C

SLEEVE BEARING | TFE LINED | PLAIN TYPE

Materials

	MJ-A	MJ-C
SLEEVE	Aluminium Alloy Anodised or Alodined	410 Stainless Steel
LINER	Teflon / Fabric	Teflon / Fabric



MJ-A
MJ-C

Description of Types

MJ xx x xx

- Length Code
- Material Code (A, C)
- Bore Code
- Basic Part No.

Dimensions in mm

MINEBEA Part No.	φB 0 − 0.025	φD (2)	WEIGHT g	
			ALUMINIUM	STAINLESS STEEL
MJ06	6.035	10	0.14 × L	0.40 × L
MJ08	8.035	11	0.13 × L	0.35 × L
MJ09	9.035	13	0.20 × L	0.54 × L
MJ10	10.035	14	0.21 × L	0.59 × L
MJ12	12.035	16	0.25 × L	0.69 × L
MJ14	14.035	18	0.28 × L	0.79 × L
MJ16	16.035	20	0.32 × L	0.89 × L
MJ18	18.035	22	0.35 × L	0.98 × L
MJ20	20.035	24	0.39 × L	1.08 × L
MJ22	22.035	27	0.54 × L	1.51 × L
MJ25	25.035	30	0.61 × L	1.69 × L
MJ28	28.035	33	0.67 × L	1.87 × L
MJ32	32.035	37	0.76 × L	2.12 × L
MJ35	35.035	40	0.82 × L	2.30 × L
MJ38	38.035	45	1.28 × L	3.57 × L
MJ40	40.035	48	1.55 × L	4.33 × L
MJ45	45.035	51	1.26 × L	3.54 × L
MJ50	50.035	57	1.64 × L	4.60 × L

Notes

1. Teflon liner permanently bonded to Sleeve I.D.

(2) (a) Tolerances:
Aluminium ± 0.013
Stainless steel 0 to − 0.013

I.D. Size shall be inspected by plug Gauge.

3. Made to order only.

◯ Please consult Minebea for availability of bearings in this series.

Dimensions in mm

MINEBEA	L																																							
Part	〔± 0.2〕											〔± 0.3〕															〔± 0.5〕														
No.	05	06	07	08	09	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
MJ06	5	6	7	8	9	10																																			
MJ08	5	6	7	8	9	10	12	14																																	
MJ09	5	6	7	8	9	10	12	14	16	18	20																														
MJ10	5	6	7	8	9	10	12	14	16	18	20	22	24																												
MJ12	5	6	7	8	9	10	12	14	16	18	20	22	24	26																											
MJ14	5	6	7	8	9	10	12	14	16	18	20	22	24	26	28	30																									
MJ16	5	6	7	8	9	10	12	14	16	18	20	22	24	26	28	30	32	34																							
MJ18	5	6	7	8	9	10	12	14	16	18	20	22	24	26	28	30	32	34	36																						
MJ20	5	6	7	8	9	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38																					
MJ22	5	6	7	8	9	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44																		
MJ25	5	6	7	8	9	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50															
MJ28				8	9	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60										
MJ32				8	9	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60										
MJ35						10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70					
MJ38						10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70					
MJ40									16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
MJ45									16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
MJ50									16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80

SLEEVE BEARING 〔SELF-LUBRICATING〕

MJF-A,MJF-C

Minebea
eMINEBEA.COM

SLEEVE | SELF-LUBRICATING | FLANGED

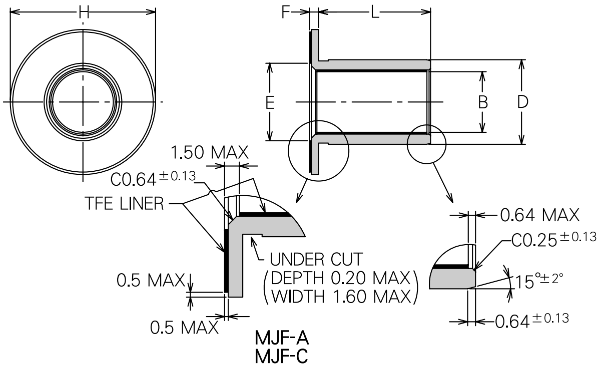
Materials

	MJF-A	MJF-C
SLEEVE	Aluminium Alloy Anodised or Alodined	410 Stainless Steel
LINER	Teflon / Fabric	Teflon / Fabric

Description of Types

MJF xx x xx

- xx → Length Code
- x → Material Code (A, C)
- xx → Bore Code
- MJF → Basic Part No.



