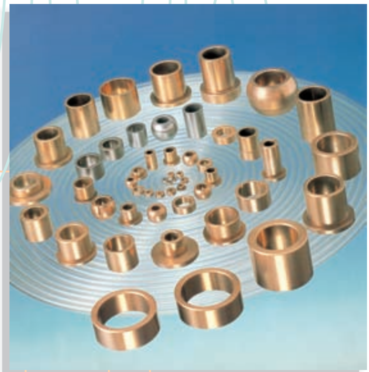
NTN

HANDBOOK

NTN BEARPHITE

OIL-IMPREGNATED SINTERED BEARINGS HANDBOOK



HANDBOOK

CAT. No. 9015-Ⅳ／E

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1. Oil-impregnated sintered bearings

1. 1 Introduction

The oil-impregnated sintered bearing is generally called the oil-impregnated bearing, the oil-less bearing, or simply the metal and is defined as "a bearing which is made of the oil-impregnated porous sintered compact mainly composed of metal powder" according to the JIS definition. This is a product in which powder metallurgy is well utilized.

*** Powder metallurgy is "a technology concerning manufacturing metal powder and manufacturing parts and products based on forming and sintering of the metal powder" (See JIS Z2500)**

Table 1.1 Type of bearing

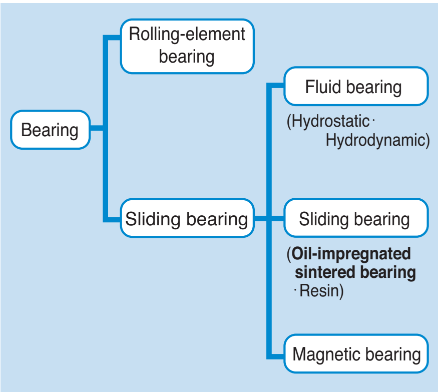


Table 1.2 Coefficient of friction

Coefficient of friction		Bearing type
Large	0.3 ～0.8	Dry metal Plastic
Medium	0.03～0.3	Boundary lubrication (**Oil-impregnated sintered bearing**)
Small	0.001～0.03	Ball bearing, Roller bearing Fluid bearing (Oil)
Very small	0.001 max.	Hydrostatic bearing Fluid bearing (Air)

1. 2 Strong points and weak points of the oil-impregnated sintered bearing

Strong points

(1) Time for lubricating work can be saved.
(2) The composites can be created which are composed of various metals and are not available from the common metal manufacturing method, or from those which are composed of metals and non-metals.
(3) Machining can be eliminated and the materials can be saved.
(4) The porous metal materials can be created.
(5) The noise level generated is lower than that generated by the ball bearing.
(6) Production cost is cheap if the production number is large, since the mass-productivity is very high.
(7) No special lubrication system is required.

Weak points

(1) Coefficient of friction is larger than that of the ball bearing, since this is a sliding bearing.
(2) It has a limit of PV value and is not suitable for high load applications, since this has the "hydraulic pressure-relief groove".
(3) Production cost is rather high, if the production number is small.
(4) Mechanical strength is lower than that made from the ingot materials.
(5) When machining is required, surface porosity becomes poor.

1. 3 Operation principle of the bearing

The oil-impregnated sintered bearing is one of the sliding bearings and requires intervention of the lubricating oil to work normally as the bearing. Although the non-porous bearing made of the ingot metal always requires the lubricating oil applied during operation when it is used, the oil-impregnated sintered bearing does not require lubricating oil, since it has pores in the bearing itself and the lubricating oil is contained inside of these pores. This lubricating oil is circulated and plays the role of lubricant in the bearing system during operation.

Conditions during halt

In the conditions during halt while the shaft is not rotating, the shaft contacts the lower part of the bore diameter of the bearing due to the self-weight of the body of rotation, and the lubricating oil is absorbed inside the pores of the bearing. When taking a look at the enlarged view of the contact area between the shaft and the bearing, the shaft rests on the surface of the bore diameter of the bearing as shown in **Fig. 1.1**. It is considered that the oil that is filled in the gap between them links with itself like the meshes of a net due to the capillary action.

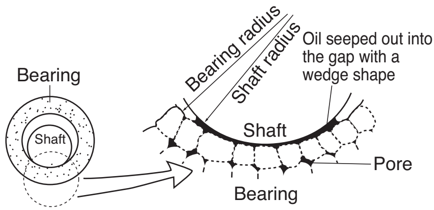


Fig. 1.1 Conditions of the oil-impregnated sintered bearing during halt

Conditions during operation

When the shaft starts rotating, the shaft starts sliding while the slight oil film is being caught in the gap between the shaft and the bearing. If the oil film is thick, contact between the metals of the shaft and the bearing does not occur. The oil film, however, generally is not so thick, and irregularities exist on both surfaces of the shaft and the bearing. Therefore, contact of both metals occurs resulting in generation of friction and frictional heat between the metals.

So far it has been considered that the temperature is raised caused by such frictional heat resulting in decreased oil viscosity contained inside of the bearing and better oil flow, and that the oil is gradually seeped out into the sliding surface of the bearing with the additional help of thermal expansion resulting in providing a lubricating effect. It has been revealed, however, that the effective mechanism called pumping action, in addition to the thermal effect, works as a mechanism which provides lubrication with the oil that is seeped out from the oil-impregnated sintered bearing. As a result, superiority of the oil-impregnated sintered bearing has been generally known. In other words, the oil inside of the bearing is sucked out due to rotation of the shaft, and the oil flows from the upper part, where the oil pressure is low, to the sliding part which is subjected to high pressure as shown in **Fig. 1.2**. The wedge of the oil generated by this oil flow lifts up the shaft from the bottom surface of the bearing and functions to prevent the contact between these two metals. In addition, since the shaft is shifted towards the rotational direction by the force of the oil flow coming in, the oil pressure distribution on the surface of the bore diameter of the bearing becomes as shown in **Fig. 1.2**.

On the other hand, the oil-impregnated sintered bearing has less load capacity compared with that of the bearing made of the ingot metal, since the oil pressure is reduced due to oil release through the pores even if the oil pressure is generated. However, helped by the existence of these pores, oil circulation by pumping action works effectively for bearing lubrication.

When the shaft stops rotating, the excessive oil on the surface of the bore diameter of the bearing is absorbed again into the pores originally in the sintered metal by the capillary force. Although the oil is actually consumed gradually due to scattering and evaporation, the oil-impregnated sintered bearing can be regarded as an economic bearing which can be used without lubrication functionally.

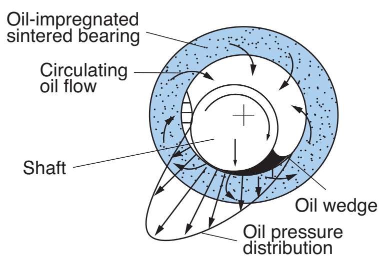


Fig. 1.2 Mechanism of pumping action

2. Features of NTN BEARPHITE

(1) **NTN BEARPHITE** Bearings incorporate a unique material comprising a metal combined with a fine powder of quality natural graphite. This material contributes to excellent bearing performance across a wide variety of applications.

The graphite skeleton is formed in the metal cavity structure of the material of the bearing incorporating a metal combined with a fine graphite powder

Photo 2.1 shows the situations where there is graphite remaining after solution of copper and tin for the **NTN** copper series spherical BEARPHITE.

(2) **NTN BEARPHITE** can have a fine communicating porous meal structure made possible by the addition of the graphite fine powder and is superior in retention capability and circulation function of the lubricating oil which are most needed for the oil-impregnated sintered bearings.

(3) Thanks to their stable lubrication function, provides a longer life and excellent bearing performance across a wide temperature range.

Copper series spherical bearing

Graphite skeleton after solution of the bearing shown in the above photo

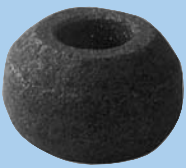
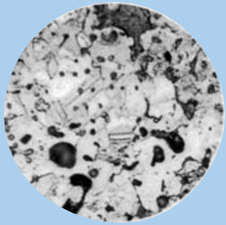
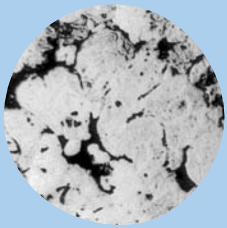


Photo 2.1

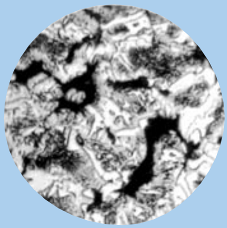
(4) Products with **NTN BEARPHITE** maintain stable quality in accuracy, density, and oil retention percentage based on the unique manufacturing technology and quality control.



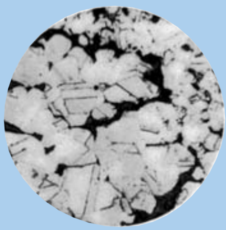
Copper series (H)



Copper-Iron series (EB)



Iron series (L)



Copper series (HD)

Photo 2.2 Photo of the metallographic structure of NTN BEARPHITE

3. Manufacturing processes for NTN BEARPHITE

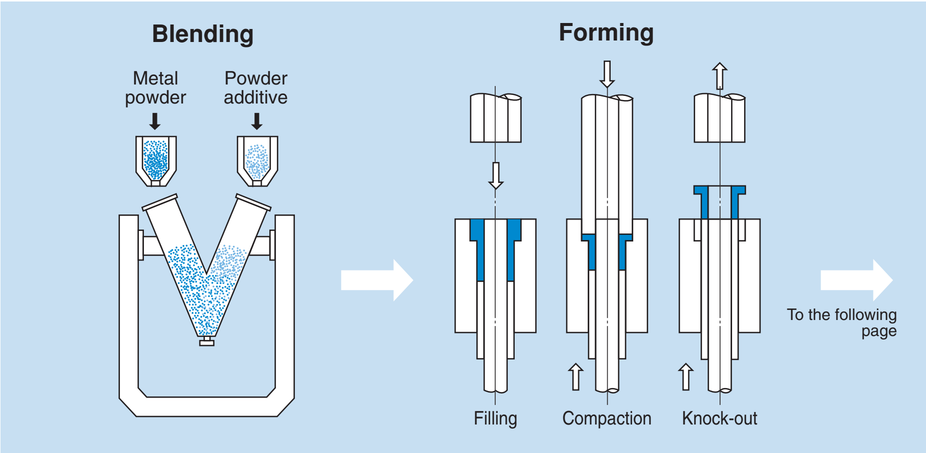
Blending of raw materials ➡ Forming

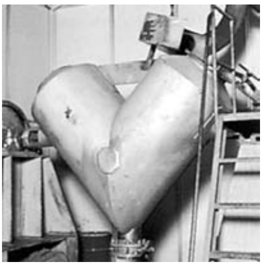
●Blending of raw materials

Raw materials are poured in the V-shape blender and are rotated to be blended to obtain the required components of the metal powder. The unique know-how of changing the blending ratio of the metal powder and the graphite depending on the type and the application required for each bearing material creates the differences in performance of our oil-impregnated bearings from that of the bearings made by other companies.

●Forming

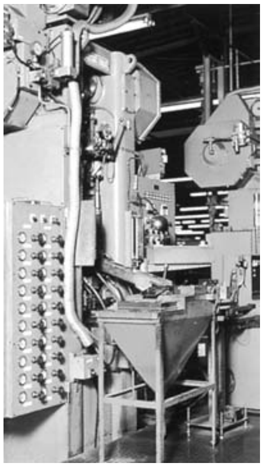
The mixed powder made by the blending of several raw material powders is filled in the die through the hopper and compacted by the forming press. During this stage the various porous green compacts of the bearings including those of the sleeve type, the flange type, and the spherical type are formed. After the forming process measurement of mass, length, and run-out accuracy is implemented.





●Blending

●Forming



●**Raw material**

Roughly three kinds of powders; copper, iron, and tin are used for the metal powder as the major raw materials of “**NTN BEARPHITE**” and graphite is added to each of these metal powders.

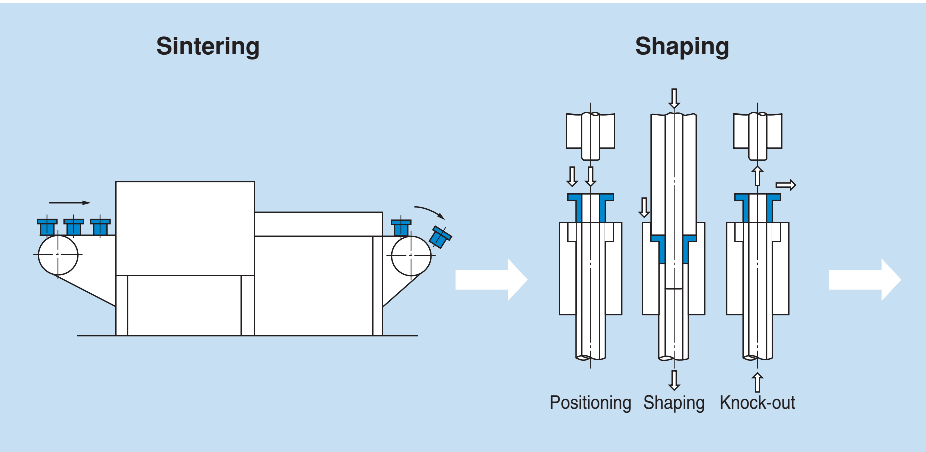
Sintering ➡ Shaping

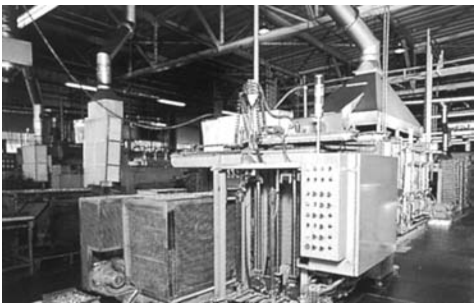
●Sintering

The sintering process is the process where the porous green compact made during the forming process is heated and fusion-bonded to obtain higher strength. The mesh-belt type continuous sintering furnace is employed to convey the green compacts automatically to each temperature zone in the reducing atmosphere without any oxidization of the surface.

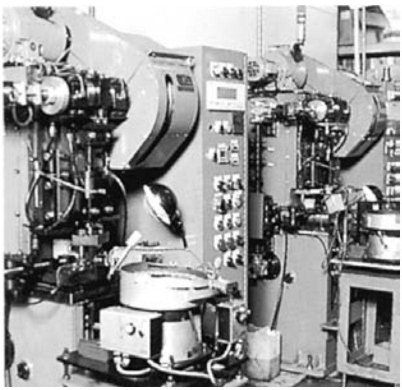
●Shaping

During the shaping press process, the inside and outside diameters are pressed with the required accuracy.





●Sintering



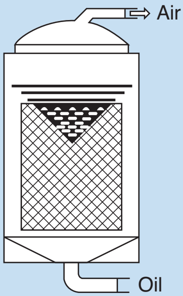
●Shaping

Oil impregnation

●Oil impregnation

The pressure inside the oil impregnation tank is reduced to the atmospheric pressure or lower so that the oil is easily impregnated into the product.
This is for impregnating the oil into the the whole clearance of the porous material by the use of the capillary phenomenon.
At this stage the completed product, "**NTN BEARPHITE**" is done.

Oil impregnation



●Oil impregnation

NTN BEARPHITE

NTN BEARPHITE was created thorough the pursuit of high quality and saving manpower.

●Research and development

●Automatic line

The state-of-the-art automatic system is employed integrating the processes from forming to sintering, shaping, and inspection into one line.

●Inspection

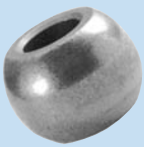
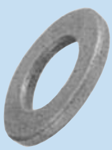
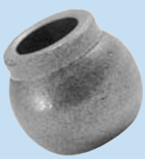
Dimensional accuracy check is implemented.

●Managing system

4. Design for NTN BEARPHITE

4. 1 Shape and typical applications

Table 4.1 Types and typical applications of NTN BEARPHITE

Type	Shape	Function	Typical Applications
Sleeve type		(1) Supports radial loads.	Household appliances Audiovisual equipment Automotive electrical equipment Office equipment Agricultural machinery
Flange type		(1) Supports both radial and axial loads (2) Flange area simplifies locating.	Automotive electrical equipment Office equipment
Spherical Type		(1) Supports radial loads. (2) Designed to be self-aligning.	Household appliances Audiovisual equipment Automotive electrical equipment
Thrust Washer Type		(1) Supports axial loads.	Household appliances Audiovisual equipment
Special Type		(1) Supports both radial and one-directional axial loads. (2) Designed to be self-aligning. (3) Extension of the bearing length is possible.	General machinery

4. 2 Material characteristics of the oil-impregnated sintered bearing

Table 4.2 Material characteristics of NTN BEARPHITE

Series	Material Code	Chemical Components						Density g/cm³ (±0.2)	Oil Retention Percentage vol. % (min.)	Radial Crushing Strength MPa (min.)	Features
		Cu	Sn	C	Fe	Ni	Others				
Copper Series	H	Residual amount	8 ~ 11	1 ~ 2	—	—	—	6.6	18	150	Standard copper series material
Copper Series	HQ	Residual amount	8 ~ 11	—	—	—	—	6.6	18	150	Suitable for sliding motion
Copper Series	HR	Residual amount	8 ~ 11	3 ~ 4	—	—	—	6.6	12	120	Superior in seizure resistance
Copper Series	HZ16	Residual amount	8 ~ 11	0.5 ~ 1.5	8 ~ 12	—	0.2 ~ 0.6 (P)	6.9 7.2	15	200	Superior in wear resistance and ease of caulking
Copper Series Alternative	CL01	15 ~ 22	0.5 ~ 2.5	0.5 ~ 2.5	Residual amount	—	1 max.	6.4	17	150	Sliding performance equivalent to that of copper H series
Copper Series Alternative	CL02	28 ~ 35	0.5 ~ 2.5	0.1 ~ 2.2	Residual amount	—	1 max.	6.4	18	150	Excellent ease of caulking
Copper-Iron Series	EE	33 ~ 38	3 ~ 6	1 ~ 2	Residual amount	—	3 max.	6.2	18	150	Used as a substitute for copper H series
Copper-Iron Series	EB	18 ~ 22	0.5 ~ 2.5	0.5 ~ 2.5	Residual amount	—	1 max.	6.2	18	150	Used as a substitute for copper-iron EC series
Copper-Iron Series	EC	38 ~ 42	1 ~ 3	0.5 ~ 2.5	Residual amount	—	1 max.	6.4	18	150	Offers acoustic characteristics superior to those of the EB series
Copper-Iron Series	EZ06	Residual amount	1 ~ 3	0.5 ~ 2.5	38 ~ 42	—	1 max.	6.5 6.9	18 12	150	Superior in wear resistance
Iron Series	P	8 ~ 11	—	—	Residual amount	—	3 max.	6.1	18	200	Used as a high-strength material for general-purpose applications
Iron Series	F	—	—	—	Residual amount	—	3 max.	5.9	20	180	Standard iron-series material
Iron Series	LB	1 ~ 3	—	2 ~ 4	Residual amount	—	1 max.	6.0	15	180	Offers excellent high-speed operation and wear resistance
Iron Series	S06	—	15 ~ 20 (Cr)	1 ~ 3 (MnS)	Residual amount	10 ~ 15	0.5 ~ 1.0 (Si)	6.5 ~ 7.0	8	—	Excellent corrosion resistance (equivalent to SUS 304)

4. 3 Bearing selection

4. 3. 1 Allowable *PV* value and speed

Study allowable *PV* values calculated by the contact pressure *P* (MPa) and circumferential speed (m/min) before using the oil-impregnated sintered bearing.

Table 4.3 Generally recommended allowable *PV* values (MPa·m/min)

Application	Allowable *PV* values
General-purpose machinery	100
Household appliances	50
Office electric appliances	50
Low noise and low wear applications	25
Especially low noise applications	20
Axial loaded applications	20

【Calculation method】

(1) Calculation method of the contact pressure *P*

P (MPa) = Radial load (N) / {Bore diameter (mm) × Length (mm)}

(2) Calculation method of the circumferential speed *V*

V (m/min) = Shaft diameter (mm) × π (Circular constant) × Number of revolutions (min^{-1}) × 10^{-3}

(3) Calculation method of the *PV* value

PV value (MPa·m/min) = *P* (MPa) × *V* (m/min)

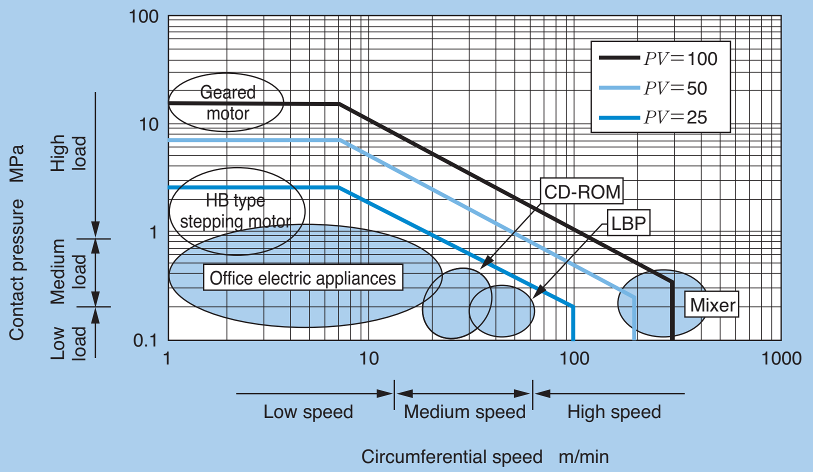


Fig. 4.1 Relationship between contact pressure and circumferential speed

4. 3. 2 Selection of lubricating oil

The type of the lubricating oil impregnated into the bearing shall be selected based on the bearing load, the sliding speed, and the bearing temperature. **Table 4.4** shows the guideline for determining the lubricating oil viscosity for a given application.

For the standard bearing operating temperature range (0 to 80˚C), mineral-based lubricating oil can be used. In addition, if the operating temperature range is expected to be higher or lower than this range or to be the whole range between higher and lower temperature, synthetic-based lubricating oil suitable for the application temperature shall be selected.

