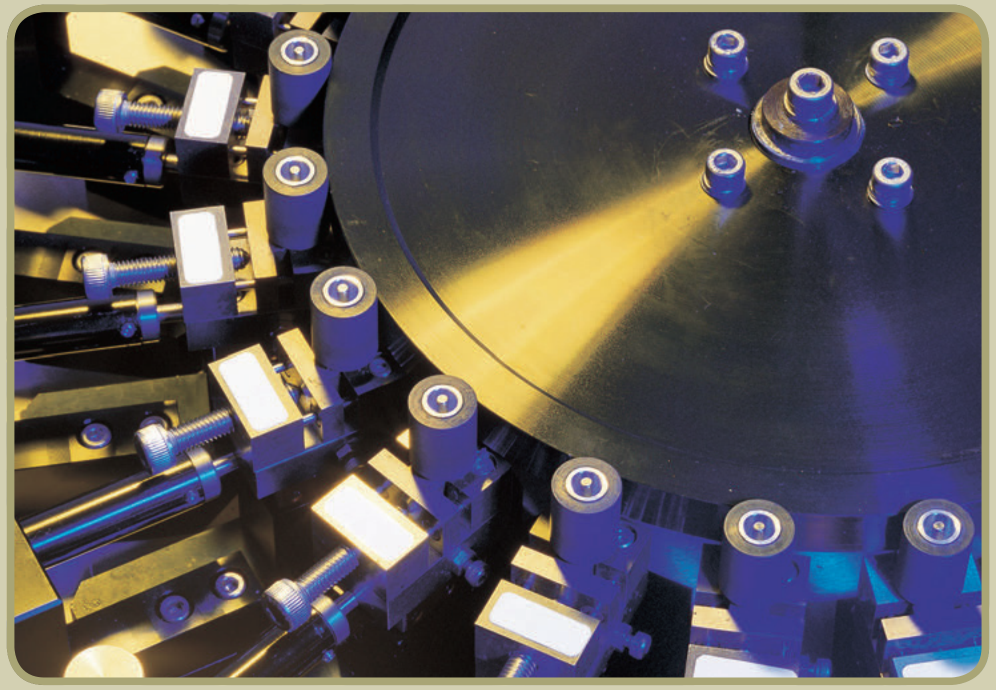
Technical Information



On Design

There is no specific method for sellection and designing of self-lubricating bearings which is a very important element in any machinary. However, selection of highly credible bearing is possible if fundamental requirements for bearing design are studied based on design process.
Here, fundamentals of tribology and fundamentals of design items will be discussed in order to improve bearing design.

Foundation of Tribology

■Contact of two solid surfaces

Contact of two solid surfaces

No matter how smooth the surface may appear, there are roughness and winding on the surface of the solid body. When two surfaces come into contact, they are actually the contacts between the rough projections of the two surfaces. Therefore, of the total area of the two surfaces the area that is actually in contact with each other is limited. As such even if the load is very small, there is strong pressure on the actual points of the contacts.
These very limited minute areas of the contacts take charge of friction between the two solid bodies, surface damage and interaction of two solid surfaces. As the load increases, projected areas of the contact surfaces go through plastic deformation and consequently the area that bears the load is expanded. As the hardness increases, the area is decreased.
These points that actually contact and support the load are called "Real Contact Points." The total sum of the contact points is called "Real Contact Area." The contact supporting area that is determined by geometric appearance is called "Apparent Contact Area."
Fig.1 shows a model of the contact.

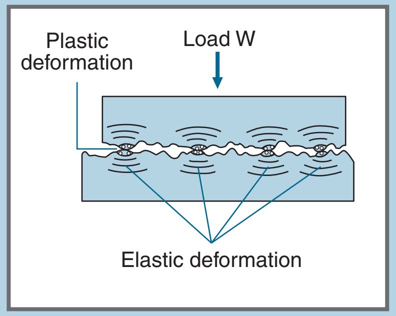


Fig.1 Real contacts of two solid surfaces

■Lubrication Mechanism

When lubrication film exists between two relatively moving surfaces, friction conditions of two contact surfaces can be classified in three steps as below:

1. **Hydrodynamic lubrication**
2. **Boundary lubrication**
3. **Solid lubrication**

Hydrodynamic Lubrication

Lubrication film between the two contact surfaces is thick enough and two contact surfaces are separated completely by viscous oil film. At this moment, frictional force of two contact surfaces is determined by viscous resistance of lubricant and it can take a very small value (coefficient of friction ; 1 × 10^{-3} to 5 × 10^{-4}). In hydrodyanmic lubrication, when shaft is rotated, the oil around the shaft also rotates due to the viscoity of the lubricant oil and generates oil pressure at the loaded area. This phenomenon is called wedge effect.
Oil pressure P generated within lubricating oil film is affected by change of temperature and viscosity of lubricating oil, surface roughness and clearance "h" and the rotational speed of the shaft "v." Fig.2 shows the model of hydrodynamic lubrication.