Dimensions in mm

MINEBEA Part No.	φB 0 −0.025	φD (2)	F 0 −0.13	φH 0 −0.5	φE 0 −0.5	WEIGHT g ALUMINIUM	STAINLESS STEEL
MJF06	6.035	10		19	8.5	1.08 + 0.14 × L	3.01 + 0.40 × L
MJF08	8.035	11		20	10.5	1.11 + 0.13 × L	3.11 + 0.35 × L
MJF09	9.035	13		22	11.5	1.33 + 0.20 × L	3.73 + 0.54 × L
MJF10	10.035	14		24	12.5	1.57 + 0.21 × L	4.40 + 0.59 × L
MJF12	12.035	16		25	14.5	1.59 + 0.25 × L	4.45 + 0.69 × L
MJF14	14.035	18	1.5	28	16.5	1.94 + 0.28 × L	5.43 + 0.79 × L
MJF16	16.035	20		32	18.5	2.53 + 0.32 × L	7.10 + 0.89 × L
MJF18	18.035	22		35	20.5	2.97 + 0.35 × L	8.33 + 0.98 × L
MJF20	20.035	24		38	22.5	3.44 + 0.39 × L	9.65 + 1.08 × L
MJF22	22.035	27		41	24.5	3.95 + 0.54 × L	11.06 + 1.51 × L
MJF25	25.035	30		45	27.5	4.62 + 0.61 × L	12.94 + 1.69 × L
MJF28	28.035	33		48	30.5	8.35 + 0.67 × L	23.40 + 1.87 × L
MJF32	32.035	37		50	34.5	8.11 + 0.76 × L	22.72 + 2.12 × L
MJF35	35.035	40		54	37.5	9.29 + 0.82 × L	26.03 + 2.30 × L
MJF38	38.035	45	2.5	57	40.5	9.91 + 1.28 × L	27.79 + 3.57 × L
MJF40	40.035	48		60	42.5	10.99 + 1.55 × L	30.79 + 4.33 × L
MJF45	45.035	51		64	47.5	11.37 + 1.26 × L	31.88 + 3.54 × L
MJF50	50.035	57		70	52.5	13.18 + 1.64 × L	36.94 + 4.60 × L

Notes

1. Teflon liner permanently bonded to sleeve I.D and flange face
(2) (a) Tolerances:
Aluminium ± 0.013
Stainless steel 0 to − 0.013
I.D. Size shall be inspected by plug Gauge.
3. Made to order only.
○ Please consult Minebea for availability of bearings in this series.

Dimensions in mm

L 〔± 0.2〕

MINEBEA Part No.	05	06	07	08	09	10	12	14	16	18	20
MJF06	5	6	7	8	9	10					
MJF08	5	6	7	8	9	10	12	14			
MJF09	5	6	7	8	9	10	12	14	16	18	20
MJF10	5	6	7	8	9	10	12	14	16	18	20
MJF12	5	6	7	8	9	10	12	14	16	18	20
MJF14	5	6	7	8	9	10	12	14	16	18	20
MJF16	5	6	7	8	9	10	12	14	16	18	20
MJF18	5	6	7	8	9	10	12	14	16	18	20
MJF20	5	6	7	8	9	10	12	14	16	18	20
MJF22	5	6	7	8	9	10	12	14	16	18	20
MJF25	5	6	7	8	9	10	12	14	16	18	20
MJF28				8	9	10	12	14	16	18	20
MJF32				8	9	10	12	14	16	18	20
MJF35						10	12	14	16	18	20
MJF38						10	12	14	16	18	20
MJF40									16	18	20
MJF45									16	18	20
MJF50									16	18	20

L 〔± 0.3〕

MINEBEA Part No.	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
MJF06															
MJF08															
MJF09															
MJF10	22	24													
MJF12	22	24	26												
MJF14	22	24	26	28	30										
MJF16	22	24	26	28	30	32	34								
MJF18	22	24	26	28	30	32	34	36							
MJF20	22	24	26	28	30	32	34	36	38						
MJF22	22	24	26	28	30	32	34	36	38	40	42	44			
MJF25	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
MJF28	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
MJF32	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
MJF35	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
MJF38	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
MJF40	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
MJF45	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
MJF50	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50