Table 4.4 Operating conditions and the type of the lubricating oil

Operating conditions		Lubricating oil viscosity	Oil type (reference)
Load MPa	Speed m/min		
~0.3	15~ 80	ISO VG 22~ 68	Spindle oil, turbine oil
	60~250	ISO VG 10~ 32	Spindle oil
0.2~0.8	~20	ISO VG 46~100	Gasoline engine oil
	15~ 80	ISO VG 32~ 68	Turbine oil
0.7~2.5	~ 20	ISO VG 100~220	Gear oil

4. 3. 3 Bearing life

The life of the oil-impregnated sintered bearing is determined by the rate of consumption of the lubricating oil impregnated into the bearing. Once 40% of the impregnated oil has been consumed, bearing wear begins to accelerate and bearing performance deteriorates accordingly. Therefore, once the residual lubricating oil drops to 60%, the bearing is generally regarded as having reached the end of its service life.

In addition, the lubricating oil is adversely affected by high temperature, and the maximum allowable temperature is generally considered to be 80˚C.

The bearing life based on the bearing temperature is shown in **Fig. 4.2**.

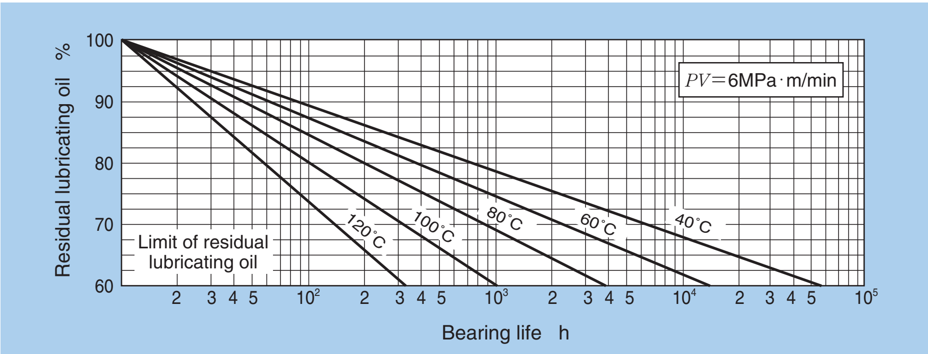


Fig. 4.2 Typical bearing life at varying temperature levels

4. 3. 4 Bearing accuracy

The accuracy of the following three types of general oil-impregnated sintered bearings is shown in **Table 4.5**; sleeve type, flange type, and spherical type.

The accuracy of the **NTN BEARPHITE** conforms to the values shown in this table. In addition, a bearing with higher accuracy than is defined in this standard can be manufactured and the dimensional tolerance of the part of those high-accuracy bearings is shown in **Fig. 4.3**.

In addition, a wide line-up of **NTN BEARPHITE** products are available in various sizes. See 11. Dimension table of the standard product of this handbook for details. Consult with **NTN** for information, as the dimension tolerance settings are different depending on the products. Inquire **NTN** for products not listed in the dimension table as we may be able to address your requirements.

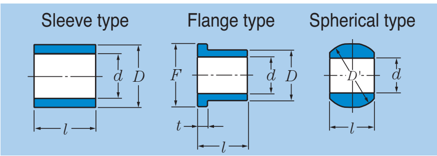


Table 4.5 Accuracy of the general oil-impregnated sintered bearing

Table 4.5 (1) Tolerance of the bore diameter d

Unit : mm

Bore diameter		Tolerance of the bore diameter
Over	Max.	
—	3	H7 $^{+0.010}_{0}$
3	6	H7 $^{+0.012}_{0}$
6	10	H7 $^{+0.015}_{0}$
10	18	H7 $^{+0.018}_{0}$
18	24	H7 $^{+0.021}_{0}$
24	30	H8 $^{+0.033}_{0}$
30	50	H8 $^{+0.039}_{0}$

Table 4.5 (2) Tolerance of the outside diameter D

Unit : mm

Outside diameter		Tolerance of the outside diameter
Over	Max.	
—	6	s7 $^{+0.031}_{+0.019}$
6	10	s7 $^{+0.038}_{+0.023}$
10	18	s7 $^{+0.046}_{+0.028}$
18	24	s7 $^{+0.056}_{+0.035}$
24	30	t7 $^{+0.062}_{+0.041}$
30	40	t7 $^{+0.073}_{+0.048}$
40	50	t7 $^{+0.079}_{+0.054}$
50	65	t7 $^{+0.096}_{+0.066}$

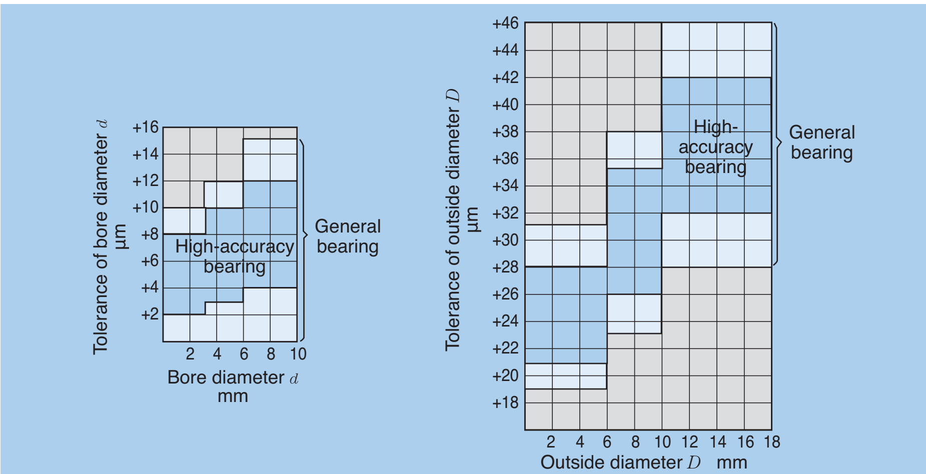


Fig. 4.3 Dimensional tolerance of NTN BEARPHITE

Table 4.5 (3) Tolerance of length l

Unit : mm

Length		Tolerance of length
Over	Max.	
—	6	±0.10
6	24	±0.15
24	65	±0.20

Table 4.5 (4) Tolerance of flange outside diameter F

Unit : mm

Flange outside diameter	Tolerance of outside diameter
Max.	
100	±0.10

Table 4.5 (5) Tolerance of flange thickness t

Unit : mm

Flange thickness	Tolerance of flange thickness
Max.	
10	±0.20

Table 4.5 (6) Tolerance of the spherical diameter D'

Unit : mm

Spherical diameter		Tolerance of spherical diameter
Over	Max.	
—	10	±0.06
10	18	±0.08
18	30	±0.10

Table 4.5 (7) Run-out of the outside diameter surface

Unit : mm

Bore diameter		Run out of the outside diameter surface (max.)
Over	Max.	
—	6	0.040
6	10	0.050
10	24	0.070
24	50	0.100

Table 4.5 (8) Run-out of the spherical surface

Unit : mm

Bore diameter		Run-out of the spherical surface (max.)
Over	Max.	
—	10	0.050
10	18	0.070

4. 3. 5 Shaft specifications

▪ Material component

The material component of the mating shaft is generally carbon steel for machine structural use or alloy steel, or stainless steel for special applications.

▪ Hardness

The minimum allowable shaft hardness may be generally HV300 or over, and higher hardness can provide improved performance.

▪ Surface roughness

Surface roughness is generally recommended to be 0.4Ra or better. Especially for operating conditions with stricter sound requirements, a finish of 0.2Ra or better is required.

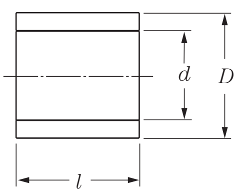
4. 4 Check items for operating conditions

Equipment name					Using location				
Dimension					Number of bearings	Pieces/month			·Continuous ·Intermittent
Shaft	mm	Material	Hardness	Roughness	Load	kN	Static	Dynamic	Impact
Housing	mm	Material	Thickness mm		Number of revolutions	min^{-1}	Vibration	Swing	Reciprocation
Mounted clearance	mm				Operating time	Hour/day			·Continuous ·Intermittent
Operating temperature	Regular use °C		Highest Lowest °C		Environmental conditions	Temperature	·High		·Low
						Dust	·Large amount		·Small amount
						Pressure	·High		·Low
						Under the water			
Type of lubricating oil					Lubrication	Oil groove	·Yes		·No
						Lubrication	·Available		·Unavailable
Noise requirement	Normal		Strict		Desired life span				Hour
Accepting inspection method									
Other items desired									

Entry blank for the bearing dimension and tolerance

Unit : mm

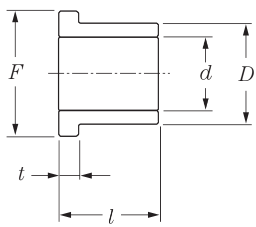
Sleeve type



Example of dimensioning

$S \quad d \times D \times l$

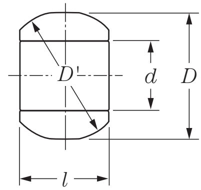
Flange type



Example of dimensioning

$F \quad d \times D \times l : F \times t$

Spherical type



Example of dimensioning

$A \quad d \times D \times l : D'$

4. 5 Bearing design

The sleeve type and flange type bearings are usually interference fit in the housing. In order to ensure optimal mounted clearance, the amount of shrinkage of the bearing bore diameter due to the interference fit shall be examined based on the tolerance of the housing bore diameter and the bearing outside diameter.

4. 5. 1 Fitting

When pressing the bearing into the housing, the interference is recommended to be as small as possible as long as the bearing can be securely mounted.

The appropriate interference is shown in **Fig. 4.4.**

• Large interference is required when

(1) the bearing load is large.

(2) the bearing length is short.

(3) thermal expansion coefficient of the housing material is large.

• Small interference is required when

(1) the bearing length is long.

(2) the bearing wall thickness is thin.

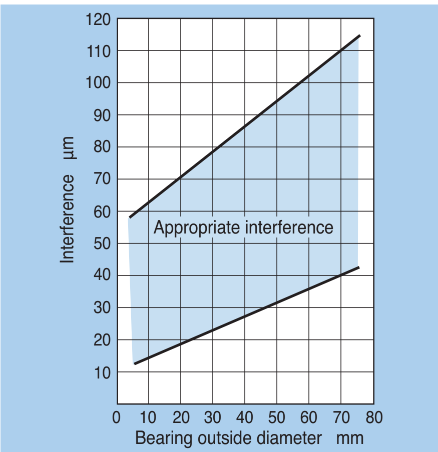


Fig. 4.4 Appropriate interference

Generally, the shrinkage of the bearing bore diameter due to press fitting becomes large when the bearing outside diameter is large, the wall thickness is thin, the interference is large, or the housing rigidity is high.

The bore diameter shrinkage percentage to the interference of the copper series bearing is shown in **Fig. 4.5**.

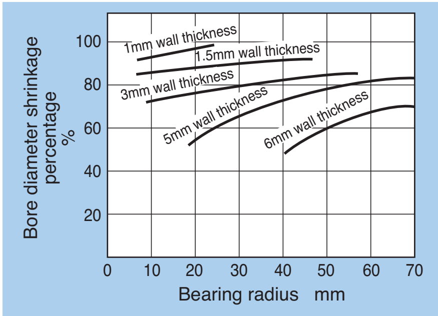


Fig. 4.5 Bore diameter shrinkage percentage to the interference of the copper series bearing

4. 5. 2 Study on fitting

(a) Fitting contact pressure P

$$P=\frac{E_1 \cdot E_2}{E_2\,(Q_1+\tau_1)+E_1\,(Q_2-\tau_2)}\times\frac{\Delta_{deff}}{d_2}$$

$$Q_1=\frac{d_1{}^2+d_2{}^2}{d_1{}^2-d_2{}^2}\qquad Q_2=\frac{d_2{}^2+d_3{}^2}{d_2{}^2-d_3{}^2}$$

(b) Shrinkage percentage of the bearing bore diameter λ_0

$$\lambda_0=\frac{E_1\,(Q_2+1)}{E_2\,(Q_1+\tau_1)+E_1\,(Q_2-\tau_2)}\times\frac{d_3}{d_2}$$

τ_1, τ_2	: Poisson's ratio of the materials of the housing and the bearing
E_1, E_2	: Young's modulus of materials of the housing and the bearing
Δ_{deff}	: Press-fitting interference
d_1	: Outside diameter of the housing (mm)
d_2	: Bearing outside diameter (mm)
d_3	: Bearing bore diameter (mm)

Material code		Young's modulus MPa	Poisson's ratio
Bearing	H	47000	0.2
	HB	56000	0.2
	HR	40000	0.2
	HQ	54000	0.2
	HD	43000	0.2
	EE	59000	0.2
	EC	59000	0.2
	EB	65000	0.2
	P	91000	0.2
	F	79000	0.2
	L	83000	0.2
Housing	Brass	103000	0.3
	Mild Steel	206000	0.3
	ADC	77000	0.3
	ZDC	94000	0.3

【Calculation Example】

In the case where the bearing dimension is equal to S6×12×8 (material of H) and the material of the housing is mild steel,

$$Q_1 = \frac{{d_1}^2 + {d_2}^2}{{d_1}^2 - {d_2}^2} = \frac{15^2 + 12^2}{15^2 - 12^2} = 4.56$$

$$Q_2 = \frac{{d_2}^2 + {d_3}^2}{{d_2}^2 - {d_3}^2} = \frac{12^2 + 6^2}{12^2 - 6^2} = 1.67$$

$${}_0 = \frac{E_1 (Q_2 + 1)}{E_2 (Q_1 + \tau_1) + E_1 (Q_2 - \tau_2)} \times \frac{d_3}{d_2}$$

$$= \frac{206000(1.67+1)}{47000(4.56+0.3)+206000(1.67-0.2)} \times \frac{6}{12}$$

$$= 0.52$$

As the result of these calculations, the shrinkage percentage of the bearing bore diameter after press-fitting is 52% of the press-fitting interference.

When the press-fitting interference is designed to be 10 to 46 μm, the amount of shrinkage of the bearing bore diameter is 5 to 24 μm. The tolerance of the bearing dimension is designed to be as shown below, based on the study on the mounted clearance in the previous section and the calculation result of the fitting.

Bearing bore diameter : $\phi 6^{+0.012}_{0}$

Bearing outside diameter : $\phi 12^{+0.022}_{+0.010}$

4. 5. 3 Mounted clearance

The mounted clearance of the bearing is determined by *PV* value, viscosity of the lubricating oil, the distance between bearings, and the bearing length.

● **Larger clearance is required when**

(1) *PV* value is large.
(2) the load is heavy and the viscosity of the lubricating oil is high.
(3) the shaft deflection occurs due to the long distance between bearings.
(4) multiple bearings are used on one shaft.
(5) the bearing length is long.

● **Smaller clearance is required when**

(1) higher running accuracy is required.
(2) noise and vibration are concerned.

The recommended standard mounted clearance for **NTN BEARPHITE** is shown in **Fig. 4.6**.

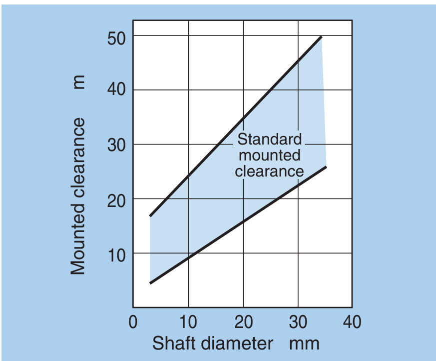


Fig. 4.6 Standard mounted clearance

4. 6 Mounting of the bearing

4. 6. 1 Mounting of the sleeve type bearing and the flange type bearing

Generally there are two mounting methods for the sleeve type bearing and the flange type bearing; press-fitting with no tool and press-fitting with a press-fitting arbor.

● In case of press-fitting with no tool

Press-fitting with no tool is the mounting method of the bearing without using a press-fitting arbor (**Fig. 4.7**).

With this method, the bearing bore diameter is shrunk depending on the interference between the bearing and the housing and on the bearing material.

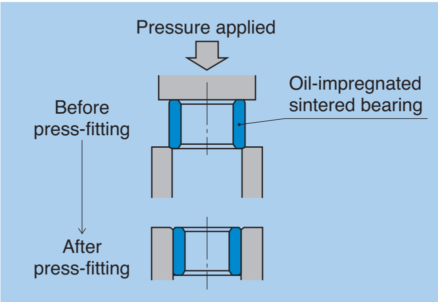


Fig. 4.7 Press-fitting with no tool

● In case of press-fitting with a press-fitting arbor

Press-fitting with a press-fitting arbor is the mounting method of the bearing to the housing with a press-fitting arbor inserted in the bearing (**Fig. 4.8**).

With this method, stable accuracy of the bearing bore diameter can be obtained and the porous metallographic structure is not damaged.

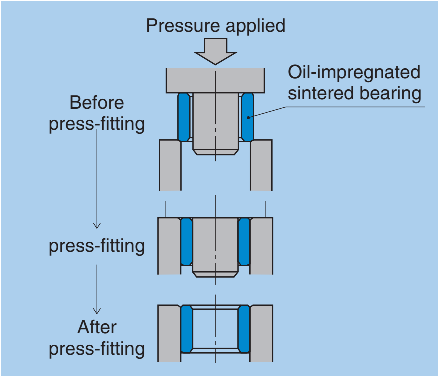


Fig. 4.8 Press-fitting with a press-fitting arbor

4. 6. 2 Mounting of the spherical type bearing

The spherical type bearing uses a different mounting method from that for the sleeve type bearing and the flange type bearing, and is mounted generally in the housing with the spring retainer as shown in **Fig. 4.9**.

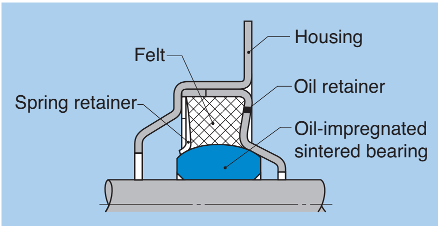


Fig. 4.9

In this case, attention shall be paid to the following.

(1) Spring pressure of the spring retainer shall not be too high.
(2) The housing shall be designed so that any oil leakage can be prevented and the oil retainer shall be installed.
(3) Use felt with high retaining capability of the lubricating oil.
(4) The lubricating oil shall be fully impregnated in the felt before using it.

4

4. 7 Care and handling of bearings

4. 7. 1 Precautions for mounting bearings

When mounting the bearing, attention shall be paid to the following.

(1) Work at a clean workshop.
(2) Use mounting tools with hard and solid ones.
(3) Make sure that there is no dent, burr, or dust on the fitting surfaces of the shaft and the housing.
(4) Do not use a hammer to mount the bearing into the housing.

4. 7. 2 Maintenance

The following points shall be taken into consideration for maintenance of the bearing.

(1) Re-lubrication is recommended for continuous operation. Although the lubrication interval may vary depending on the operating conditions, lubrication shall be performed about every 500 to 1000 operating hours as a guideline.
(2) When impregnating the lubricating oil, immerse the bearing in the oil bath which is heated to about 60˚C, and keep it warm uniformly for 1 to 2 hours. When no bubbles are released in the oil bath, cool down the oil bath with the bearing inside or immerse the bearing in the cool oil.

4. 7. 3 Storage

The following points shall be taken into consideration for storage of the bearing.

(1) Store the bearing at a location with low humidity.
(2) Store the bearing in a cool area since the lubricating oil impregnated into the bearing deteriorates if the temperature of the bearing exceeds 70˚C.
(3) Keep the bearings away from objects that absorb the lubricating oil such as paper or wood.

One point advice
Bits of knowledge for the oil-impregnated bearing

Terms for powder metallurgy

Terms and Definition

Powder metallurgy
Technology concerning manufacturing metal powder and manufacturing parts and products based on forming and sintering of the metal powder

Powder
The aggregate of particles of 1mm maximum or smaller in size

Forming
To provide a given shape and dimensions to the powder by compacting the powder

Sintering
To bond the particles together of the powder or the green compact by heating

Sintered Product
Products made from the sintered material

5. Technical data

5. 1 Effect of the mating shaft to wear

Sample and test conditions

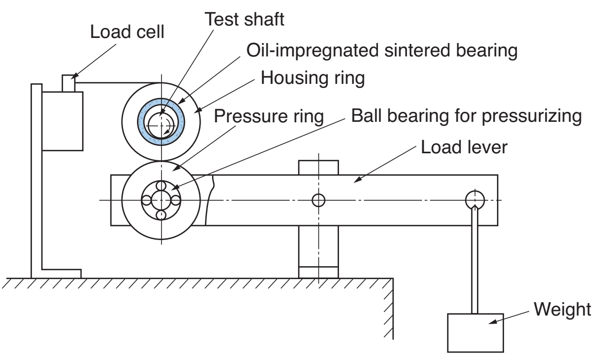
Bearing : S6×12×8
Material : H
Impregnating oil : ISO VG68 (Mineral oil)
Density : 6.6g/cm^3
Oil retention percentage : 20Vol. %
Radial crushing strength : 150MPa
Clearance : 14～16 μm
Contact pressure : 0.94MPa

Circumferential speed : 34m/min
PV value : 32MPa · m/min
Atmosphere :
Normal temperature and normal humidity (25±2˚C)
Operating hour : 620h
Shaft material : SKS-3, SUS303
Shaft surface roughness : 0.1～0.5Ra

Table 5.1 Test result

No.	Mating shaft			Rate of oil consumption %	Amount of wear of the bearing µm
	Material	Hardness HRC	Surface roughness Ra		
1	SKS-3	12.0	0.30	4.1	4.0
2	↑	32.0	0.25	2.8	4.0
3	↑	42.5	0.25	4.3	3.0
4	↑	12.0	0.15	3.0	1.5
5	↑	32.0	0.15	4.0	2.0
6	↑	42.5	0.10	5.4	2.0
7	SUS303	3.6	0.50	21.2	6.0
8	↑	3.6	0.15	6.3	3.5

【Testing machine】 The A-type testing machine is used.



【A-type testing machine】

5. 2 Relationships of *PV* value to temperature rise and coefficient of friction depending on the different materials

Sample

Bearing size	: S6×12×8
Lubricating oil	: ISO VG68
Bearing material	: ①H ②EB ③P
Shaft material	: SUJ2
Shaft hardness	: HRC60
Shaft finish roughness	: 0.2 μmRa

Test conditions

Test No.	Contact pressure (MPa)	Circumferential speed (m/min)	*PV* value (MPa・m/min)
Test 1	0.25～2.0	74 (constant)	18.5～148
Test 2	0.25～2.0	38 (constant)	9.5～ 76

Operating hour : 2h
Mounted clearance : 10～14μm
Room temperature : 25±2˚C

Test result

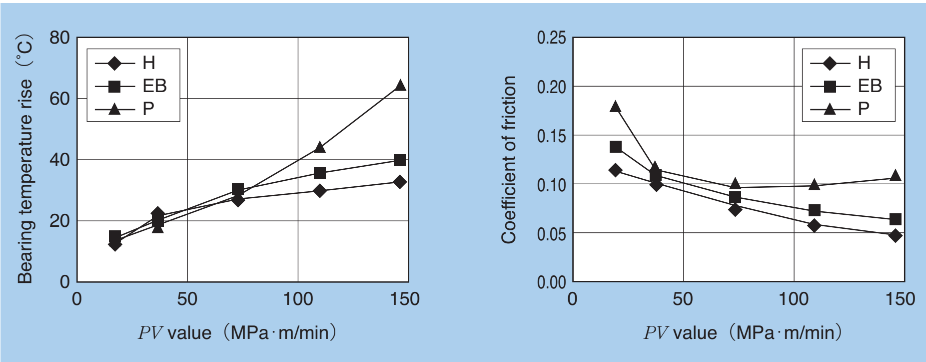


Fig. 5.1 Test 1

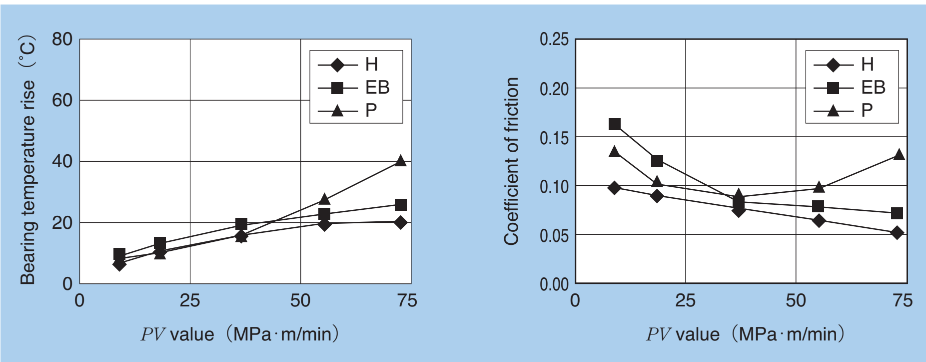


Fig. 5.2 Test 2

【Testing machine】 The A-type testing machine was used.

5. 3 Relationships of the mounted clearance to temperature rise and coefficient of friction depending on the different lubricating oil

Sample

Bearing size	：S6×12×8
Bearing material	：H (Copper series)
Lubricating oil	：① ISO VG32 ② ISO VG68 ③ ISO VG100
Shaft material	：SUJ2
Shaft hardness	：HRC60
Shaft finish roughness	：0.2 μmRa

Test conditions

Test No.	Contact pressure (MPa)	Circumferential speed (m／min)	*PV* value (MPa・m／min)
Test 1	0.25	34	8.5
Test 2	1.0	34	34

Operating hour ：2h
Room temperature ：25±2°C

Test result

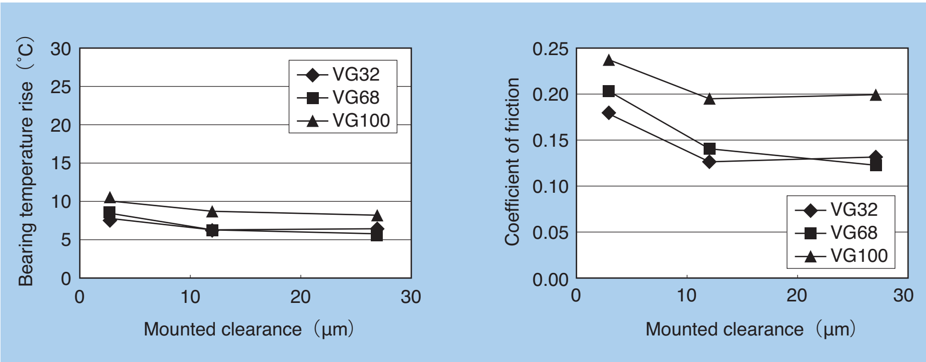


Fig. 5.3 Test 1

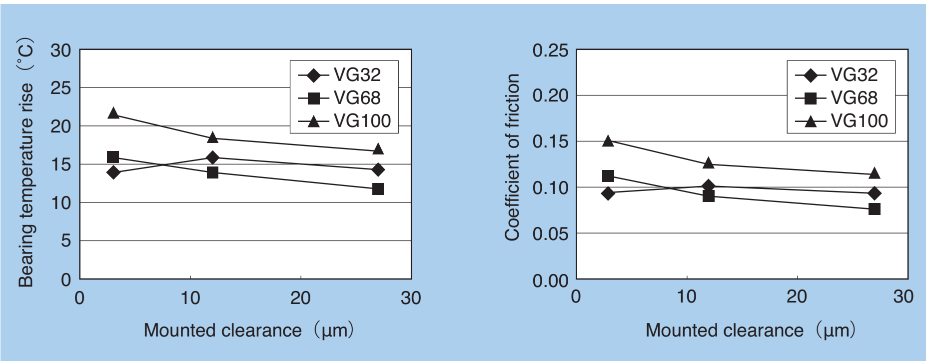


Fig. 5.4 Test 2

【Testing machine】 The A-type testing machine was used.

5. 4 Friction characteristics when the bearing is sliding

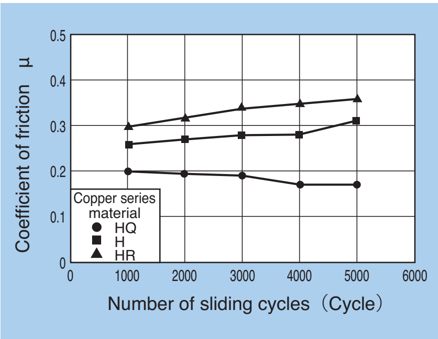
Sample

Bearing size	: S6×10×5
Bearing material	: H, HQ, HR
Lubricating oil	: ISO VG68
Shaft material	: SUS 420J2
Shaft surface roughness	: 0.2Ra
Shaft hardness	: HV580

Test conditions

Contact pressure	: 0.07MPa
Sliding speed	: 5.8m/min
Stroke	: 160mm
Mounted clearance	: 10～14μm
Room temperature	: 25±2˚C

Test result



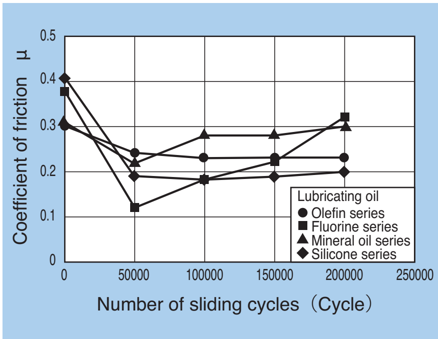
Sample

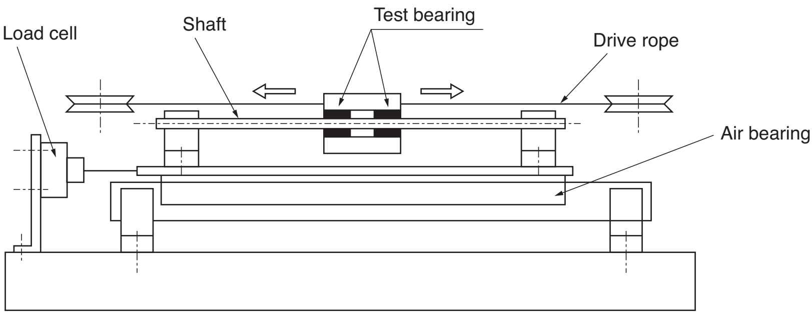
Bearing size	: S6×10×5
Bearing material	: H
Shaft material	: SUS 420J2
Shaft surface roughness	: 0.2Ra
Shaft hardness	: HV580

Test conditions

Contact pressure	: 0.08MPa
Sliding speed	: 5.4m/min
Stroke	: 160mm
Mounted clearance	: 10～14μm
Room temperature	: 25±2˚C

Test result





【Testing machine】

5. 5 Oil resistance test of the resin

Table 5.2 Result of the oil resistance test of the resin (80˚C×72h)

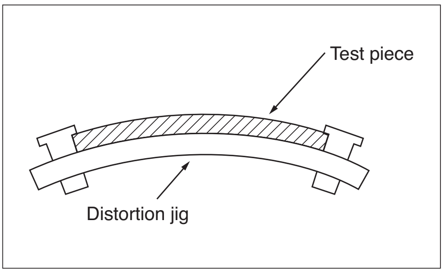
No.	Name of Resin	Mineral oil	Synthetic hydrocarbon	Ester series	Alkyldiphenyl ether	Liquid grease	
		Tellus 68	Floil 947P	Alltime J652	Moresco BS-100	AL-1	EU-1
1	Polyphenylene ether (PPE)	○	△	△	△	△	○
2	Polyphenylene sulfide (PPS)	○	○	○	○	○	○
3	Polycarbonate (PC)	○	○	× 1)	○	× 2)	○
4	Polyetherimide (PEI)	◎	◎	◎	◎	◎	◎
5	Polybutylene terephthalate (PBT)	○	○	○	○	○	○
6	Polyamide (PA)	○	○	○	○	○	◎
7	Polyoxy methylene (POM) (=Polyacetal)	○	○	○	○	○	○
8	Acrylonitrile-Butadiene-Styrene copolymer (ABS)	△	△	△	△	△	△
9	Polyethylene terephthalate (PET)	○	○	○	○	○	○
10	Polyarylate	○	◎	× 1)	◎	○	◎

Note) ◎ : Deformation ratio up to 40% ○ : Deformation ratio 41 to 70%
△ : Deformation ratio 71% or greater × : Rupture occurs

1) : After 24h, Rupture

2) : After 72h, Cracks at several locations

【Testing apparatus】



5.6 Evaporative test of the lubricants

Measurement method of the evaporation amount

A similar test method to the one for the grease evaporation amount of JIS-K2220 (A-method) was used for the test. Weigh precisely 20g of the test sample and place it in a 100cc beaker and hold the beaker in a thermostatic bath with the temperature of 80˚C, 100˚C, and 120˚C respectively. Take out the beaker from the thermostatic bath at every specified interval and cool it down before weighing to calculate the evaporation loss.

Table 5.3 Evaporation test result of the lubricants

No.	Brand	Component 1)	Kinematic viscosity mm^2/s		Evaporation amount g (after 2000h)		
			40˚C	100˚C	80˚C	100˚C	120˚C
1	Shell Tellus 68	Mineral oil	68.0	8.9	0.108	0.24	1.34
2	Diamond Power Fluid 10	Mineral oil	9.8	2.7	6.81	11.1	14.5
3	Shell Tellus T37	Mineral oil	37.2	7.14	0.30	1.17	3.8
4	Mobil DTE-EH	Mineral oil	143.6	14.58	0.111	0.135	0.29
5	Anderol 456	DE	33.0	7.5	0.20	1.49	4.0
6	Anderol 465	DE	58.0	11.3	0.170	0.33	1.13
7	Floil 947P	PAO	30.4	7.45	0.25	0.51	1.09
8	Mobil EJ44/13AAC	PAO	60.5	11.1	0.24	0.41	0.98
9	Moresco Hi-Lube BS100	ADPE	95.3	12.5	0.016	0.015	0.062
10	IVY Atlas 32	PAO+PE	32.7	6.34	0.090	0.131	0.57
11	IVY Atlas56	PAO+PE	57.2	9.84	0.076	0.185	0.42
12	AL-1	PAO+PE+Li.st	—	—	0.101	0.091	0.54
13	Alltime J652	PE	63.9	12.5	—	—	0.46
14	EU-1	ADPE+PAO+Urea	—	—	—	—	0.62

Note 1) PAO: Poly-alpha-olefin (Synthetic hydrocarbon) PE: Polyolester
ADPE: Alkyldiphenyl ether DE: Diester

6. Examples of product application

NTN boasts a long experience in the field of the oil-impregnated sintered bearings and has been creating various kinds of product groups making full use of our unique technologies. "**NTN BEARPHITE**", which has gained a favorable reputation with reliable quality realizing 100% function even under severe environmental conditions, has rapidly expanded the scope of its application field by providing cost performance with quick response to user needs of miniaturization, weight reduction, and enhancement of high precision. In addition, the demands for the unit products, which can realize streamlining of the customer's assembling process and cost reduction, have been increasing from various fields. Moreover, we are energetically striving for unique product development responding to the needs of long life products with a high quality level including special grease, and hydrodynamic **BEARPHITE** which are superior in the rotational accuracy during high speed rotation.

For automotive electrical equipment

We are developing unique bearing material and lubricating oil for **NTN BEARPHITE** to respond to requirements for durability at an elevated temperature for the oil-impregnated sintered bearing for automotive electrical equipment.

We are developing materials to respond to requirements for excellent wear resistance with high strength for sintered machine parts.

For office equipment and information equipment

We are developing materials superior in sliding characteristics and lubricating oil friendly to resin for the bearing for office equipment and information equipment, and responding to the requirements.

We developed the world's first fluid dynamic bearing "**Hydrodynamic BEARPHITE**" with **NTN** unique technologies, and they are now employed in the polygon scanner motor which requires high rotational accuracy and in the cooling fan motor which requires a severe less noise requirement.

For household appliance

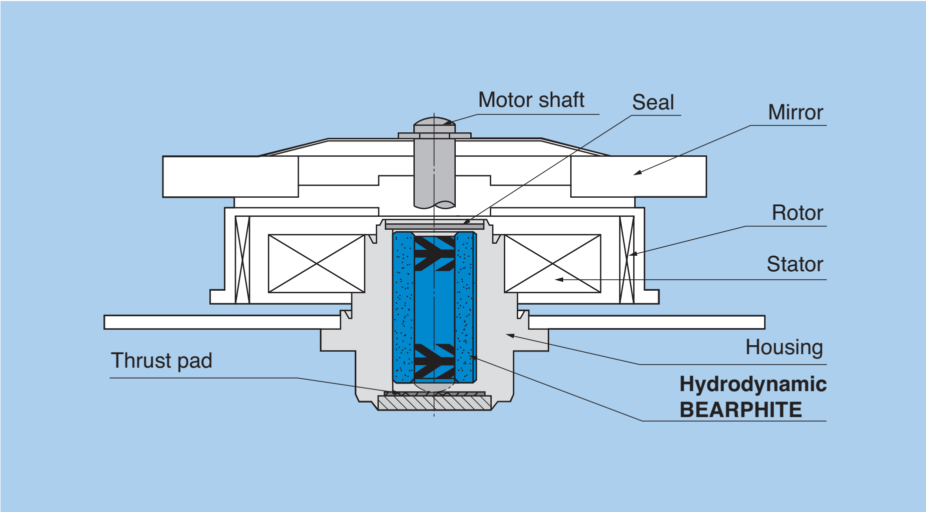
We are responding to requirements for the bearing of household appliances with the bearing having low-noise characteristics and superior durability.

These bearings are playing active roles in applications of the air conditioner, the laundry machine, the ventilating fan, the mixer, etc.

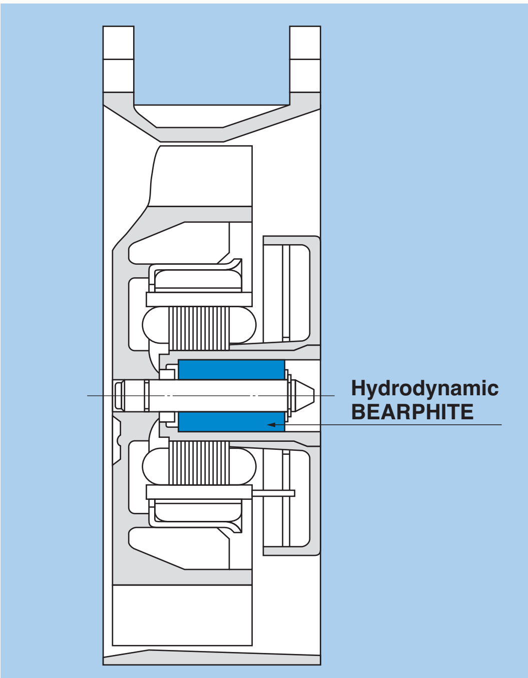
Mini pillow unit

The "**NTN BEARPHITE**" mini pillow unit has a self-aligning property and is made by a combination of the spherical bearing and steel plate housing. Being a light and compact bearing unit, it has the characteristics of easy mounting and long life with no lubrication and is widely used for general industrial machineries.

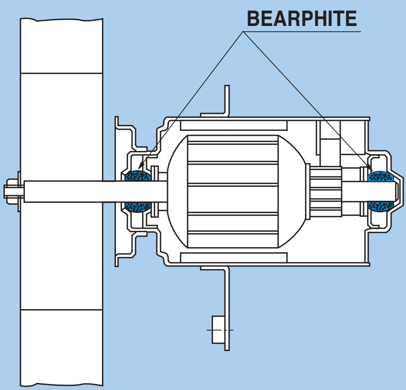
7. Examples of use by application



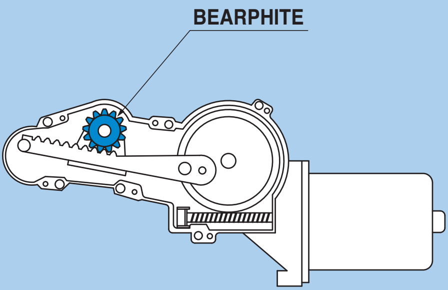
Application example to the LBP motor



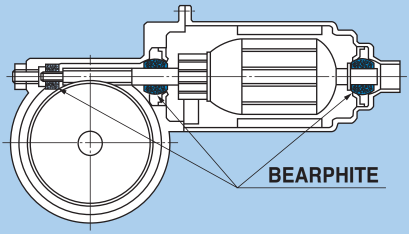
Application example to the axial flow fan



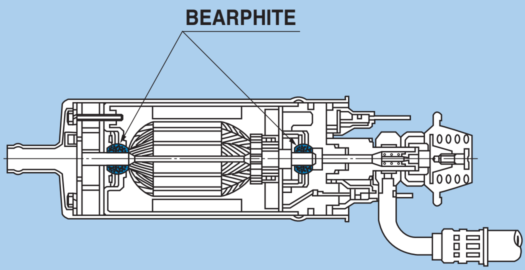
●Electric fan motor



●Wiper motor

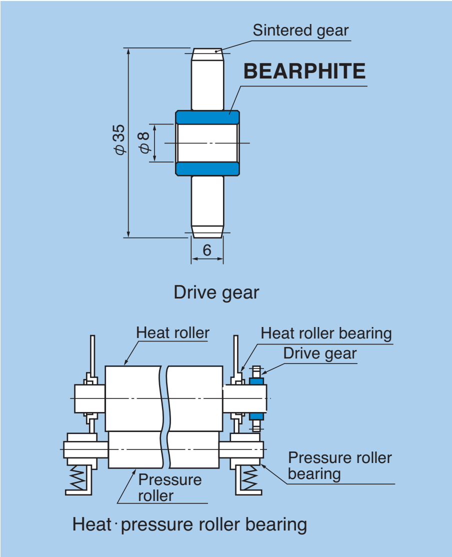


●Power window motor

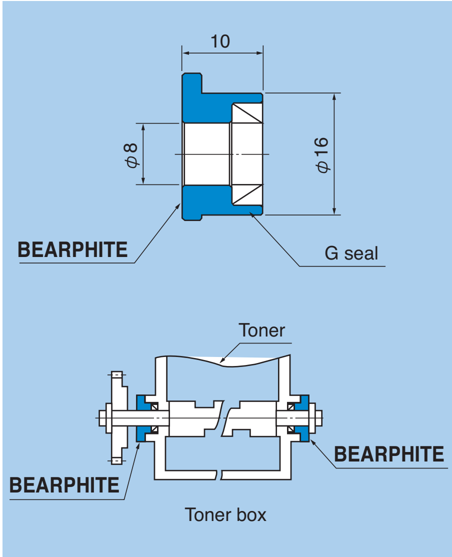


●Fuel pump motor

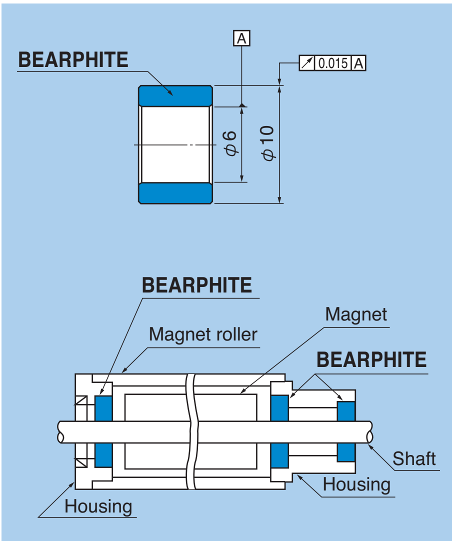
Automotive electrical equipment　Electric fan motor/ Wiper motor/ Fuel pump motor/ Power window motor