L 〔± 0.5〕

MINEBEA Part No.	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
MJF06															
MJF08															
MJF09															
MJF10															
MJF12															
MJF14															
MJF16															
MJF18															
MJF20															
MJF22															
MJF25															
MJF28	52	54	56	58	60										
MJF32	52	54	56	58	60										
MJF35	52	54	56	58	60	62	64	66	68	70					
MJF38	52	54	56	58	60	62	64	66	68	70					
MJF40	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
MJF45	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
MJF50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80

BALL ROD END BEARING 〔LUBRICATED〕

PBR-EFN

ROD END MALE | BALL INSERT | LOW TORQUE

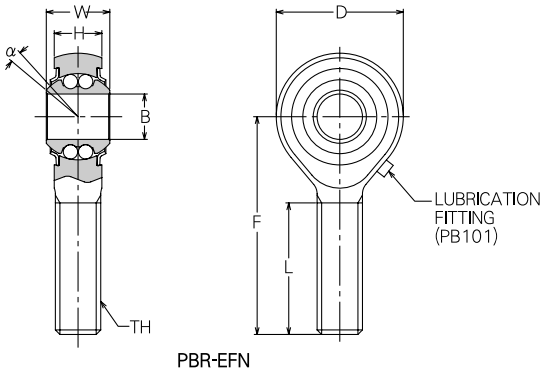
Materials

BODY	Chrome Molydbenum Steel / Zinc Plated
INNER RACE	Bearing Steel / Chrome Plated
BALL	Bearing Steel

Description of Types

PBR L xx EFN

- xx → Bearing Bore Code
- L → No Letter Indicates Right Hand Thread / Letter "L" Indicates Left Hand Thread
- PBR EFN → Basic Part No.



PBR-EFN

Dimensions in mm

MINEBEA Part No.	ϕB H7	ϕD ± 0.5	W 0 − 0.13	H ± 0.13	F ± 0.5	TH JIS Class 2	L ± 0.7	α (deg.)	Basic Static Limit Load kN	Basic Dynamic Limit Load kN	Approx. Weight g
PBR5EFN	5	18	8	6.75	33	M5 × 0.8	16	5.5	0.42	1.15	16
PBR6EFN	6	20	9	6.75	36	M6 × 1.0	22	8.0	0.64	2.74	19
PBR8EFN	8	24	12	9.00	42	M8 × 1.25	25	8.5	1.00	4.00	36
PBR10EFN	10	28	14	10.50	48	M10 × 1.5	29	8.0	1.44	4.45	60
PBR12EFN	12	32	16	12.00	54	M12 × 1.75	33	7.5	1.79	4.95	87
PBR14EFN	14	36	19	13.50	60	M14 × 2.0	36	6.0	2.00	5.59	135
PBR16EFN	16	42	21	15.00	66	M16 × 2.0	40	8.0	2.34	6.24	190
PBR18EFN	18	46	23	16.50	72	M18 × 1.5	44	8.5	2.89	7.10	270
PBR20EFN	20	50	25	18.00	78	M20 × 1.5	47	7.0	3.45	7.90	338
PBR22EFN	22	54	28	20.00	84	M22 × 1.5	51	8.0	3.98	9.29	450
PBR25EFN	25	64	31	22.00	94	M24 × 2.0	57	5.0	5.67	11.03	572
PBR30EFN	30	70	37	25.00	110	M30 × 2.0	66	7.5	7.45	14.15	992

Notes

1. Made to order only.
2. Lubrication: MIL-PRF-23827 (yellow) grease
3. Radial Clearance All Size: 0.010mm MAX

◯ Please consult Minebea for availability of bearings in this series.

Bore size	~ 3	~ 6	~ 10	~ 18	~ 30
H7 Tolerance (μm)	+ 10 0	+ 12 0	+ 15 0	+ 18 0	+ 21 0

BALL ROD END BEARING 〔LUBRICATED〕

PBR-FN

ROD END FEMALE **BALL INSERT** **LOW TORQUE**

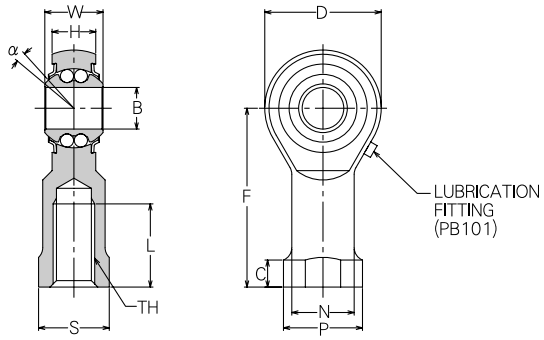
Materials

BODY	Chrome Molydbenum Steel / Zinc Plated
INNER RACE	Bearing Steel / Chrome Plated
BALL	Bearing Steel

Description of Types

PBR L xx FN

- xx → Bearing Bore Code
- L → No Letter Indicates Right Hand Thread / Letter "L" Indicates Left Hand Thread
- PBR FN → Basic Part No.