Fixing part: Drive gear and BEARPHITE

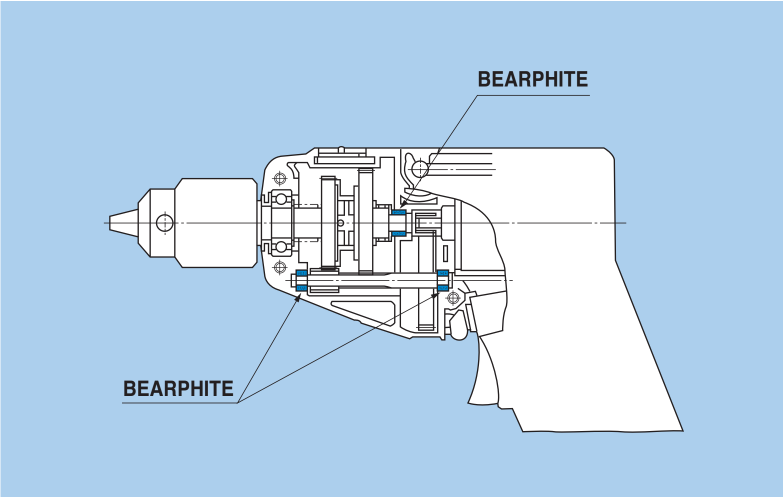


Developing part: BEARPHITE for stirring the tonner

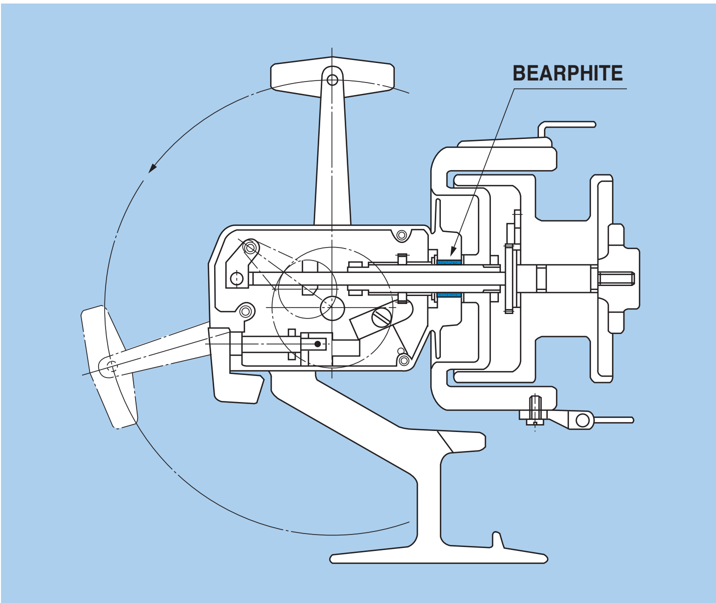


Developing part: BEARPHITE for the magnet roller

Application example for the copy machine



Electric drill



Fishing reel

8. Product introduction

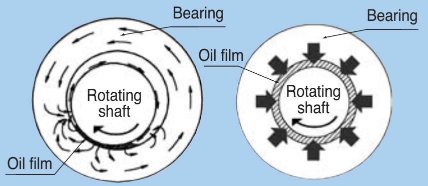
Hydrodynamic BEARPHITE

Realized high rotational accuracy during high rotation speed due to the hydrodynamic effect

1. Lubrication principle of hydrodynamic BEARPHITE

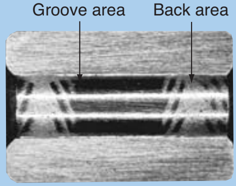
The hydrodynamic BEARPHITE is a oil-impregnated sintered bearing where herringbone shaped (fishbone shaped) hydrodynamic grooves are installed on the bore diameter surface.

The uniform oil film is formed by the hydrodynamic effect and contributes to high rotational accuracy, low noise, and super-long life span by supporting the rotating shaft without completely allowing the shaft to contact the bearing during operation. By utilizing these characteristics this bearing is widely used for equipment including the polygon scanner motor and the cooling fan. When the shaft starts rotating, the uniform oil film is formed in the clearance between the shaft and the bearing throughout the whole circumference assisted by the action of the inclined grooves installed diagonally on the bore diameter surface of the bearing and can support the rotating shaft with high rigidity.



The oil film and the mechanism of the flow of the oil in the oil-impregnated sintered bearing

The oil film and the mechanism of the flow of the oil in the hydrodynamic bearing

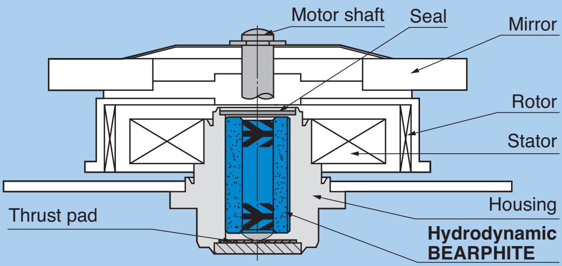


2. Comparison to other bearings

	Hydrodynamic BEARPHITE	Fluid dynamic bearing	Rolling-element bearing	Oil-impregnated sintered bearing
Rotational accuracy	◎	◎	○	×
High speed range	◎	◎	○	×
Low speed range	○	×	◎	○
Seizure resistance	◎	×	○	○
Degree of quietness	◎	◎	×	○
Torque	△	△	◎	○
Cost	○	△	△	◎

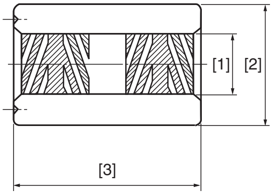
◎Excellent ○Good △Usable ×Not usable

3. Application examples of the hydrodynamic BEARPHITE



The structural drawing of the hydrodynamic BEARPHITE used in the LBP

4. Accuracy of dimension of the hydrodynamic BEARPHITE

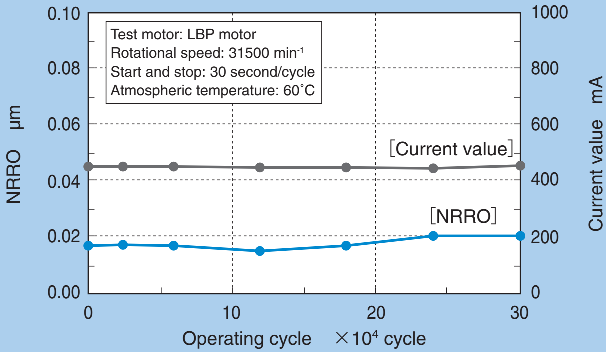


No.	[1] Bore diameter	[2] Outside diameter	[3] Length
1	1.5	3	5
2	2	4	6
3	3	5.5	8.75

5. Material of the hydrodynamic BEARPHITE

Material code	Chemical components %					Density g/cm³	Oil retention percentage vol. % (min.)	Radial crushing strength MPa (min.)
	Cu	Sn	C	Fe	Others			
EZ06	Residual amount	1～3	0.5～2.5	38～42	1 max.	6.9±0.2	12 min.	150 min.
EZ17	Residual amount	1～3	—	38～40	1 max.	7.2±0.2	10 min.	180 min.

6. Technical data



Twin BEARPHITE

Realized the lower torque due to the relief at the middle part of the bearing width

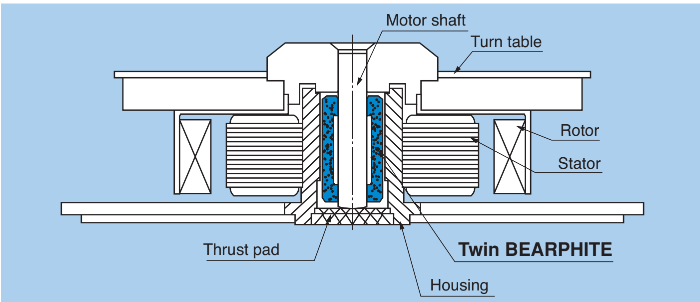
1. Features

- Enhanced concentricity of the two bearings by being integrated into one bearing
- Reduced the number of parts and manpower needed for assembling
- Reduced torque compared to that generated by one bearing currently used due to the relief at the middle part of the bearing

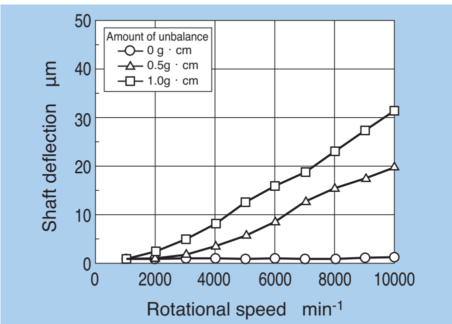
2. Application examples

- Dimension of the bore diameter: ϕ1.5 to ϕ4
- Applicable equipment: CD-ROM, CD-R/RW, DVD-ROM, axial flow fan, etc.

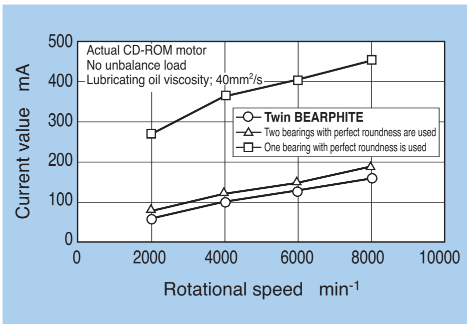
3. Application example to the CD-ROM motor



4. Shaft deflection



5. Current value



Hybrid BEARPHITE

Realized low friction, high accuracy, and high degree of quietness made possible by the hybrid structure of the resin and the sintered metal alloy

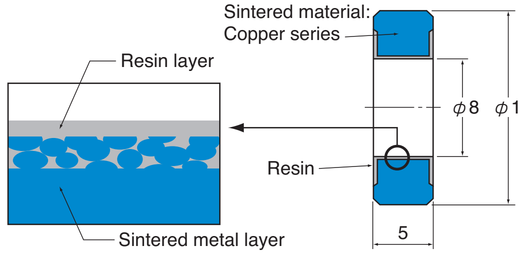
1. Features

- Low friction (μ = 0.05)
- Higher running accuracy compared to that of the resin bearing
- Superior in the degree of quietness compared to that of the rolling-element bearing
- Capable to bear the axial load
- Applicable to the aluminum shaft

2. Features

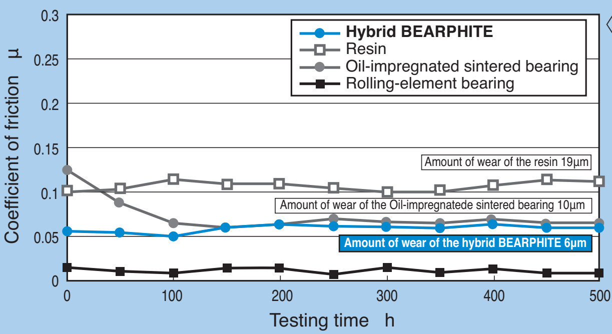
- Dimension of the bore diameter: φ6 to φ10
- Office equipment (replacement with the rolling-element bearing)

3. Structure of the hybrid BEARPHITE



8

4. Friction and wear characteristics when the radial load is applied



〈Test conditions〉
Radial load: 29.4 N
Rotational speed: 240min^{-1}
Temperature: Room temperature
Mating material: SUM + Ni plating (clearance 15μm)

BEARPHITE SG

BEARPHITE SG where the special grease is impregnated

NTN BEARPHITE SG is the oil-impregnated sintered bearing where the special liquid grease is impregnated. This grease stabilizes bearing rotation torque over a wide range of operating temperatures, and the low amount of leakage of the grease greatly enhances durability of the bearing. There are two types of greases; AL-1 for normal temperature and EU-1 for high temperature. The oil-impregnated sintered bearing where this grease is impregnated can respond to a wide range of needs.

Features

- Small rotational torque at low temperature
- Low leakage of the lubricant
- Long life span

AL-1

Representative features

AL-1 shows good characteristics in the temperature ranges from relatively low temperature to 80˚C. The representative characteristics are shown in **Table 8.1**.

Durability

(Durability test of the prototype axial flow fan motor)

The AL-1 oil-impregnated sintered bearing showed a three times or more longer life span at (4500min^{-1}) than the normal oil-impregnated sintered bearing. In addition, at 2800min^{-1} the bearing can be still continuously usable even after 20000h.

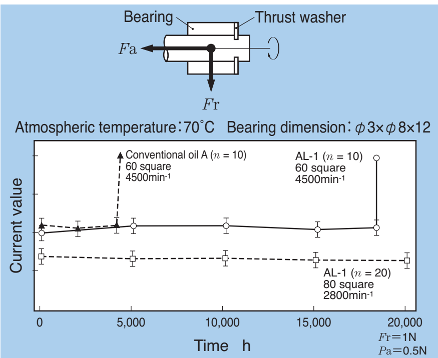


Fig. 8.1 Durability of AL-1 oil-impregnated sintered bearing

Table 8.1 Representative characteristics of AL-1

	Characteristics
Allowable temperature range	80°C or lower (Bearing temperature)
Base oil, Thickener	Synthetic oil, Lithium
Application examples	Axial flow fan motor, ventilating fan, electric fan, various OA equipment motor

Temperature dependence of viscosity

AL-1 is less affected by temperature, and hence, it has small agitating resistance at low temperatures, which enables low torque even in cold temperatures.

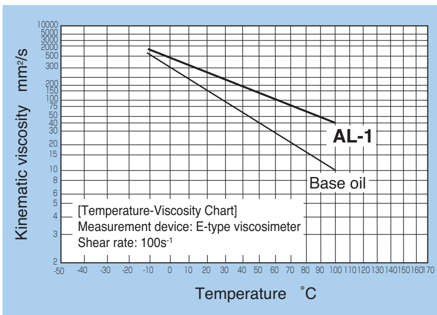


Fig. 8.2 Temperature dependency of viscosity (AL-1)

EU-1

Representative features

EU-1 shows good characteristics in the temperature ranges up to 80˚C.

The representative characteristics are shown in **Table 8.2**.

Durability

The EU-1 oil-impregnated sintered bearing showed a three times or more longer life span according to the result of the durability test with the oil-impregnated sintered bearing alone compared to that of the oil-impregnated sintered bearing with the lubricating oil for high temperature (synthetic oil).

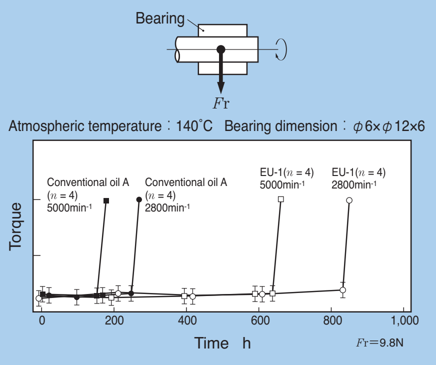


Fig. 8.3 Durability of EU-1 oil-impregnated sintered bearing

Table 8.2 Representative characteristics of EU-1

	Characteristics
Allowable temperature range	140°C or lower (Bearing temperature)
Base oil, Thickener	Synthetic oil, Urea
Application examples	Bearings for high temperature application such as those for automobile electrical equipment motor

Temperature dependence of viscosity

Temperature dependence of viscosity of EU-1 has the same tendency as AL-1.

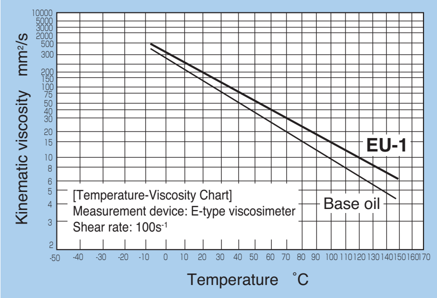


Fig. 8.4 Temperature dependency of viscosity (EU-1)

8

Mini pillow unit

Light and compact bearing unit responding to the needs for the vast industrial fields

1. Characteristics

Light weight, compact, and high rigid steel plate housing

The housing of **NTN BEARPHITE** mini pillow unit is locally reinforced by the press forming process on the steel plate. Therefore, it has not only high rigidity, but it is also light and compact.

Long life span without lubrication

The **NTN BEARPHITE** mini pillow unit can be used for a long time without lubrication, since the oil-impregnated sintered bearing material used for this pillow unit has a porous metallographic structure with good communication between pores and is superior in retention capability compared to lubricating oil.

Easy mounting

Appropriate installation of the **NTN BEARPHITE** mini pillow unit can be easily implemented, since it uses the self-aligning spherical type bearing.

Wide range of application

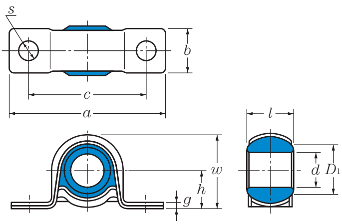
The **NTN BEARPHITE** mini pillow unit can be used widely as a general purpose bearing unit, since the allowable PV value of the oil-impregnated sintered bearing used in its pillow unit is 50 MPa･m/min (P: contact pressure MPa V: circumferential speed m/min).

Heavy duty mini pillow unit

In addition to the standard type, a heavy duty type **NTN BEARPHITE** mini pillow unit for high allowable load is available. The symbol H is suffixed at the end of the unit number code to distinguish it from the standard type.

2. Dimension table

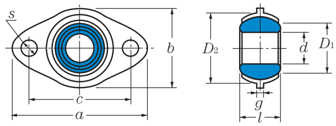
Mini pillow unit



Unit: mm

	Unit Number Code	Dimension d	a	b	g	h	l	w	c	D_1	s	Mounting Bolt	Recommended Shaft Dimension	Bearing Number Code
Standard type	**B-BAP 608**	6	36	11	1.2	7	8	13.6	26	8.9	6	M5	6 $^{-0.004}_{-0.016}$	B-A6-3E
	B-BAP 810	8	42	12	1.6	9	10	17.8	30	12.5	6	M5	8 $^{-0.005}_{-0.020}$	B-A8-10E
	B-BAP 1012	10	48	15	1.6	11	12	21.8	36	16	6	M5	10 $^{-0.005}_{-0.020}$	B-A10-1E
	B-BAP 1214	12	56	18	2	13	14	26	42	19.5	7	M6	12 $^{-0.006}_{-0.024}$	B-A12-2E
	B-BAP 1518	15	63	22	3.2	14.9	18	30	48	20.1	7	M6	15 $^{-0.006}_{-0.024}$	B-A15-2E
	B-BAP 1720	17	74	24	3.2	16.8	20	33.4	56	22.4	9	M8	17 $^{-0.006}_{-0.024}$	B-A17-1E
	B-BAP 2022	20	81	27	3.2	18.8	22	37.4	63	25.9	9	M8	20 $^{-0.007}_{-0.028}$	B-A20-2E
Heavy duty type	**B-BAP 1518H**	15	65	22	4.6	15.6	18	31.4	50	20.1	7	M6	15 $^{-0.006}_{-0.024}$	B-A15-2E
	B-BAP 1720H	17	76	24	4.6	17.5	20	34.8	58	22.4	9	M8	17 $^{-0.006}_{-0.024}$	B-A17-1E
	B-BAP 2022H	20	83	27	4.6	19.5	22	38.8	65	25.9	9	M8	20 $^{-0.007}_{-0.028}$	B-A20-2E

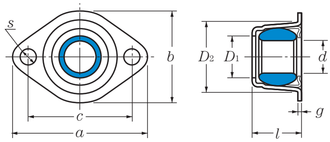
Mini flange unit



Unit: mm

Unit Number Code	Dimension d	a	b	g	l	D_1	D_2	c	s	Mounting Bolt	Recommended Shaft Dimension	Bearing Number Code
B-BAF 608	6	36	20	1.6	8	8.9	14	26	6	M5	6 $^{-0.004}_{-0.016}$	B-A6-3E
B-BAF 810	8	42	24	2	10	12.5	19	30	6	M5	8 $^{-0.005}_{-0.020}$	B-A8-10E
B-BAF 1012	10	48	28	2	12	16	23	35	6	M5	10 $^{-0.005}_{-0.020}$	B-A10-1E
B-BAF 1214	12	56	36	2.8	14	19.5	28	42	7	M6	12 $^{-0.006}_{-0.024}$	B-A12-2E
B-BAF 1518	15	63	42	3.2	18	20.1	32	48	7	M6	15 $^{-0.006}_{-0.024}$	B-A15-2E
B-BAF 1720	17	74	48	3.6	20	22.4	36	56	9	M8	17 $^{-0.006}_{-0.024}$	B-A17-1E
B-BAF 2022	20	81	55	4	22	25.9	40	63	9	M8	20 $^{-0.007}_{-0.028}$	B-A20-2E

Mini side flange unit



Unit: mm

Unit Number Code	Dimension d	a	b	g	l	D_1	D_2	c	s	Mounting Bolt	Recommended Shaft Dimension	Bearing Number Code
B-BSF 1012	10	48	31	1	16	14	24	35	6	M5	10 $^{-0.005}_{-0.020}$	B-A10-1E
B-BSF 1214	12	56	36	1.5	18	17	30	42	7	M6	12 $^{-0.006}_{-0.024}$	B-A12-2E
B-BSF 1518	15	63	42	1.5	23	19	34	48	7	M6	15 $^{-0.006}_{-0.024}$	B-A15-2E

8

Parts for machineries use

Responding to the diversified needs with superior quality

Table 8.3 Material characteristics of the sintered machinery parts

Material Code	Chemical Components %						Density g/cm³ (±0.2)	Tensile Strength MPa (min.)	Apparent Hardness HRF	Radial Crushing Strength MPa (min.)	Features
	Fe	C	Cu	Ni	Mo	Others					
FB60	Residual amount	–	–	–	–	–	6.0	70	40	147	Small high-precision product
FB64	Residual amount	–	–	–	–	–	6.4	98	50	245	
FB68	Residual amount	–	–	–	–	–	6.8	147	70	294	
FE60	Residual amount	0.2~0.8	0.5~2.0	–	–	–	6.0	147	70	294	Light-load structural components
FE64	Residual amount	0.2~0.8	0.5~2.0	–	–	–	6.4	196	75	490	
FE68	Residual amount	0.2~0.8	0.5~2.0	–	–	–	6.8	245	85	637	
FG60	Residual amount	0.2~0.8	2~5	–	–	–	6.0	245	80	392	Strength is enhanced by quench and temper. Excellent durability.
FG64	Residual amount	0.2~0.8	2~5	–	–	–	6.4	343	90	588	
FG68	Residual amount	0.2~0.8	2~5	–	–	–	6.8	441	95	735	
Z15	Residual amount	0.2~1.0	2~5	–	–	–	6.4	–	–	–	Small dimensional change (high-precision product)
Z24	Residual amount	0.3~0.9	1~3	2~4	0.5~1.5	1 max.	7.0	800	HRA55	1300	High hardness without heat treatment
Z25	Residual amount	0.2~1.0	2~5	–	–	–	6.8	–	–	–	Small module for gears
S01	Residual amount	0.1以下	15~20 (Cr)	10~15	2~4	2 max.	6.6	–	–	–	Excellent corrosion resistance and wear resistance (equivalent to SUS316L)
S03	Residual amount	0.1以下	15~20 (Cr)	10~15	–	0.5~1.0 (Si)	6.6	–	–	–	Excellent corrosion resistance (SUS304L)

※ Density is different in the materials with the same chemical components.

The characteristic values described above are the representative test results obtained under the specified test conditions. The characteristic values are representative values and are not guaranteed values.

One point advice
Bits of knowledge for the oil-impregnated bearing

Bits of knowledge for the oil-impregnated sintered bearing

■Outline of NTN Powder Metal Corporation

NTN Powder Metal introduces the state-of-the-art testing and inspecting equipment to develop the oil-impregnated sintered bearing with higher performance and higher quality and continues to conduct ongoing research activities. **NTN** Powder Metal is aiming to become the leading manufacturer of the oil-impregnated sintered bearing by not only efforts of the daily work to improve the product characteristics including chemical components, lubricating performance and finish of surface conditions, but also continuous efforts in the fields of research, development, and manufacturing.

■History of NTN Powder Metal Corporation

1965/ NTN Corporation concluded the agreement of technical cooperation with Birfield Ltd. in England. **NTN** Corporation introduced powder metallurgy technologies from Bound Brook Oil-less Bearing Company who is a member of Birfield Ltd. in England.

1966/ Toyo Bearing Powder Metal Company was established in Kanie-cho, Kaifu-gun, Aichi Prefecture. It started production of oil-impregnated sintered bearing for the first time in the rolling-element bearing industry.
Capital 50 million yen　Trademark NTN-BBB

1967/ No.1 Plant (450m²) was completed.

1980/ No.2 Plant (225m²) was completed.

1984/ Technical cooperation was terminated.
Trademark was changed.
NTN BEARPHITE
No.3 Plant (900m²) was completed.

1989/ Changed company name to **NTN Powder Metal Corporation**

1990/ Capital 200 million yen

1991/ New plant (3,150m² including No.3 Plant) was completed.
Capital 400 million yen

1994/ Administration building was completed.
Steel construction building with three floors above ground
Total floor space is 1,785m².

1996/ Transforming of the main plant to one floor was completed (Added floor space: 473m²)

1998/ Acquired the certificate of ISO 9001

1999/ ISO 14001 approved with a multi-site system

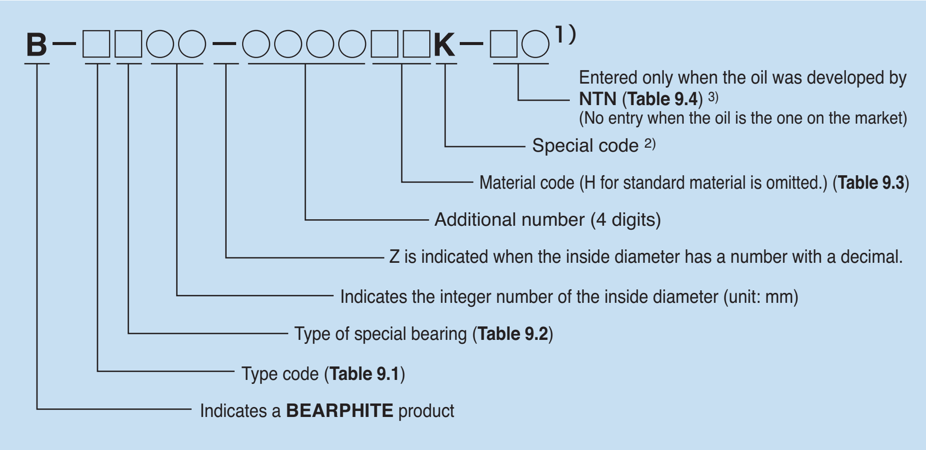
2008/ Becomes a wholly owned subsidiary of **NTN** Corp.

2009/ Extension (722m²) of new factory completed.

8

9. Number code

9.1 Oil-impregnated sintered bearing



Note 1) The ○ symbol represents the numerical number, and the □ symbol the alphabet.

2) The special code K shall be indicated when the oil-impregnated sintered bearing is partially modified in its shape in each model including addition of key, cut, groove, notch on the end surface, or modification to another shape.

Table 9.1 Type of the oil-impregnated sintered bearing

Type code	Type
S	Sleeve type
F	Flange type
A	Spherical type
W	Thrust washer type
T	Inside diameter middle part relief type
Z	Other type

Table 9.2 Special bearing type

Code	Special bearing
D	Hydrodynamic bearing

Table 9.3 Material code

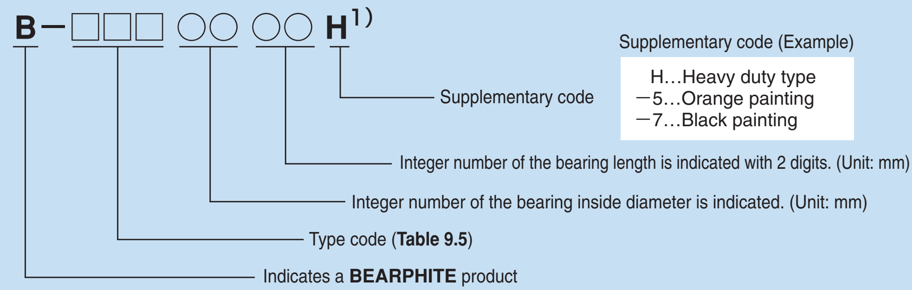
Material code	Series	Material
H	Copper series	H
HB		HB
HC		HC
HD		HD
		HE
HQ		Q
HR		R
EE	Copper-Iron series	E
EB		EB
EC		EC
F	Iron series	F
L		LB
P		P

※Refer to **Table 4.2** for details.

Table 9.4 Code for the oil that NTN has developed

Developed oil code	Name of lubricating oil	Details
A1	AL-1	Synthetic oil, Lithium
A2	EU-1	Synthetic oil, Urea
C1	NC101	Poly-alpha-olefin
C2	NC103	Poly-alpha-olefin
C3	NC105	Poly-alpha-olefin
C4	NC201	Polyol ester
C5	NSM101	Poly-alpha-olefin
C6	NL202	Diester
C7	NC403	Polyol ester + Poly-alpha-olefin
C8	NC404	Polyol ester + Poly-alpha-olefin
C9	NC401	Polyol ester + Poly-alpha-olefin

9.2 Mini pillow unit



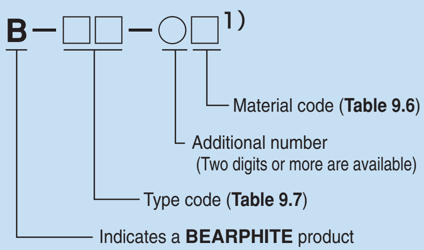
Note 1) The ○ symbol represents the numerical number, and the □ symbol the alphabet.

Table 9.5 Type code

Type code	Type
BAP	Pillow type
BAF	Flange type
BSF	Side flange type

9.3 Sintered machinery parts

Sintered machinery parts are the sintered products without having bearing function.



Note 1) The ○ symbol represents the numerical number, and the □ symbol the alphabet.

Table 9.6 Material code

Material code	Series
B	Iron series
C	
D	
E	
G	

Table 9.7 Type and type code

Type code	Type
BS	Boss
CM	Cam
CR	Collar
GR	Gear
HS	Journal box
NC	One way clutch (NCU, NCR)
NT	Torque limiter (NTL)
PN	Pin
PU	Pulley
RL	Roller
SE	Serration
SR	Sprocket
ZZ	Others

9

10. Cause of trouble and countermeasures

Details of the trouble	Phenomena	Cause	Countermeasures Bearing
Seizure	Abnormal heat Galling Rough sliding surface Blockade of the pore	Excessive load	Review of the material
		High speed	
		Too-small clearance	
		Poor lubricating oil	
		Inappropriate shaft	
Abnormal wear	Rough sliding surface Discoloration Galling Blockade of the pore	Foreign material contamination	Cleaning of the bearing
		Excessive load	Review of the material
		Poor lubricating oil	
		Inappropriate shaft	
Noise	Rough sliding surface Galling Blockade of the pore Wear	Excessive load	Review of the material
		Excessive clearance	
		Inappropriate shaft	
		Shaft misalignment	Improvement of run-out accuracy
Breakage	Crack･Chipping Deformation Dent	Excessive impact load	Review of the material
		Excessive press-fitting interference	
		Poor handling	
Creep	Discoloration Galling Rough sliding surface	Too small press-fitting interference	
		Abnormal temperature rise	
		Excessive load	
Rust (Corrosion)	Discoloration (Oxidization) Verdigris (Copper)	Poor storage condition Package fault Intrusion of water and acid Handling with bare hands	

<table>
<tr><th colspan="4">Countermeasures</th></tr>
<tr><th>Lubricating Oil</th><th>Shaft</th><th>Mounted clearance</th><th>Others</th></tr>
<tr><td>Increase viscosity (Higher)</td><td rowspan="5">Increase hardness
Improve the surface roughness
Improve roundness</td><td>Increase the clearance</td><td rowspan="5">Review of the operating conditions</td></tr>
<tr><td>Decrease viscosity (Lower)</td><td></td></tr>
<tr><td></td><td>Adjust to the specified clearance</td></tr>
<tr><td>Review of the lubricating oil</td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td rowspan="4">Increase hardness
Improve the surface roughness
Improve roundness</td><td></td><td rowspan="4">Review of the operating conditions</td></tr>
<tr><td>Increase viscosity</td><td>Increase the clearance</td></tr>
<tr><td>Review of the lubricating oil</td><td rowspan="2"></td></tr>
<tr><td></td></tr>
<tr><td>Increase viscosity.</td><td rowspan="4">Improve the surface roughness
Improve roundness</td><td></td><td rowspan="3"></td></tr>
<tr><td></td><td>Decrease the clearance</td></tr>
<tr><td></td><td rowspan="2"></td></tr>
<tr><td></td><td>Review of the assembling method</td></tr>
<tr><td></td><td rowspan="3"></td><td rowspan="3"></td><td>Review of the operating conditions</td></tr>
<tr><td></td><td>Review of the specified interference</td></tr>
<tr><td></td><td>Improve the handling method</td></tr>
<tr><td></td><td rowspan="3"></td><td></td><td>Review of the specified interference</td></tr>
<tr><td>Review of the lubricating oil</td><td>Review of the specified clearance</td><td rowspan="2">Review of the operating conditions</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Review of the lubricating oil</td><td></td><td></td><td>Improve the handling method</td></tr>
</table>

11. Dimension table of standard products

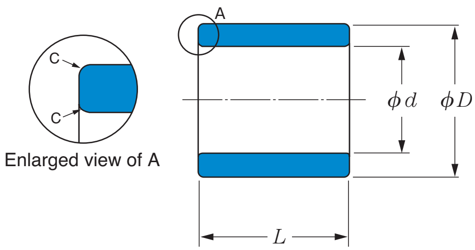
● **Material:** Copper-base (H)

The material based on Cu and Sn have superb characteristics of “low-friction”, "quietness" and "wear resistance".

Material code		Chemical components %				Density	Oil retention percentage	Radial crushing strength
		Cu	Sn	C	Others	g/cm³ (±0.2)	vol. % (min.)	MPa (min.)
H	Copper series	Residual amount	8～11	1～2	—	6.6	18	150

● **14. Lubrication:** mineral oil, operating temperature range 0 to 80˚C

● **Dimension table (Sleeve type)**



(1) Sleeve type product number: B-BRS□□□□□□

Select product number from the bore diameter, outside diameter and length in the table below:

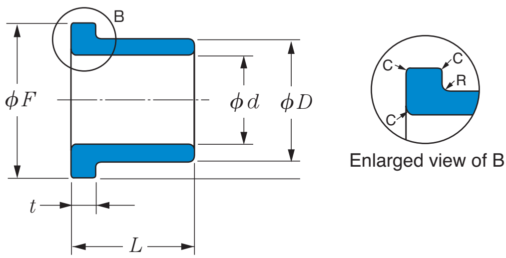
(Example) **B-BRS081210**, in case of bore diameter of 8 mm, outside diameter of 12 mm and length of 10 mm

Unit: mm

Bore diameter ϕd	Tolerance		Outside diameter ϕD	Tolerance		Length L tolerance/Product number ±0.10: 2	±0.10: 4	±0.10: 5	±0.10: 6	±0.15: 8	±0.15: 10	±0.15: 12	±0.15: 15	±0.15: 18	±0.15: 20	±0.20: 25	Corner	Bore diameter after press-fitting (reference)	Recommended clearance
3	+0.010 /0	H7	5	+0.031 /+0.019	s7	030502	030504	030505									C0.3	2.977～3.005	+0.004～+0.016
4	+0.012 /0	H7	6	+0.031 /+0.019	s7		040604	040605	040606								C0.3	3.976～4.007	+0.005～+0.017
5	+0.012 /0	H7	8	+0.038 /+0.023	s7		050804		050806	050808							C0.3	4.973～5.006	+0.006～+0.019
6	+0.012 /0	H7	10	+0.038 /+0.023	s7				061006	061008	061010	061012					C0.3	5.975～6.007	+0.006～+0.020
8	+0.015 /0	H7	12	+0.046 /+0.028	s7				081206	081208	081210	081212					C0.3	7.969～8.008	+0.008～+0.022
10	+0.015 /0	H7	14	+0.046 /+0.028	s7					101408	101410	101412	101415	101418			C0.3	9.968～10.008	+0.009～+0.024
12	+0.018 /0	H7	18	+0.046 /+0.028	s7					121808	121810	121812	121815	121818	121820		C0.3	11.972～12.012	+0.010～+0.026
14	+0.018 /0	H7	20	+0.056 /+0.035	s7						142010	142012	142015	142018	142020		C0.3	13.965～14.009	+0.012～+0.028
16	+0.018 /0	H7	22	+0.056 /+0.035	s7						162210		162215		162220	162225	C0.3	15.965～16.009	+0.013～+0.031
18	+0.018 /0	H7	24	+0.056 /+0.035	s7						182410		182415		182420	182425	C0.3	17.964～18.009	+0.015～+0.033
20	+0.021 /0	H7	26	+0.062 /+0.041	t7								202615	202618	202620	202625	C0.3	19.960～20.008	+0.016～+0.035
25	+0.033 /0	H8	30	+0.062 /+0.041	t7								253015		253020	253025	C0.3	24.957～25.019	+0.020～+0.041

(Note) The dimension ranges after press-fitting are reference only, under the assumptions of soft steel housing material, bore diameter tolerance of H7 and wall thickness of 3 mm. Contact **NTN** for details, as the values vary depending on the housing, wall thickness, etc.

● Dimension table (Flange type)



Enlarged view of B

(2) Flange type product number: B-BRF□□□□□□

Select product number from the bore diameter, outside diameter, length, flange outside diameter and flange width in the table below:

(Example) **B-BRF081210** in case of bore diameter of 8 mm, outside diameter of 12 mm, length of 10 mm, flange outside diameter of 16 mm and flange width of 2 mm.

Unit: mm

Bore diameter			Outside diameter			Length		Flange		Flange width		Product number	Corner	Interior corner	Bore diameter after press-fitting (reference)	Recommended clearance
φd	Tolerance		φD	Tolerance		L	Tolerance	φF	Tolerance	t	Tolerance					
3	+0.010 /0	H7	6	+0.031 /+0.019	s7	3	±0.10	7	±0.10	1	±0.20	**030603**	C0.2	R0.2 or less	2.981～3.006	+0.004～+0.016
4	+0.012 /0		6			5		8		1		**040605**	C0.2	R0.2 or less	3.976～4.007	+0.005～+0.017
5			8	+0.038 /+0.023		6		10		1		**050806**	C0.3	R0.3 or less	4.973～5.006	+0.006～+0.019
6			10			8	±0.15	12		1		**061008**	C0.3	R0.3 or less	5.975～6.007	+0.006～+0.020
8	+0.015 /0		12	+0.046 /+0.028		10		16		2		**081210**	C0.3	R0.3 or less	7.969～8.008	+0.008～+0.022
10			14			12		18		2		**101412**	C0.5	R0.3 or less	9.968～10.008	+0.009～+0.024
12	+0.018 /0		18			14		20		2		**121814**	C0.5	R0.3 or less	11.972～12.012	+0.010～+0.026
14			20	+0.056 /+0.035		16		24		2		**142016**	C0.5	R0.3 or less	13.965～14.009	+0.012～+0.028
16			22			18		26		3		**162218**	C0.5	R0.3 or less	15.965～16.009	+0.013～+0.031
18			24			20		28		3		**182420**	C0.5	R0.3 or less	17.964～18.009	+0.015～+0.033
20	+0.021 /0		26	+0.062 /+0.041	t7	22		32		4		**202622**	C0.5	R0.5 or less	19.960～20.008	+0.016～+0.035
25	+0.033 /0	H8	30			25	±0.20	35		4		**253025**	C0.5	R0.5 or less	24.957～25.019	+0.020～+0.041

(Note) The dimension ranges after press-fitting are reference only, under the assumptions of soft steel housing material, bore diameter tolerance of H7 and wall thickness of 3 mm. Contact **NTN** for details, as the values vary depending on the housing, wall thickness, etc.

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12. Dimension table of made-to-order products (when molds are available)

Sleeve type bearing Dimension table

d 1～4mm

Dimension mm						
Bore diameter φd		Outside diameter φD		Length ℓ		Product number
1	+0.010 / +0.005	2.5	−0.005 / −0.015	1.3	±0.050	**B-S1-1024**
1	+0.014 / +0.008	3	+0.020 / +0.010	0.9	±0.100	**B-S1-21**
1.5	+0.010 / +0.004	3	+0.031 / +0.019	2	0 / −0.100	**B-S1Z89**
1.5	+0.010 / +0.004	4	+0.020 / +0.010	2.5	0 / −0.100	**B-S1Z72**
2	+0.010 / 0	4	+0.031 / +0.019	1.5	0 / −0.100	**B-S2-131**
2	+0.010 / +0.001	4	+0.030 / +0.020	5	0 / −0.080	**B-S2-104**
2	+0.014 / +0.004	5	+0.020 / +0.010	1.5	±0.050	**B-S2-188**
2	+0.013 / +0.008	5	+0.015 / +0.008	2	±0.050	**B-S2-1165**
2	+0.012 / +0.002	5	+0.023 / +0.015	8	±0.150	**B-S2-66**
2.5	+0.035 / +0.020	4	+0.040 / +0.025	3	0 / −0.300	**B-S2Z1026**
2.5	+0.015 / +0.010	4	+0.030 / +0.020	3	0 / −0.100	**B-S2Z27**
2.5	+0.034 / +0.020	6	+0.031 / +0.019	3	0 / −0.100	**B-S2Z38**
3	+0.025 / +0.020	4	+0.010 / 0	2.5	0 / −0.100	**B-S3-61**
3	+0.043 / +0.031	5	+0.022 / +0.010	2	±0.100	**B-S3-90**
3	+0.015 / +0.010	5	+0.030 / +0.020	2.5	0 / −0.100	**B-S3-122**
3	+0.010 / +0.002	5	+0.015 / +0.005	5	0 / −0.200	**B-S3-104**
3	+0.020 / +0.010	6	+0.034 / +0.024	2	±0.100	**B-S3-95**
3	+0.010 / 0	6	+0.031 / +0.019	4	±0.100	**B-S3-4**
3	+0.030 / +0.010	6	+0.030 / +0.010	6	±0.100	**B-S3-7**
3	+0.020 / +0.010	7	+0.025 / +0.010	3	±0.100	**B-S3-1024**
3	+0.026 / +0.016	7	+0.038 / +0.023	4.5	±0.100	**B-S3-32**
3	+0.010 / 0	8	+0.038 / +0.023	6	±0.100	**B-S3-22**
4	+0.030 / +0.010	6	+0.055 / +0.035	3	0 / −0.100	**B-S4-1047**
4	+0.030 / 0	6	0 / −0.030	4.5	±0.100	**B-S4-1040**
4	+0.012 / 0	6	+0.038 / +0.023	5	±0.100	**B-S4-1220**
4	+0.012 / 0	6	+0.038 / +0.023	6	0 / −0.100	**B-S4-73**

d 4～5mm

Dimension mm						
Bore diameter φd		Outside diameter φD		Length ℓ		Product number
4	+0.020 / +0.012	6	+0.015 / +0.005	6	0 / −0.100	**B-S4-1142**
4	+0.028 / +0.010	6	+0.034 / +0.019	7	0 / −0.100	**B-S4-110**
4	+0.030 / 0	7	+0.038 / +0.023	2	0 / −0.100	**B-S4-1042**
4	+0.004 / −0.002	7	+0.020 / +0.010	4	±0.100	**B-S4-87**
4	+0.012 / 0	7	+0.038 / +0.023	6	±0.100	**B-S4-11**
4	+0.012 / 0	7	+0.038 / +0.023	8	±0.150	**B-S4-1218**
4	+0.012 / 0	7	+0.038 / +0.023	8	0 / −0.150	**B-S4-105**
4	+0.012 / 0	7	+0.038 / +0.023	10	0 / −0.150	**B-S4-1242**
4	+0.012 / 0	8	+0.038 / +0.023	3	±0.100	**B-S4-21**
4	+0.015 / +0.007	8	+0.008 / 0	3	±0.100	**B-S4-1023**
4	+0.022 / +0.010	8	+0.038 / +0.023	4	±0.100	**B-S4-84**
4	+0.020 / +0.010	8	+0.038 / +0.023	5	0 / −0.100	**B-S4-1225**
4	+0.012 / 0	8	+0.038 / +0.023	6	±0.100	**B-S4-30**
4	+0.012 / 0	8	+0.038 / +0.023	8	±0.100	**B-S4-31**
4	+0.012 / 0	9	+0.038 / +0.023	5	0 / −0.200	**B-S4-36**
4	+0.012 / 0	9	+0.038 / +0.023	6	±0.100	**B-S4-37**
4	+0.012 / 0	10	+0.038 / +0.023	8	±0.150	**B-S4-40**
5	+0.020 / +0.013	7	+0.040 / +0.025	3	±0.100	**B-S5-146**
5	+0.035 / +0.020	7	+0.040 / +0.025	4	0 / −0.300	**B-S5-1084**
5	+0.040 / +0.025	7	+0.040 / +0.020	4	±0.050	**B-S5-1099**
5	+0.035 / +0.020	7	+0.040 / +0.025	5	0 / −0.300	**B-S5-1213**
5	+0.025 / +0.005	7	+0.050 / +0.020	6	±0.100	**B-S5-1152**
5	+0.030 / +0.010	8	+0.040 / +0.020	3.5	0 / −0.100	**B-S5-1024**
5	+0.023 / +0.013	8	+0.023 / +0.013	4	±0.100	**B-S5-41**
5	+0.070 / +0.050	8	+0.030 / +0.010	5	±0.100	**B-S5-1241**
5	+0.035 / +0.025	8	+0.038 / +0.023	5	±0.050	**B-S5-89**

Note) Please contact **NTN** for the type of oil.
Material is copper series (H).