PBR-FN

Dimensions in mm

MINEBEA Part No.	ϕB H7	ϕD ± 0.5	W 0 / − 0.13	H ± 0.13	F ± 0.5	TH JIS Class 2	L ± 0.7	ϕN ± 0.5	ϕP ± 0.5	C + 0.2 / − 0.7	S ± 0.25	α (deg.)	Basic Static Limit Load kN	Basic Dynamic Limit Load kN	Approx. Weight g
PBR5FN	5	18	8	6.75	27	M5 × 0.8	14	9.0	11	4.0	9	5.5	0.42	1.15	20
PBR6FN	6	20	9	6.75	30	M6 × 1.0	12	10.0	13	5.0	11	8.0	0.64	2.74	24
PBR8FN	8	24	12	9.00	36	M8 × 1.25	16	12.5	16		14	8.5	1.00	4.00	44
PBR10FN	10	28	14	10.50	43	M10 × 1.5	20	15.0	19	6.5	17	8.0	1.44	4.45	72
PBR12FN	12	32	16	12.00	50	M12 × 1.75	22	17.5	22		19	7.5	1.79	4.95	107
PBR14FN	14	36	19	13.50	57	M14 × 2.0	25	20.0	25	8.0	22	6.0	2.00	5.59	160
PBR16FN	16	42	21	15.00	64	M16 × 2.0	28	22.0	27			8.0	2.34	6.24	224
PBR18FN	18	46	23	16.50	71	M18 × 1.5	32	25.0	31	10.0	27	8.5	2.89	7.10	293
PBR20FN	20	50	25	18.00	77	M20 × 1.5	33	27.5	34		30	7.0	3.45	7.90	367
PBR22FN	22	54	28	20.00	84	M22 × 1.5	37	30.0	38	12.0	32	8.0	3.98	9.29	480
PBR25FN	25	64	31	22.00	94	M24 × 2.0	42		35	10.0	30	5.0	5.67	11.03	602
PBR30FN	30	70	37	25.00	110	M30 × 2.0	51	40.0	50	15.0	41	7.5	7.45	14.15	978

Notes

1. Made to order only.
2. Lubrication: MIL-PRF-23827 (yellow) grease
3. Radial Clearance All Size: 0.010mm MAX

◯ Please consult Minebea for availability of bearings in this series.

Bore size	~ 3	~ 6	~ 10	~ 18	~ 30
H7 Tolerance (μm)	+ 10 0	+ 12 0	+ 15 0	+ 18 0	+ 21 0

Request and Caution

Protecting the Environment

Acutely aware of environment issues as a key element in business deployment, Minebea has approached environmental protection at all of its all of its production bases worldwide.
In 1997, the Karuizawa plant, to which the Rod-End Manufacturing Department belongs, became the world's first bearing manufacturer to obtain ISO14001 certification, the ISO's standard for environmental management systems, and since then, has deployed activity to obtain this certification at all of its plants in the world.

Quality Assurance System

The Rod-End Manufacturing Department of the Karuizawa Manufacturing Unit, which makes the products listed in the catalog, obtained ISO9001 certification in 1996. The Department has established a quality assurance system to satisfy customers, under which it is making efforts aimed at enhancing product quality further.

Warning

Use of our product may require consideration to the safety and reliability of your equipment.

Caution

- If you use our product in equipment requiring a high level of safety---- such as medical equipment, disaster prevention equipment, anticrime devices and automobiles, use the product after fully ensuring the adaptability of the safety.
- Minebea shall not be liable for any damages from unpredictable usage of our products.
- Consult the Rod-End Sales Department if:
  – You use our product beyond the bounds of permissibility specified in the catalog;
  – You use our product in a situation in which a special fit, etc. is required; or
  – You use our product in high temperature and humidity, low temperature

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Export permit by the Japanese government might be required to export our products from Japan.
Failure to obtain such permit might infringe on Foreign Exchange and Foreign Trade Law with Concomitant Orders & Ordinances of Japan.
With respect to laws and regulations other then Japanese government, or for more information, please contact our sales offices.
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