Sleeve type bearing Dimension table

d 5～6mm

Dimension mm						Product number
Bore diameter ϕd		Outside diameter ϕD		Length ℓ		
5	+0.040 +0.020	8	+0.020 0	6	±0.100	**B-S5-5**
5	+0.012 0	8	+0.028 +0.012	8	±0.150	**B-S5-10**
5	+0.012 0	8	+0.038 +0.023	10	±0.150	**B-S5-39**
5	+0.012 0	8	+0.038 +0.023	12	±0.150	**B-S5-14**
5	+0.015 0	9	+0.030 +0.015	4	±0.100	**B-S5-1123**
5	+0.025 +0.013	9	+0.039 +0.018	6	±0.100	**B-S5-19**
5	+0.015 0	10	+0.030 +0.015	3	±0.100	**B-S5-1125**
5	+0.012 0	10	+0.038 +0.023	4	±0.100	**B-S5-22**
5	+0.028 +0.018	10	+0.020 +0.010	6	±0.100	**B-S5-25**
5	+0.018 +0.006	10	+0.038 +0.023	7	±0.100	**B-S5-40**
5	+0.012 +0.006	11	+0.040 +0.032	5	±0.100	**B-S5-109**
5	+0.050 +0.020	13	+0.030 +0.010	5	0 −0.100	**B-S5-66**
6	+0.030 +0.010	8	+0.040 +0.020	3	0 −0.100	**B-S6-1292**
6	+0.040 +0.025	8	+0.040 +0.020	3	0 −0.100	**B-S6-1051**
6	+0.020 +0.012	8	+0.015 +0.005	3	0 −0.100	**B-S6-311**
6	+0.027 +0.017	8	+0.035 +0.020	4	±0.100	**B-S6-168**
6	+0.040 +0.025	8	+0.040 +0.020	4	±0.050	**B-S6-1035**
6	+0.030 +0.010	8	+0.040 +0.020	4	0 −0.100	**B-S6-1048**
6	+0.020 0	8	+0.050 +0.020	4	±0.100	**B-S6-1060**
6	+0.020 0	8	+0.050 +0.020	5	0 −0.100	**B-S6-2**
6	+0.020 +0.005	8	+0.040 +0.020	5	±0.050	**B-S6-1050**
6	+0.027 +0.017	8	+0.035 +0.020	6	±0.100	**B-S6-4**
6	+0.020 0	8	+0.050 +0.020	8	−0.050 −0.250	**B-S6-7**
6	+0.040 +0.020	8	+0.046 +0.028	10	−0.050 −0.200	**B-S6-177**
6	+0.012 0	8	+0.110 +0.075	12	±0.150	**B-S6-1080**
6	+0.023 +0.008	8	+0.038 +0.023	13	0 −0.150	**B-S6-146**

Note) Please contact **NTN** for the type of oil.

d 6mm

Dimension mm						Product number
Bore diameter ϕd		Outside diameter ϕD		Length ℓ		
6	+0.018 0	9	+0.038 +0.023	3	±0.100	**B-S6-194**
6	+0.035 +0.025	9	+0.038 +0.023	3	0 −0.200	**B-S6-342**
6	+0.035 +0.025	9	+0.038 +0.023	5	±0.050	**B-S6-180**
6	+0.015 0	9	+0.038 +0.023	6	±0.100	**B-S6-17**
6	+0.015 0	9	+0.038 +0.023	6	±0.100	**B-S6-1343**
6	+0.015 0	9	+0.038 +0.023	8	±0.100	**B-S6-18**
6	+0.015 0	9	+0.038 +0.023	10	±0.100	**B-S6-19**
6	+0.015 0	9	+0.030 +0.015	16	±0.100	**B-S6-230**
6	+0.035 +0.023	10	+0.038 +0.023	3	±0.100	**B-S6-219**
6	+0.015 0	10	+0.038 +0.023	4	±0.100	**B-S6-110**
6	+0.045 +0.035	10	+0.038 +0.023	4	0 −0.100	**B-S6-1256**
6	+0.035 +0.023	10	+0.038 +0.023	5	+0.200 0	**B-S6-272**
6	+0.030 +0.015	10	+0.041 +0.025	5	±0.100	**B-S6-197**
6	+0.020 +0.012	10	+0.015 +0.005	6	0 −0.100	**B-S6-1197**
6	+0.012 0	10	+0.038 +0.023	7	±0.100	**B-S6-117**
6	+0.012 0	10	+0.038 +0.023	8	±0.100	**B-S6-85**
6	+0.045 +0.033	10	+0.038 +0.023	8	0 −0.100	**B-S6-1312**
6	+0.012 0	10	+0.038 +0.023	9	±0.100	**B-S6-39**
6	+0.012 0	10	+0.038 +0.023	10	0 −0.100	**B-S6-43**
6	+0.015 0	10	+0.038 +0.023	11	±0.100	**B-S6-45**
6	+0.015 0	10	+0.038 +0.023	12	±0.150	**B-S6-46**
6	+0.012 0	10	+0.046 +0.028	13	±0.100	**B-S6-48**
6	+0.020 +0.012	10	+0.033 +0.023	14	−0.300 −0.500	**B-S6-160**
6	+0.012 0	10	+0.038 +0.023	15	±0.150	**B-S6-52**
6	+0.050 +0.020	10	0 −0.030	17	±0.150	**B-S6-88**
6	+0.040 +0.020	11	+0.041 +0.023	4	±0.100	**B-S6-175**

Sleeve type bearing Dimension table

d 6～8mm

Dimension mm						Product number
Bore diameter φ*d*		Outside diameter φ*D*		Length ℓ		
6	+0.033 +0.018	11	+0.038 +0.023	5	+0.200 0	**B-S6-1325**
6	+0.012 0	12	+0.046 +0.028	3	±0.100	**B-S6-1359**
6	+0.010 0	12	+0.046 +0.028	3	−0.100 −0.300	**B-S6-1061**
6	+0.012 0	12	+0.046 +0.028	4	±0.100	**B-S6-1395**
6	+0.012 0	12	+0.038 +0.023	6	±0.100	**B-S6-353**
6	+0.012 0	12	+0.046 +0.028	7	±0.100	**B-S6-196**
6	+0.040 +0.020	12	+0.200 0	9	±0.150	**B-S6-65**
6	+0.015 0	13	−0.020 −0.040	5	±0.100	**B-S6-1340**
6	+0.018 +0.006	15	+0.046 +0.028	5	±0.100	**B-S6-184**
7	+0.015 0	10	+0.035 +0.023	10	±0.150	**B-S7-4**
7	+0.025 +0.010	10	+0.038 +0.023	10	±0.050	**B-S7-1110**
7	+0.012 0	10	±0.030	12	0 −0.100	**B-S7-23**
7	+0.040 +0.020	11	+0.051 +0.033	7	±0.100	**B-S7-6**
7	+0.015 0	11	+0.046 +0.028	10	±0.150	**B-S7-24**
7	+0.053 +0.038	12	+0.046 +0.028	7	±0.100	**B-S7-46**
7	+0.015 0	13	0 −0.020	4	±0.050	**B-S7-14**
7	+0.048 +0.033	14	+0.046 +0.028	10	±0.100	**B-S7-48**
8	+0.030 +0.015	10	+0.038 +0.023	3	±0.100	**B-S8-413**
8	+0.020 +0.012	10	+0.015 +0.005	3.5	0 −0.100	**B-S8-411**
8	+0.030 +0.015	10	+0.038 +0.023	5	±0.100	**B-S8-1406**
8	+0.030 +0.010	10	0 −0.020	5	0 −0.500	**B-S8-394**
8	+0.045 +0.030	10	+0.038 +0.023	6	±0.100	**B-S8-235**
8	+0.030 +0.015	10	+0.038 +0.023	8	±0.100	**B-S8-1504**
8	+0.015 0	10	+0.038 +0.023	8	±0.100	**B-S8-187**
8	+0.015 0	10	+0.038 +0.023	10	±0.100	**B-S8-5**
8	+0.035 +0.020	10	+0.040 +0.020	15	±0.150	**B-S8-1497**

Note) Please contact **NTN** for the type of oil.

d 8mm

Dimension mm						Product number
Bore diameter φ*d*		Outside diameter φ*D*		Length ℓ		
8	+0.018 0	11	+0.038 +0.023	4	±0.100	**B-S8-342**
8	+0.029 +0.014	11	+0.043 +0.028	10	±0.100	**B-S8-160**
8	+0.015 0	11	+0.046 +0.028	12	±0.150	**B-S8-17**
8	+0.022 0	11	+0.055 +0.028	18	±0.150	**B-S8-20**
8	+0.015 0	11	+0.046 +0.028	20	±0.150	**B-S8-21**
8	+0.040 +0.015	11	+0.046 +0.016	25	0 −0.300	**B-S8-243**
8	+0.020 0	12	+0.030 +0.010	2	0 −0.100	**B-S8-1388**
8	+0.040 +0.025	12	+0.046 +0.028	4	0 −0.100	**B-S8-192**
8	+0.030 +0.010	12	+0.040 +0.020	4	0 −0.100	**B-S8-358**
8	+0.015 0	12	+0.038 +0.023	5	±0.100	**B-S8-356**
8	+0.030 +0.015	12	+0.041 +0.023	5	0 −0.100	**B-S8-1252**
8	+0.018 0	12	+0.046 +0.028	6	±0.100	**B-S8-32**
8	+0.015 0	12	+0.046 +0.028	6	±0.100	**B-S8-36**
8	+0.034 +0.025	12	+0.046 +0.028	6	±0.100	**B-S8-370**
8	+0.055 +0.040	12	+0.046 +0.028	6	±0.100	**B-S8-1100**
8	+0.015 0	12	+0.046 +0.028	8	±0.100	**B-S8-42**
8	+0.040 +0.025	12	+0.046 +0.028	8	0 −0.100	**B-S8-169**
8	+0.030 +0.015	12	+0.041 +0.023	8	0 −0.100	**B-S8-1253**
8	+0.015 0	12	+0.046 +0.028	10	±0.100	**B-S8-1402**
8	+0.018 0	12	+0.046 +0.028	10	0 −0.300	**B-S8-381**
8	+0.015 0	12	+0.046 +0.028	12	±0.100	**B-S8-1311**
8	+0.035 +0.013	12	+0.041 +0.023	12	±0.100	**B-S8-63**
8	+0.035 +0.013	12	+0.041 +0.023	14	±0.100	**B-S8-209**
8	+0.035 +0.013	12	+0.041 +0.023	15	0 −0.200	**B-S8-73**
8	+0.015 +0.008	12	+0.034 +0.023	16	0 −0.100	**B-S8-75**
8	+0.035 +0.013	12	+0.041 +0.023	18	0 −0.200	**B-S8-79**

Sleeve type bearing Dimension table

d 8～10mm

Bore diameter φd		Outside diameter φD		Length ℓ		Product number
8	+0.015 / 0	12	+0.046 / +0.028	18	±0.150	**B-S8-81**
8	+0.015 / 0	12	+0.046 / +0.028	20	±0.100	**B-S8-84**
8	+0.022 / 0	12	+0.046 / +0.028	35	±0.500	**B-S8-296**
8	+0.015 / 0	13	+0.046 / +0.028	5	±0.100	**B-S8-90**
8	+0.035 / +0.013	13	+0.041 / +0.023	9	±0.150	**B-S8-91**
8	+0.035 / +0.013	13	+0.041 / +0.023	15	0 / −0.200	**B-S8-93**
8	+0.015 / 0	14	+0.046 / +0.028	3.5	±0.100	**B-S8-231**
8	+0.025 / +0.010	14	+0.045 / +0.026	16	±0.100	**B-S8-115**
8	+0.017 / 0	15	+0.045 / +0.025	24	±0.200	**B-S8-130**
8	+0.015 / 0	16	+0.036 / +0.018	5	0 / −0.200	**B-S8-132**
8	+0.028 / +0.005	16	+0.046 / +0.028	10	±0.100	**B-S8-234**
8	+0.015 / 0	16	+0.046 / +0.028	13	±0.150	**B-S8-376**
8	+0.015 / 0	16	+0.046 / +0.028	20	±0.150	**B-S8-258**
9	+0.025 / +0.010	12	+0.046 / +0.028	13	±0.050	**B-S9-1014**
9	+0.015 / 0	13	+0.046 / +0.028	8	±0.150	**B-S9-37**
9	+0.015 / 0	14	+0.046 / +0.028	12	±0.100	**B-S9-12**
10	+0.015 / 0	12	+0.046 / +0.028	7.8	±0.150	**B-S10-1194**
10	+0.015 / 0	13	+0.046 / +0.028	8	±0.100	**B-S10-3**
10	+0.070 / +0.050	14	+0.038 / +0.023	4	±0.100	**B-S10-132**
10	+0.070 / +0.050	14	+0.038 / +0.023	5	±0.100	**B-S10-21**
10	+0.018 / 0	14	+0.046 / +0.028	7	±0.100	**B-S10-25**
10	+0.015 / 0	14	+0.046 / +0.028	12	±0.150	**B-S10-136**
10	+0.015 / 0	14	+0.046 / +0.028	15	±0.100	**B-S10-144**
10	+0.015 / 0	14	+0.046 / +0.028	16	±0.150	**B-S10-42**
10	+0.030 / +0.010	14	+0.036 / +0.018	18	±0.100	**B-S10-44**
10	+0.015 / 0	15	+0.046 / +0.028	4	±0.100	**B-S10-1025**

d 10～12mm

Bore diameter φd		Outside diameter φD		Length ℓ		Product number
10	+0.035 / +0.013	15	+0.041 / +0.023	19	0 / −0.100	**B-S10-53**
10	+0.015 / 0	16	+0.046 / +0.028	9	±0.150	**B-S10-1050**
10	+0.015 / 0	16	+0.046 / +0.028	15	±0.150	**B-S10-60**
10	+0.035 / +0.020	16	+0.046 / +0.028	20	±0.150	**B-S10-125**
10	+0.045 / +0.027	18	+0.050 / +0.032	5	±0.100	**B-S10-1102**
11	+0.080 / +0.030	14	+0.046 / +0.028	19	±0.150	**B-S11-5**
12	+0.053 / +0.034	14	+0.043 / +0.028	8	±0.200	**B-S12-1021**
12	+0.053 / +0.034	14	+0.043 / +0.028	14	±0.200	**B-S12-1132**
12	+0.018 / 0	15	+0.046 / +0.028	15	±0.150	**B-S12-6**
12	+0.018 / 0	15	+0.053 / +0.033	20	±0.150	**B-S12-7**
12	+0.018 / 0	16	+0.046 / +0.028	9	±0.150	**B-S12-120**
12	+0.018 / 0	16	+0.046 / +0.028	10	±0.100	**B-S12-10**
12	+0.018 / 0	16	+0.046 / +0.028	12	±0.150	**B-S12-14**
12	+0.036 / +0.018	16	+0.041 / +0.023	14	±0.100	**B-S12-15**
12	+0.018 / 0	16	+0.046 / +0.028	15	±0.150	**B-S12-16**
12	+0.036 / +0.018	16	+0.041 / +0.023	20	0 / −0.400	**B-S12-20**
12	+0.043 / +0.025	16	+0.046 / +0.028	22	±0.300	**B-S12-62**
12	+0.050 / +0.030	17	+0.050 / +0.030	7	0 / −0.200	**B-S12-122**
12	+0.050 / +0.030	17	+0.050 / +0.030	11	±0.150	**B-S12-27**
12	+0.080 / +0.060	18	+0.038 / +0.023	5	±0.100	**B-S12-32**
12	+0.018 / 0	18	+0.046 / +0.028	5	±0.100	**B-S12-33**
12	+0.030 / +0.010	18	+0.050 / +0.030	10	±0.100	**B-S12-35**
12	+0.018 / 0	18	+0.046 / +0.028	12	±0.100	**B-S12-37**
12	+0.025 / +0.010	18	+0.046 / +0.028	18	0 / −0.200	**B-S12-71**
12	+0.018 / 0	18	+0.046 / +0.028	20	±0.100	**B-S12-45**
12	+0.018 / 0	18	+0.046 / +0.028	38	±0.200	**B-S12-48**

Note) Please contact **NTN** for the type of oil.

Sleeve type bearing Dimension table

d 12～16mm

Dimension mm						Product number
Bore diameter φ*d*		Outside diameter φ*D*		Length ℓ		
12	+0.028 +0.020	20	+0.040 +0.022	15	±0.100	**B-S12-83**
13	+0.018 0	18	+0.046 +0.028	15	±0.150	**B-S13-5**
13	+0.018 0	18	+0.046 +0.028	26	±0.150	**B-S13-9**
14	+0.027 0	18	+0.046 +0.028	10	±0.100	**B-S14-2**
14	+0.018 0	18	+0.046 +0.028	12	±0.150	**B-S14-3**
14	+0.060 +0.040	18	+0.060 +0.030	14	±0.200	**B-S14-31**
14	+0.080 +0.060	20	+0.030 +0.015	5	±0.100	**B-S14-13**
14	+0.053 +0.035	20	+0.081 +0.063	10	±0.100	**B-S14-1032**
14	+0.015 0	20	+0.056 +0.035	12	±0.100	**B-S14-17**
14	+0.015 0	20	+0.056 +0.035	15	±0.150	**B-S14-18**
14	+0.018 0	20	+0.056 +0.035	19	±0.100	**B-S14-20**
14	+0.018 0	20	+0.056 +0.035	21	±0.100	**B-S14-21**
15	+0.048 +0.030	19	+0.056 +0.036	10	±0.100	**B-S15-3**
15	+0.018 0	19	+0.056 +0.035	25	±0.200	**B-S15-6**
15	+0.080 +0.050	20	+0.050 +0.020	15	±0.150	**B-S15-1066**
15	+0.018 0	20	+0.056 +0.035	20	±0.150	**B-S15-11**
15	+0.067 +0.052	21	+0.056 +0.035	12	±0.100	**B-S15-42**
15	+0.018 0	21	+0.056 +0.035	14	0 −0.300	**B-S15-12**
15	+0.018 0	21	+0.056 +0.035	20	±0.150	**B-S15-14**
15	+0.018 0	22	+0.056 +0.035	25	±0.200	**B-S15-51**
16	+0.018 0	20	+0.056 +0.035	10	±0.100	**B-S16-1**
16	+0.018 0	20	+0.046 +0.028	20	±0.150	**B-S16-7**
16	+0.018 0	20	+0.056 +0.035	25	±0.200	**B-S16-9**
16	+0.018 0	21	+0.056 +0.035	16	±0.150	**B-S16-11**
16	+0.018 0	22	+0.056 +0.035	15	±0.150	**B-S16-15**
16	+0.018 0	22	+0.056 +0.035	20	±0.150	**B-S16-21**

Note) Please contact **NTN** for the type of oil.

d 17～25mm

Dimension mm						Product number
Bore diameter φ*d*		Outside diameter φ*D*		Length ℓ		
17	+0.018 0	22	+0.056 +0.035	25	±0.100	**B-S17-2**
17	+0.018 0	23	+0.056 +0.035	18	0 −0.100	**B-S17-6**
18	+0.018 0	22	+0.055 +0.040	15	±0.150	**B-S18-3**
18	+0.018 0	22	+0.056 +0.035	20	±0.150	**B-S18-5**
18	+0.018 0	24	+0.056 +0.035	20	±0.150	**B-S18-13**
20	+0.021 0	24	+0.062 +0.041	15	±0.100	**B-S20-1**
20	+0.041 +0.020	25	+0.043 +0.022	13	0 −0.200	**B-S20-1046**
20	+0.021 0	25	+0.062 +0.041	20	±0.150	**B-S20-12**
20	+0.055 +0.035	25	+0.047 +0.027	25	±0.200	**B-S20-13**
20	+0.021 0	26	+0.062 +0.041	15	0 −0.300	**B-S20-22**
20	+0.021 0	26	+0.062 +0.041	20	±0.150	**B-S20-24**
20	+0.021 0	26	+0.062 +0.041	25	±0.150	**B-S20-26**
20	+0.021 0	26	+0.062 +0.041	28	±0.150	**B-S20-1027**
20	+0.045 +0.025	26	+0.062 +0.041	30	±0.150	**B-S20-81**
20	+0.021 0	28	+0.062 +0.041	25	0 −0.100	**B-S20-37**
20	+0.021 0	28	+0.062 +0.041	30	±0.150	**B-S20-40**
22	+0.041 +0.020	28	+0.062 +0.041	9	±0.150	**B-S22-1002**
22	+0.021 0	28	+0.062 +0.041	20	±0.150	**B-S22-4**
22	+0.021 0	28	+0.062 +0.041	30	±0.150	**B-S22-8**
24	+0.033 0	30	+0.073 +0.048	18	±0.150	**B-S24-1**
24	+0.073 +0.043	30	+0.056 +0.035	29	0 −0.400	**B-S24-2**
25	+0.033 0	30	+0.062 +0.041	15	±0.150	**B-S25-3**
25	+0.033 0	30	+0.073 +0.048	20	±0.150	**B-S25-4**
25	+0.033 0	30	+0.073 +0.048	25	±0.150	**B-S25-5**
25	+0.033 0	31	+0.062 +0.041	16	0 −0.300	**B-S25-8**
25	+0.033 0	32	+0.073 +0.048	25	±0.200	**B-S25-35**

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Sleeve type bearing Dimension table

d 28～50mm

Dimension mm						Product number
Bore diameter ϕd		Outside diameter ϕD		Length ℓ		
28	+0.033 / 0	36	+0.073 / +0.048	30	±0.150	**B-S28-5**
30	+0.033 / 0	35	+0.073 / +0.048	35	±0.200	**B-S30-8**
30	+0.033 / 0	36	+0.073 / +0.048	20	±0.150	**B-S30-13**
30	+0.033 / 0	36	+0.073 / +0.048	30	±0.200	**B-S30-17**
30	+0.090 / +0.070	37	+0.025 / +0.010	10	±0.100	**B-S30-19**
30	+0.039 / 0	38	+0.073 / +0.048	30	±0.200	**B-S30-35**
35	+0.039 / 0	40	+0.073 / +0.048	30	±0.200	**B-S35-1**
35	+0.039 / 0	41	+0.079 / +0.054	40	±0.200	**B-S35-6**
35	+0.090 / +0.070	42	+0.025 / +0.010	10	±0.100	**B-S35-7**
35	+0.039 / 0	42	+0.079 / +0.054	40	±0.200	**B-S35-13**
35	+0.039 / 0	43	+0.079 / +0.054	30	±0.150	**B-S35-17**
40	+0.039 / 0	48	+0.079 / +0.054	30	±0.150	**B-S40-4**
40	+0.039 / 0	48	+0.079 / +0.054	35	±0.200	**B-S40-11**
45	+0.110 / +0.071	52	+0.096 / +0.066	40	±0.200	**B-S45-3**
50	+0.039 / 0	58	+0.096 / +0.066	40	±0.150	**B-S50-4**

Note) Please contact **NTN** for the type of oil.

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Flange type bearing Dimension table

d 1.5～4mm

Bore diameter φd (mm)	Outside diameter φD (mm)	Length ℓ (mm)	Flange outside diameter φF (mm)	Flange thickness t (mm)	Product number
1.5 $^{+0.014}_{+0.009}$	3 $^{+0.037}_{+0.027}$	1.6	4 $^{+0.030}_{-0.100}$	0.5 ±0.050	**B-FIZ1008**
1.5 $^{+0.014}_{+0.008}$	4 $^{+0.020}_{+0.010}$	1.7	6 $^{0}_{-0.050}$	0.8 ±0.100	**B-FIZ1003**
2 $^{+0.020}_{0}$	3 $^{0}_{-0.100}$	2 ±0.100	4 ±0.100	0.5 ±0.100	**B-F2-16**
2 $^{+0.020}_{+0.010}$	3.5 $^{+0.030}_{+0.020}$	2.9	5 ±0.100	1.4 ±0.100	**B-F2-76**
2 $^{+0.004}_{0}$	4.5 $^{+0.060}_{+0.040}$	2.5 $^{0}_{-0.200}$	6 ±0.100	0.5 ±0.100	**B-F2-1**
2 $^{+0.014}_{+0.004}$	5 $^{+0.040}_{+0.030}$	2 $^{+0.050}_{-0.100}$	6 ±0.070	0.5 ±0.050	**B-F2-3**
2 $^{+0.010}_{0}$	6 $^{+0.025}_{+0.015}$	3 ±0.150	7 ±0.100	0.7 ±0.200	**B-F2-8**
3 $^{+0.025}_{0}$	5 $^{0}_{-0.030}$	3 ±0.150	8 ±0.100	1.4 $^{0}_{-0.100}$	**B-F3-1**
3 $^{+0.010}_{0}$	6 ±0.010	2.4 ±0.100	7 ±0.100	1 ±0.100	**B-F3-3**
3 $^{+0.010}_{0}$	6 ±0.010	2.9 ±0.100	7 ±0.150	1 $^{0}_{-0.100}$	**B-F3-1123**
3 $^{+0.010}_{0}$	6 ±0.050	4 ±0.100	7 ±0.050	1 $^{0}_{-0.100}$	**B-F3-7**
3 $^{+0.020}_{+0.010}$	6 $^{0}_{-0.100}$ / 5 $^{0}_{-0.100}$	4 $^{0}_{-0.100}$	7 ±0.100	1 $^{0}_{-0.100}$	**B-F3-1136K※**
3 $^{+0.017}_{+0.010}$	6.3 $^{+0.033}_{+0.020}$	3.6 ±0.100	9 ±0.100	0.8 ±0.100	**B-F3-27**
3 $^{+0.028}_{+0.022}$	7 $^{+0.045}_{+0.030}$	3 ±0.100	10 $^{-0.050}_{-0.070}$	1.2 ±0.100	**B-F3-38※**
3 $^{+0.015}_{+0.005}$	7.5 $^{+0.010}_{0}$	2.2 ±0.100	10 $^{0}_{-0.050}$	0.9	**B-F3-32※**
3 $^{+0.009}_{+0.003}$	8 $^{0}_{-0.012}$	2.8 ±0.100	10 $^{0}_{-0.018}$	1.5	**B-F3-29**
4 $^{+0.030}_{+0.010}$	6 $^{0}_{-0.050}$	2.5 ±0.100	8 ±0.100	1 ±0.100	**B-F4-1**
4 $^{+0.030}_{0}$	6 $^{-0.020}_{-0.050}$	3 ±0.200	11 ±0.200 / 9.5 $^{0}_{-0.100}$	1.5 ±0.200	**B-F4-2※**
4 $^{+0.030}_{+0.010}$	6 $^{0}_{-0.050}$	5 ±0.100	8 ±0.100	1 ±0.100	**B-F4-73**
4 $^{+0.030}_{0}$	6 $^{-0.020}_{-0.050}$	5 ±0.200	10 ±0.200	1.5 ±0.200	**B-F4-43**
4 $^{+0.030}_{+0.010}$	6 $^{0}_{-0.050}$	7 ±0.100	8 ±0.100	1 ±0.100	**B-F4-1079**
4 $^{+0.038}_{+0.020}$	6 $^{0}_{-0.018}$ / 5.6 $^{0}_{-0.100}$	5.9 ±0.100	9 ±0.100	1 ±0.100	**B-F4-1045K※**
4 $^{+0.030}_{0}$	7 $^{0}_{-0.018}$	2.5 ±0.100	8.2 ±0.100	0.6 ±0.100	**B-F4-5**

Note) The※symbol indicates the bearing with a special shape. Please contact **NTN** for details.
Please contact **NTN** for the type of oil.

Flange type bearing Dimension table

d 4～5mm

Dimension mm										Product number
Bore diameter φ*d*		Outside diameter φ*D*		Length ℓ		Flange outside diameter φ*F*		Flange thickness *t*		
4	+0.030 0	7	0 −0.058	3	±0.300	8.2	±0.100	0.6	±0.100	**B-F4-50※**
4	+0.050 +0.020	7	0 −0.050	3	±0.100	9	±0.150	0.9	±0.100	**B-F4-6**
4	+0.030 0	7	−0.025 −0.083	3	±0.300	10	±0.300	1.5		**B-F4-7**
4	+0.020 0	7	0 −0.020	4.7		9	±0.100	1.5	±0.100	**B-F4-101**
4	+0.050 +0.020	7	−0.010 −0.030	5	±0.100	9	±0.100	1	±0.100	**B-F4-93**
4	+0.048 0	7	−0.040 −0.098	6	±0.100	10	±0.200	1.5	±0.100	**B-F4-9**
4	+0.012 0	7	+0.038 +0.023	10	±0.100	9	±0.200	1.5	±0.100	**B-F4-49**
4	+0.020 0	7 6	0 −0.020 −0.100 −0.200	4.7		9	±0.100	1.5	±0.100	**B-F4-102※**
4	+0.048 0	7 6.5	−0.040 −0.098 0 −0.200	6	±0.100	10	±0.100	1.5	±0.100	**B-F4-10※**
4	+0.030 0	8	−0.025 −0.083	3	±0.300	12	±0.300	1.5		**B-F4-40**
4	+0.012 0	8	+0.046 +0.028	3.5	±0.100	10	±0.200	1	±0.100	**B-F4-36**
4	+0.018 0	8	+0.038 +0.023	4	±0.100	11	±0.100	1.5	−0.100 −0.200	**B-F4-15**
4	+0.012 0	8	+0.038 +0.023	5		12	±0.100	2	0 −0.100	**B-F4-18**
4	+0.048 0	8	−0.013 −0.049	5.4	±0.300	18	±0.200	2.2		**B-F4-35**
4	+0.045 +0.033	8	+0.038 +0.023	6	±0.150	12	±0.140	2	±0.200	**B-F4-21**
4	+0.012 0	8	+0.038 +0.023	10	±0.100	12	±0.100	2	±0.050	**B-F4-33**
4	+0.030 0	8 6.8	−0.025 −0.083 0 −0.090	8	±0.200	12	±0.140	2	±0.200	**B-F4-57※**
4	+0.060 +0.045	8 7	+0.032 +0.023 ±0.200	6	±0.100	10	±0.100	1.5	±0.200	**B-F4-42※**
4	+0.080 +0.050	8 7	−0.020 −0.070 0 −0.100	6	±0.300	12	±0.300	2	±0.300	**B-F4-1016K※**
4	+0.021 +0.015	10	+0.045 +0.030	4	±0.100	12	±0.100	1.5	±0.100	**B-F4-59※**
5	+0.050 0	7	0 −0.050	2.5	±0.100	8	±0.100	1	±0.200	**B-F5-1093**

Note) The※symbol indicates the bearing with a special shape. Please contact **NTN** for details.
Please contact **NTN** for the type of oil.

Flange type bearing Dimension table

d 5～6mm

Dimension mm										
Bore diameter φ*d*		Outside diameter φ*D*		Length ℓ		Flange outside diameter φ*F*		Flange thickness *t*		Product number
5	+0.030 0	7	0 −0.022	3	±0.100	8	±0.100	1		**B-F5-1094**
5	+0.075 0	7.92 7.5	0 −0.090 0 −0.100	5		10	±0.500	1	±0.150	**B-F5-67※**
5	+0.038 +0.020	8	+0.041 +0.023	3	±0.100	10	±0.100	1	0 −0.050	**B-F5-1056**
5	+0.038 +0.020	8	+0.041 +0.023	3	±0.100	10	±0.100	1	0 −0.050	**B-F5-53**
5	+0.050 +0.020	8	+0.028 +0.019	3.5	±0.100	11	±0.100	1.5	±0.100	**B-F5-2**
5	+0.012 0	8	+0.020 0	5	±0.100	10	±0.150	0.9	±0.100	**B-F5-4**
5	+0.025 +0.010	8	+0.038 +0.023	5	±0.100	11	±0.200	1	±0.100	**B-F5-5**
5	+0.025 +0.013	8	+0.038 +0.023	6	±0.100	11	±0.150	1.5	±0.100	**B-F5-7**
5	+0.025 +0.010	8	+0.038 +0.023	7	±0.100	11	±0.100	1	±0.100	**B-F5-72**
5	+0.025 +0.010	8	+0.038 +0.023	11	±0.150	11	±0.200	1	±0.100	**B-F5-1081**
5	+0.018 0	9	0 −0.018	4	±0.100	11	±0.100	1.5	±0.100	**B-F5-10**
5	+0.012 0	9	+0.038 +0.023	4.3	±0.100	11	±0.100	0.8	±0.200	**B-F5-11**
5	+0.018 +0.003	9 8	+0.045 +0.030 −0.050 −0.200	9.5	±0.150	11	±0.200	1.5	±0.100	**B-F5-13※**
5	+0.020 +0.005	10	+0.038 +0.023	4	±0.100	12	±0.100	1	±0.100	**B-F5-30**
6	+0.048 0	8	0 −0.058	2.6	±0.200	10	±0.300	1	±0.100	**B-F6-1272**
6	+0.120 0	8	−0.013 −0.103	3	±0.300	10	±0.300	1	±0.300	**B-F6-1247**
6	+0.030 +0.010	8	0 −0.050	3	±0.100	10	±0.100	1	±0.100	**B-F6-3**
6	+0.120 0	8	−0.010 −0.030	4	±0.500	10	±0.500	1	±0.500	**B-F6-1068**
6	+0.038 +0.020	8	−0.013 −0.035	4	±0.100	10	±0.200	1	±0.100	**B-F6-1099**
6	+0.030 +0.010	8	0 −0.050	4	±0.100	10	±0.100	1	±0.100	**B-F6-1292**
6	+0.012 0	8	0 −0.015	5	±0.100	12	±0.100	1	±0.200	**B-F6-121**
6	+0.015 0	8	+0.038 +0.023	5.8	±0.150	12	±0.100	2	±0.100	**B-F6-92**
6	+0.030 +0.010	8	0 −0.050	6	±0.100	10	±0.100	1	±0.100	**B-F6-1111**
6	+0.020 0	8	−0.008 −0.030	9	±0.200	10	±0.200	1	±0.100	**B-F6-1122**

Note) The※symbol indicates the bearing with a special shape. Please contact **NTN** for details.
Please contact **NTN** for the type of oil.

Flange type bearing Dimension table

d 6mm

Bore diameter φ*d*		Outside diameter φ*D*		Length *ℓ*		Flange outside diameter φ*F*		Flange thickness *t*		Product number
Dimension mm										
6	+0.030 +0.010	8	0 −0.043	10	±0.150	10	±0.100	1	±0.100	**B-F6-306**
6	+0.035 +0.025	9	+0.038 +0.023	4	0 −0.100	11	±0.100	1	0 −0.100	**B-F6-180**
6	+0.018 0	9	+0.034 +0.019	4	±0.100	11	±0.100	1	±0.100	**B-F6-6**
6	+0.012 0	9	+0.030 +0.015	6	±0.100	12	±0.100	1.5	±0.100	**B-F6-168**
6	+0.018 0	9	+0.034 +0.019	7	±0.100	11	±0.100	1	±0.100	**B-F6-8**
6	+0.012 0	9	+0.028 +0.019	7	±0.150	12	±0.100	2	±0.200	**B-F6-289**
6	+0.018 0	9	+0.034 +0.019	9	+0.200 0	11	±0.200	1	0 −0.100	**B-F6-10**
6	+0.032 +0.020	9	+0.038 +0.023	10	±0.100	11	±0.100	1	0 −0.200	**B-F6-1324**
6	+0.030 0	9 7.8	−0.025 −0.083 0 −0.090	5	±0.200	11	±0.200	2	±0.200	**B-F6-283※**
6	+0.030 0	9 8	−0.013 −0.036 0 −0.058	5.5	±0.300	13	±0.300	1.5	±0.300	**B-F6-84※**
6	+0.012 0	9 8.5	+0.021 +0.006 0 −0.100	3	±0.100	12	±0.100	1.5	0 −0.200	**B-F6-1123K※**
6	+0.012 0	9 8.5	+0.021 +0.006 0 −0.100	5.5	±0.200	12	±0.100	1.5	0 −0.200	**B-F6-7※**
6	+0.030 0	9.6 8	0 −0.040 0 −0.100	10	0 −0.200	12	±0.100	1.5	0 −0.200	**B-F6-185※**
6	+0.012 0	10	+0.038 +0.023	2.5	±0.100	12	±0.100	1	±0.100	**B-F6-181**
6	+0.012 0	10	+0.038 +0.023	3.5	±0.100	12	±0.100	1	±0.100	**B-F6-14**
6	+0.045 +0.033	10	+0.038 +0.023	3.8	±0.200	14	±0.140	1	±0.200	**B-F6-116**
6	+0.012 0	10	+0.038 +0.023	4	±0.100	12	±0.100	1.5	±0.100	**B-F6-15**
6	+0.048 0	10	−0.025 −0.061	4	±0.200	14	±0.200	1	±0.200	**B-F6-182**
6	+0.030 0	10	−0.025 −0.061	4	±0.100	14	±0.140	2	±0.200	**B-F6-18**
6	+0.030 0	10	0 −0.036	4.5	0 −0.100	12	±0.200	1	±0.100	**B-F6-178**
6	+0.020 0	10	0 −0.020	4.5	0 −0.200	12	±0.200	2	0 −0.100	**B-F6-20**

Note) The※symbol indicates the bearing with a special shape. Please contact **NTN** for details.
Please contact **NTN** for the type of oil.

Flange type bearing Dimension table

d 6mm

Dimension mm										Product number
Bore diameter φd		Outside diameter φD		Length ℓ		Flange outside diameter φF		Flange thickness t		
6	+0.030 +0.015	10	+0.038 +0.023	5	±0.100	12	±0.100	1	±0.100	**B-F6-163**
6	+0.012 0	10	+0.038 +0.023	5	±0.100	12	±0.100	2	±0.100	**B-F6-24**
6	+0.078 +0.030	10	0 −0.058	5	±0.100	14	0 −0.200	1.5	0 −0.300	**B-F6-128**
6	+0.045 +0.033	10	+0.038 +0.023	5	±0.200	14	±0.140	2	±0.200	**B-F6-106**
6	+0.025 0	10	0 −0.015	6	±0.100	12	±0.120	2	±0.100	**B-F6-1112**
6	+0.045 +0.033	10	+0.038 +0.023	6	±0.220	14	±0.140	2	±0.200	**B-F6-30**
6	+0.012 0	10	+0.038 +0.023	6.5	±0.100	12	±0.100	1.5	0 −0.100	**B-F6-130**
6	+0.025 0	10	0 −0.015	7	±0.100	12	±0.120	2	±0.100	**B-F6-35**
6	+0.012 0	10	+0.046 +0.028	7	±0.150	14	±0.100	2	±0.100	**B-F6-36**
6	+0.050 +0.020	10	0 −0.050	7.5	0 −0.300	14	±0.100	2	0 −0.100	**B-F6-269※**
6	+0.015 0	10	+0.038 +0.023	8	±0.100	14	±0.200	1	±0.050	**B-F6-40**
6	+0.035 +0.015	10	+0.046 +0.028	8	±0.150	14	±0.100	2	±0.200	**B-F6-41**
6	+0.012 0	10	+0.046 +0.028	9	±0.150	14	±0.100	2	±0.100	**B-F6-46**
6	+0.035 +0.015	10	+0.046 +0.028	9	±0.100	14	±0.100	2	0 −0.050	**B-F6-47**
6	+0.015 0	10	+0.046 +0.028	10	±0.150	14	±0.100	2	±0.100	**B-F6-1035**
6	+0.070 +0.020	10 8	−0.025 −0.061 −0.020 −0.170	4.5	0 −0.300	14	±0.100	1.5	0 −0.100	**B-F6-270※**
6	+0.060 +0.010	10 8	−0.010 −0.050 0 −0.100	6	±0.200	12	±0.300	2	0 −0.200	**B-F6-1201K※**
6	+0.070 +0.020	10 8	−0.025 −0.061 −0.020 −0.170	6	0 −0.300	14	±0.100	1.5	0 −0.100	**B-F6-29※**
6	+0.050 +0.020	10 8	−0.025 −0.047 −0.040 −0.180	7	±0.150	12	±0.150	1	±0.100	**B-F6-34※**
6	+0.030 +0.010	10 8	−0.010 −0.030 0 −0.150	7	±0.100	12	±0.200	1	±0.100	**B-F6-83※**

Note) The※symbol indicates the bearing with a special shape. Please contact **NTN** for details.
Please contact **NTN** for the type of oil.

Flange type bearing Dimension table

d 6mm

Bore diameter ϕd		Outside diameter ϕD		Length ℓ		Flange outside diameter ϕF		Flange thickness t		Product number
6	+0.030 +0.010	10 / 8	−0.010 −0.030 / 0 −0.150	8	±0.100	12	±0.200	1	±0.100	**B-F6-364K※**
6	+0.030 0	10 / 8.8	−0.025 −0.083 / 0 −0.090	3.5	±0.500	12	±0.500	1.5	+0.100 −0.200	**B-F6-78※**
6	+0.030 0	10 / 8.8	−0.025 −0.083 / 0 −0.090	4	±0.200	14	±0.140	2	±0.200	**B-F6-112※**
6	+0.030 0	10 / 8.8	−0.025 −0.083 / 0 −0.090	6	±0.200	14	±0.140	2	±0.200	**B-F6-1187K※**
6	+0.030 0	10 / 8.8	−0.025 −0.083 / 0 −0.090	8	±0.200	14	±0.140	2	±0.200	**B-F6-45※**
6	+0.030 0	10 / 8.8	−0.025 −0.083 / 0 −0.090	12	±0.200	14	±0.300	2	±0.200	**B-F6-104※**
6	+0.030 0	10 / 8.8	±0.200 / 0 −0.090	12	±0.200	14	±0.200	2	±0.200	**B-F6-1301K※**
6	+0.012 0	10 / 9	+0.038 +0.023 / 0 −0.100	4	±0.100	12	±0.150	1.5	±0.100	**B-F6-16※**
6	+0.012 0	10 / 9	+0.038 +0.023 / 0 −0.100	6	±0.100	12	±0.150	1.5	±0.100	**B-F6-98※**
6	+0.022 +0.010	11	+0.041 +0.023	5	±0.100	14	±0.100	2	±0.100	**B-F6-57**
6	+0.022 +0.010	11	0 −0.025	7	±0.150	14	±0.100	2	±0.100	**B-F6-58**
6	+0.025 +0.003	11	+0.040 +0.025	10	±0.150	14	±0.100	3	±0.100	**B-F6-60**
6	+0.024 +0.008	11 / 10	0 −0.200 / 0 −0.050	3	±0.100	13	±0.100	1	±0.100	**B-F6-169※**
6	+0.020 +0.010	12	+0.019 +0.001	4	±0.100	12.7	0 −0.300	1	0 −0.150	**B-F6-171**
6	+0.050 +0.010	12	0 −0.050	4	±0.200	15.8	0 −0.300	1.5	±0.100	**B-F6-176※**

Note) The※symbol indicates the bearing with a special shape. Please contact **NTN** for details.
Please contact **NTN** for the type of oil.

Flange type bearing Dimension table

d 6～8mm

Dimension mm										Product number
Bore diameter ϕd		Outside diameter ϕD		Length ℓ		Flange outside diameter ϕF		Flange thickness t		
6	+0.012 0	12	−0.050 −0.077	5	0 −0.100	16 14.5	±0.250 ±0.150	2	±0.100	**B-F6-63※**
7	+0.015 0	10	+0.038 +0.023	6	±0.100	13	±0.100	1.3	±0.100	**B-F7-1**
7	+0.036 0	10	−0.025 −0.061	8	±0.100	12	±0.100	2	±0.100	**B-F7-3**
8	+0.036 0	10	−0.025 −0.047	3	±0.200	11.2	±0.200	0.6		**B-F8-285**
8	+0.021 +0.005	10	+0.038 +0.023	5	±0.100	13	±0.100	2	±0.200	**B-F8-1**
8	+0.058 0	10	0 −0.036	5.5	±0.300	12	±0.300	2	±0.100	**B-F8-200**
8	+0.060 +0.040	10	+0.038 +0.023	10	±0.300	14	±0.300	1	±0.100	**B-F8-310**
8	+0.035 +0.013	11	−0.016 −0.043	4.5	±0.100	13	±0.100	1.5	±0.100	**B-F8-1078**
8	+0.020 0	11	+0.050 +0.030	7	±0.100	14	±0.100	2	±0.100	**B-F8-3**
8	+0.060 +0.040	11	+0.038 +0.023	7	±0.100	15.5	−0.100 −0.150	2	±0.100	**B-F8-4**
8	+0.022 0	12	+0.060 +0.033	4	±0.100	16	±0.100	1.5	±0.100	**B-F8-8**
8	+0.015 0	12	+0.046 +0.028	4.5	±0.100	16	±0.100	2	±0.200	**B-F8-100**
8	+0.049 +0.013	12	+0.046 +0.028	5	±0.200	14	±0.200	2	±0.200	**B-F8-199**
8	+0.050 +0.020	12	0 −0.050	5	±0.100	16	±0.150	2	±0.100	**B-F8-13※**
8	+0.036 0	12	−0.032 −0.075	5	±0.300	16	±0.300	2	±0.300	**B-F8-16**
8	+0.070 +0.050	12	+0.040 +0.020	6	±0.100	14	±0.100	2	±0.200	**B-F8-188**
8	+0.020 0	12	+0.050 +0.030	6	0 −0.100	16	±0.100	2	0 −0.100	**B-F8-23**
8	+0.020 0	12	+0.050 +0.030	7	±0.100	14	±0.100	2	±0.100	**B-F8-25**
8	+0.020 0	12	−0.005 −0.025	7	±0.150	14 13	±0.150 ±0.050	2	±0.100	**B-F8-26※**
8	+0.020 0	12	−0.005 −0.025	7	±0.150	14 13	+0.050 −0.150 ±0.050	2	±0.100	**B-F8-27※**
8	+0.015 0	12	+0.046 +0.028	7	±0.200	16	±0.100	1.5	±0.100	**B-F8-29**
8	+0.015 +0.003	12	+0.040 +0.012	8	0 −0.100	16	±0.150	2	0 −0.100	**B-F8-1015**
8	+0.015 0	12	+0.040 +0.012	8	0 −0.100	16	±0.150	2	0 −0.100	**B-F8-33**

Note) The※symbol indicates the bearing with a special shape. Please contact **NTN** for details.
Please contact **NTN** for the type of oil.

Flange type bearing Dimension table

d 8mm

Bore diameter ϕd	Outside diameter ϕD	Length ℓ	Flange outside diameter ϕF	Flange thickness t	Product number
Dimension mm					
8 $^{+0.049}_{+0.013}$	12 $^{+0.075}_{+0.032}$	10 ±0.300	14 ±0.300	1 ±0.100	**B-F8-146**
8 $^{+0.015}_{0}$	12 $^{+0.046}_{+0.028}$	10 $^{0}_{-0.300}$	15 ±0.100	2 ±0.100	**B-F8-41**
8 $^{+0.050}_{+0.020}$	12 $^{0}_{-0.050}$	10 ±0.150	16 ±0.150	2 ±0.100	**B-F8-45※**
8 $^{+0.040}_{+0.020}$	12 $^{0}_{-0.050}$	10 ±0.100	16 ±0.200 14 ±0.200	1.7 ±0.100	**B-F8-121※**
8 $^{+0.050}_{+0.020}$	12 $^{0}_{-0.050}$	12 $^{0}_{-0.300}$	14 ±0.100	1.5 $^{0}_{-0.100}$	**B-F8-50**
8 $^{+0.015}_{0}$	12 $^{+0.046}_{+0.028}$	12 ±0.150	14 ±0.100	2.5 ±0.100	**B-F8-52**
8 $^{+0.055}_{+0.040}$	12 $^{+0.046}_{+0.028}$	12 ±0.220	16 ±0.140	2 ±0.200	**B-F8-103**
8 $^{+0.036}_{0}$	12 $^{-0.032}_{-0.102}$	15 ±0.500	16 ±0.300	2 ±0.200	**B-F8-58**
8 $^{+0.061}_{+0.025}$	12 $^{-0.032}_{-0.075}$ 10 $^{-0.040}_{-0.200}$	6.5 ±0.100	14 ±0.100	1 ±0.100	**B-F8-160※**
8 $^{+0.036}_{0}$	12 $^{-0.050}_{-0.080}$ 10.8 $^{0}_{-0.110}$	4 ±0.100	16 ±0.140	2 ±0.200	**B-F8-1110K※**
8 $^{+0.036}_{0}$	12 $^{-0.032}_{-0.102}$ 10.8 $^{0}_{-0.110}$	4 ±0.200	16 ±0.140	2 ±0.200	**B-F8-9※**
8 $^{+0.036}_{0}$	12 $^{-0.032}_{-0.102}$ 10.8 $^{0}_{-0.070}$	4.5 ±0.200	16 ±0.150	1 ±0.150	**B-F8-10※**
8 $^{+0.036}_{0}$	12 $^{-0.032}_{-0.102}$ 10.8 $^{0}_{-0.110}$	4.8 ±0.200	16 ±0.500	2 ±0.200	**B-F8-12※**
8 $^{+0.036}_{0}$	12 $^{-0.032}_{-0.102}$ 10.8 $^{0}_{-0.110}$	5 ±0.200	16 ±0.140 12 ±0.200	2 ±0.200	**B-F8-195※**
8 $^{+0.022}_{0}$	12 $^{-0.032}_{-0.102}$ 10.8 $^{0}_{-0.110}$	6 ±0.200	16 ±0.140	2 ±0.200	**B-F8-112※**
8 $^{+0.036}_{0}$	12 $^{-0.032}_{-0.102}$ 10.8 $^{0}_{-0.110}$	8 ±0.200	16 ±0.140	2 ±0.100	**B-F8-101※**

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Flange type bearing Dimension table

d 8～10mm

Dimension mm										Product number
Bore diameter φd		Outside diameter φD		Length ℓ		Flange outside diameter φF		Flange thickness t		
8	+0.036 0	12 10.8	−0.032 / −0.102 0 / −0.110	12	±0.200	16	±0.200	2	±0.100	**B-F8-116※**
8	+0.036 0	12 10.8	−0.032 / −0.102 0 / −0.110	14	±0.200	16	±0.140	2	±0.200	**B-F8-56※**
8	+0.036 0	12 11	0 / −0.100 0 / −0.100	10	±0.100	15	±0.100	2	±0.100	**B-F8-152※**
8	+0.040 +0.025	12.5	0 −0.100	6	±0.100	19	±0.100	2	±0.100	**B-F8-60**
8	+0.015 0	12.5	+0.100 0	12	±0.150	25	±0.150	3	+0.100 0	**B-F8-62**
8	+0.050 +0.030	13	+0.050 +0.030	12	±0.100	15	±0.100	3	±0.100	**B-F8-68**
8	+0.050 +0.010	13 10	−0.010 / −0.050 +0.100 / −0.050	9.5	±0.150	16	±0.100	1.5	±0.100	**B-F8-65※**
8	+0.017 0	13 12	+0.041 / +0.023 0 / −0.100	5	±0.100	16	±0.150	2	±0.100	**B-F8-64※**
8	+0.020 0	14	−0.032 −0.075	4	±0.300	15.6	±0.100	0.8	0 −0.200	**B-F8-305**
8	+0.036 0	14	−0.032 −0.075	4	±0.150	18	±0.200	1	±0.300	**B-F8-74**
8	+0.020 0	14	−0.005 −0.025	6	0 −0.100	16 15	±0.150 ±0.050	2	±0.100	**B-F8-78※**
8	+0.015 0	15 12	0 / −0.018 −0.050 / −0.200	8	±0.100	20	±0.100	3	0 −0.100	**B-F8-88※**
8	+0.028 +0.005	16	+0.046 +0.028	17	±0.100	22	±0.100	2	±0.100	**B-F8-169**
9	+0.040 +0.020	12	+0.026 +0.006	10.5	±0.100	14	±0.200	1.5	±0.100	**B-F9-2**
10	+0.015 0	13	+0.046 +0.028	5.7	±0.100	14	±0.100	1	±0.100	**B-F10-117**
10	+0.036 0	14	0 −0.110	4	±0.300	16	±0.400	2	±0.150	**B-F10-3**
10	+0.015 0	14	+0.046 +0.028	5	±0.100	18	±0.100	2	±0.100	**B-F10-7**
10	+0.020 +0.005	14	+0.046 +0.028	5	±0.100	19	±0.150	2	±0.100	**B-F10-87**
10	+0.015 0	14	+0.046 +0.028	6	±0.100	18	±0.100	2	±0.100	**B-F10-72**

Note) The※symbol indicates the bearing with a special shape. Please contact **NTN** for details.
Please contact **NTN** for the type of oil.

Flange type bearing Dimension table

d 10mm

Dimension mm										Product number
Bore diameter φ*d*		Outside diameter φ*D*		Length ℓ		Flange outside diameter φ*F*		Flange thickness *t*		
10	+0.045 +0.030	14	+0.050 +0.032	6	±0.100	18	±0.200	2	±0.100	**B-F10-96**
10	+0.050 +0.020	14	0 −0.050	7	±0.150	18	±0.100	2	±0.100	**B-F10-10**
10	+0.040 +0.025	14	+0.046 +0.028	7.5	±0.150	18	±0.100	2	±0.100	**B-F10-11**
10	+0.055 +0.040	14	+0.046 +0.028	8	±0.100	18	±0.100	2	±0.100	**B-F10-12**
10	+0.015 0	14	+0.046 +0.028	10	±0.100	18	±0.100	2	±0.100	**B-F10-15**
10	+0.050 +0.020	14	0 −0.050	10	0 −0.300	18	±0.150	2	0 −0.100	**B-F10-17※**
10	+0.055 +0.040	14	+0.046 +0.028	12	±0.220	18	±0.140	2	±0.200	**B-F10-23**
10	+0.015 0	14	+0.046 +0.028	16	±0.100	18	±0.100	2	±0.100	**B-F10-26**
10	+0.015 0	14	+0.046 +0.028	18	±0.200	18	±0.100	2	±0.100	**B-F10-70**
10	+0.036 +0.016	14 12	0 −0.043 0 −0.200	7	±0.200	17 12	±0.200 0 −0.200	1.5	±0.200	**B-F10-9※**
10	+0.036 0	14 12.8	−0.032 −0.102 0 −0.110	4	±0.200	18	±0.140	2	±0.200	**B-F10-63※**
10	+0.036 0	14 12.8	−0.032 −0.102 0 −0.110	6	±0.200	18	±0.140	2	±0.200	**B-F10-131K※**
10	+0.036 0	14 12.8	−0.032 −0.102 0 −0.110	8	±0.200	18	±0.140	2	±0.200	**B-F10-60※**
10	+0.015 0	15	+0.046 +0.028	6.5	±0.100	18	±0.100	2	±0.100	**B-F10-28**
10	+0.035 +0.013	15	+0.041 +0.023	10	±0.100	18	±0.100	2	±0.100	**B-F10-30**
10	+0.020 0	15	+0.050 +0.030	13	±0.100	18	±0.100	2.5	±0.100	**B-F10-32**
10	+0.035 +0.013	15	+0.041 +0.023	15	±0.100	18	±0.100	2	±0.100	**B-F10-80**
10	+0.035 +0.013	15 14	+0.041 +0.023 0 −0.100	6	0 −0.100	18	±0.100	2	±0.100	**B-F10-1026K※**
10	+0.040 +0.025	16	+0.041 +0.023	6	±0.100	22	±0.100	3	±0.100	**B-F10-37**
10	+0.055 +0.040	16	+0.046 +0.028	10	±0.180	22	±0.170	3	±0.200	**B-F10-54**
10	+0.090 +0.070	16	+0.040 0	12	±0.100	19	+0.040 0	2	±0.100	**B-F10-41**

Note) The※symbol indicates the bearing with a special shape. Please contact **NTN** for details.
Please contact **NTN** for the type of oil.

Flange type bearing Dimension table

d 10～16mm

Dimension mm										Product number
Bore diameter ϕd		Outside diameter ϕD		Length ℓ		Flange outside diameter ϕF		Flange thickness t		
10	+0.040 +0.025	16	+0.041 +0.023	16	±0.100	22	±0.100	3	±0.100	**B-F10-42**
10	+0.015 0	16	+0.046 +0.028	16	±0.150	22	±0.200	3	±0.100	**B-F10-65**
10	+0.040 +0.025	16	+0.041 +0.023	17	±0.150	22	±0.150	3	±0.100	**B-F10-44**
10	+0.015 0	16	+0.046 +0.028	20	±0.150	22	±0.150	3	±0.100	**B-F10-45**
10	+0.070 +0.050	16 15	+0.025 +0.005 0 −0.150	6	±0.200	19	±0.100	2	±0.100	**B-F10-36※**
12	+0.058 +0.040	16	+0.046 +0.028	8	0 −0.100	20	±0.170	2	±0.100	**B-F12-5**
12	+0.058 +0.040	16	+0.046 +0.028	10	±0.180	20	±0.170	2	±0.200	**B-F12-6**
12	+0.018 0	16	+0.036 +0.018	11	±0.100	22	±0.100	2	±0.100	**B-F12-8**
12	+0.058 +0.040	16	+0.046 +0.028	14	±0.220	20	±0.170	2	0 −0.200	**B-F12-1054**
12	+0.043 0	16 14.8	−0.032 −0.102 0 −0.150	8	±0.200	20	±0.140	2	±0.200	**B-F12-4※**
12	+0.018 0	17	+0.046 +0.028	18	±0.150	20	±0.100	3	±0.100	**B-F12-16**
12	+0.058 +0.040	18	+0.046 +0.028	5.6	±0.100	24	±0.170	3	±0.200	**B-F12-1018**
12	+0.058 +0.040	18	+0.046 +0.028	8	±0.200	24	±0.170	3	±0.200	**B-F12-63**
12	+0.018 0	18	+0.046 +0.028	12	±0.150	24	±0.100	3	±0.100	**B-F12-22**
12	+0.018 0	18	+0.046 +0.028	15	±0.100	24	±0.100	3	±0.100	**B-F12-25**
12	+0.018 0	18	+0.046 +0.028	20	±0.150	24	±0.100	3	±0.100	**B-F12-27**
12	+0.032 +0.012	18	+0.046 +0.028	25	±0.200	21	±0.150	2	0 −0.200	**B-F12-28**
14	+0.058 +0.040	18	+0.046 +0.028	14	±0.220	22	±0.170	2	±0.200	**B-F14-6**
14	+0.018 0	20	+0.056 +0.035	16	±0.150	24	±0.100	2	±0.100	**B-F14-3**
14	+0.041 +0.020	20	+0.056 +0.035	20	±0.150	26	±0.100	3	±0.100	**B-F14-4**
15	+0.034 +0.016	19	−0.100 −0.150	12	±0.500	23	±0.200	2	±0.200	**B-F15-11**
15	+0.080 +0.050	20	+0.050 +0.020	18	±0.150	24	0 −0.300	9	±0.100	**B-F15-1※**
15	+0.018 0	21	+0.056 +0.035	16	±0.150	25	±0.120	2.5	±0.100	**B-F15-1013**
16	+0.035 +0.015	20	+0.056 +0.035	13.5	±0.120	28	±0.150	2	±0.100	**B-F16-1014**

Note) The※symbol indicates the bearing with a special shape. Please contact **NTN** for details.
Please contact **NTN** for the type of oil.

Flange type bearing Dimension table

d 16～40mm

Bore diameter ϕd		Outside diameter ϕD		Length ℓ		Flange outside diameter ϕF		Flange thickness t		Product number
Dimension mm										
16	+0.024 +0.006	21	+0.056 +0.035	8.5	±0.150	23	±0.100	1.5	±0.100	**B-F16-7**
16	+0.018 0	22	+0.035 +0.015	25	±0.150	28	±0.100	3	±0.100	**B-F16-12**
18	+0.018 0	23	+0.043 +0.022	20	±0.150	29	±0.100	3	±0.100	**B-F18-1**
20	+0.021 0	26	+0.079 +0.054	15	±0.150	32	±0.100	3	±0.100	**B-F20-1006**
20	+0.041 +0.020	26	0 −0.025	20	±0.150	32	±0.150	4	±0.100	**B-F20-5**
22	+0.021 0	28	+0.062 +0.041	12	±0.200	34	±0.300	3	±0.200	**B-F22-2**
22	+0.021 0	28	+0.062 +0.041	18	±0.100	34	±0.100	3	±0.100	**B-F22-1**
25	+0.041 +0.020	32	+0.060 +0.028	30	±0.200	39	±0.100	3.5	±0.100	**B-F25-4**
30	+0.053 +0.020	35	+0.010 −0.015	30	±0.150	39	0 −0.100	2.5	0 −0.200	**B-F30-1**
40	+0.216 +0.177	50	+0.073 +0.041	30	±0.150	60	±0.150	5	±0.150	**B-F40-1**

Note) The※symbol indicates the bearing with a special shape. Please contact **NTN** for details.
Please contact **NTN** for the type of oil.

Spherical type bearing Dimension table

d 3~8mm

Dimension mm								Product number
Bore diameter ϕd		Outside diameter ϕD		Length ℓ		Spherical diameter $\phi D'$		
3	+0.008 / 0	6.9		4	±0.100	7	±0.050	**B-A3-7**
3	+0.010 / 0	7.8		5	±0.100	8	±0.050	**B-A3-16**
3.5	+0.011 / +0.006	7.8	+0.200 / 0	6	±0.100	8	±0.050	**B-A3Z8**
4	+0.010 / +0.002	7.8		6	±0.100	8	±0.050	**B-A4-29**
4	+0.008 / 0	7.8		6	±0.100	8	±0.050	**B-A4-22**
4	+0.012 / 0	7.95	0 / −0.150	5.4	±0.100	8	±0.050	**B-A4-1038-A1**
4	+0.020 / +0.012	9.8	+0.150 / 0	7	±0.100	10	±0.050	**B-A4-57**
4.8	+0.016 / +0.006	10.8		8	±0.150	11	0 / −0.150	**B-A4Z13**
5	+0.012 / 0	9.8	+0.150 / 0	7	±0.100	10	±0.050	**B-A5-32**
5	+0.012 / +0.002	9.9		7	±0.100	10	±0.050	**B-A5-46**
5	+0.012 / 0	11.8	±0.100	8	±0.100	12	±0.050	**B-A5-19**
5	+0.012 / 0	11.8	±0.120	8	±0.150	12	±0.150	**B-A5-16**
6	+0.010 / +0.002	11.7		8	±0.150	12	±0.050	**B-A6-2**
8	+0.015 / 0	14.75		9	±0.100	15	±0.050	**B-A8-7**
8	+0.015 / 0	15.7	+0.200 / −0.100	11	±0.100	16	±0.070	**B-A8-37**

Mini pillow unit/ Mini flange unit/ Mini side flange unit bearing Dimension table

d 6～20mm

Dimension mm Bore diameter ϕd	Outside diameter ϕD	Length ℓ	Spherical diameter $\phi D'$	Bearing product number	Unit product number
$6^{+0.012}_{0}$	11.8	8 ±0.100	12 ±0.050	**B-A6-3E**	**B-BAP608** **B-BAF608**
$8^{+0.015}_{0}$	15.8	10 ±0.100	16 ±0.100	**B-A8-10E**	**B-BAP810** **B-BAF810**
$10^{+0.015}_{0}$	19.8	12 ±0.100	20 ±0.100	**B-A10-1E**	**B-BAP1012** **B-BAF1012** **B-BSF1012**
$12^{+0.018}_{0}$	$23.8^{+0.100}_{-0.200}$	14 ±0.150	24 ±0.100	**B-A12-2E**	**B-BAP1214** **B-BAF1214** **B-BSF1214**
$15^{+0.018}_{0}$	26.7	18 ±0.150	27 ±0.120	**B-A15-2E**	**B-BAP1518** **B-BAP1518H** **B-BAF1518** **B-BSF1518**
$17^{+0.018}_{0}$	29.7	20 ±0.150	30 ±0.120	**B-A17-1E**	**B-BAP1720** **B-BAP1720H** **B-BAF1720**
$20^{+0.021}_{0}$	33.6	22 ±0.150	34 ±0.100	**B-A20-2E**	**B-BAP2022** **B-BAP2022H** **B-BAF2022**