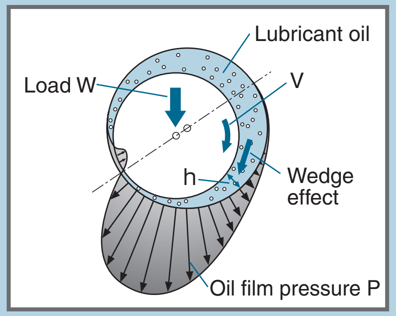


Fig.2 Distribution of oil film pressure under hydrodynamic lubrication

Boundary Lubrication

Lubricating oil film between the two contact surfaces is extremely thin and no viscous hydrodynamic oil film exists between the two. As shown in the Fig.3, only film of absorbed oil molecules exists. Absorptive oil film is arranged oil molecules that are adhered onto the solid surfaces and its shear resistance is greater than hydrodynamic oil film. Frictional force in this area, compared to hydrodyanamic lubrication, is greater (coefficient of friction ; 5 × 10^{-2} to 5 × 10^{-1}). In the frictional contact points such as real contact points, oil film is frequently broken. The lubrication condition that generates a frictional condition such as this is called "Boundary Lubrication." In order to decrease the friction under this condition, selection of self-lubricating bearing may be desirable.

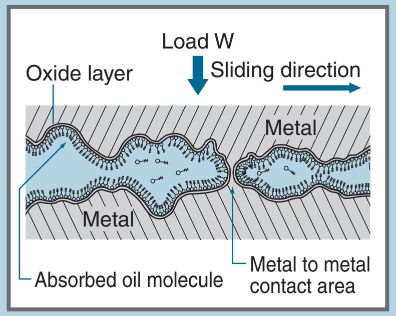


Fig.3 Modle of absorption of oil molecule in boundary lubrication

Solid lubrication (Dry friction area)

This is a condition in which two solid surfaces come into contact directly with each other. In this condition, there is no lubricating film such as hydrodynamic film or absorptive oil film. An empirical law by Amonton (1663-1705) and Coulomb (1736-1806) explains the principles of dry friction as below.

> **"Amonton and Coulomb's Law"**
> 1. Frictional force is proportional only to the vertical load applied to the contact surface of the solid body and is independent of apparent contact area.
> 2. Coefficient of friction is independent of the sliding velocity.
> 3. Under the same condition, the static friction (force required to generate sliding) is greater than kinetic (force required to maintain sliding) friction.

■Friction and Wear

There are two contradictory theories that attempt to explain mechanism of friction between the two solid surfaces. One is a theory based on concavity and convexity of solid surface. The other is a theory based on adhesion. This theory accounts adhesion which takes place between the two convex parts as a cause of friction. Recently, the adhesion of two solid surfaces is considered to be the main cause of the friction. According to the theory of adhesion, contacts of convex parts of two solid bodies consists of minute real contact points as shown in Fig.4. The very tops of convex parts are constantly squashed and generate adhesion to each other forming a junction. A relative motion breaks this junction. As such, adhesion and disjunction repeatedly occurs. Sum of the force needed to detach this adhesion is friction force. The generation of wear particles at this moment as "free wear pieces" results in wear.

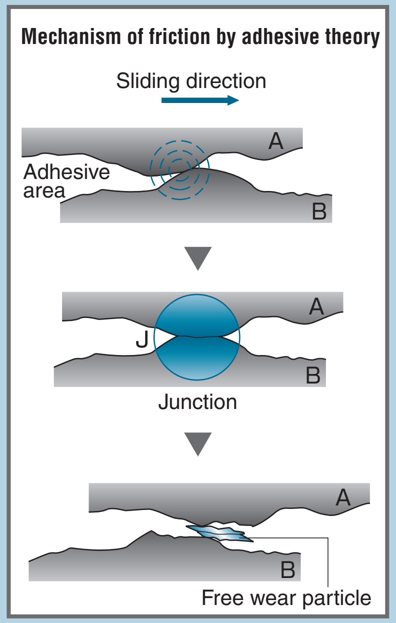


Fig.4 Mode of producing wear particles by adhesive friction

On Design

Selection and Design of Oiles Bearings

Design and required performance features

▼

Determination of rough layout

Determine I.D., O.D., length of the bearing, material of the mating shaft and lubrication method.

▼

Confirmation of application environment and design specifications

Normal environment: room temp, atmospheric air | Special enviroment: high/low temp.,underwater, chemical liquid

▼

Study of application condition

Study allowable P,V, PV value, operating motion, frequency, availability of oiling, environmental conditons, temperature, foreign particles, corrosion resistance and chemical resistance.
Study dynamic load,static load, impact load, static stress and impact strength.

Attention should be paid to special environment.

▼

Study of configuration design, detail design and standard products

Confirm and verify material, strength, rigidity, accuracy of housing and the mating shaft. Confirm and verify bearing accuracy, clearance, oil grooves and oil holes. Study restictons on bearing material manufacturing.
Study possibility of standard products.

▼

Selection of primary material

Study whether each design factor falls within each allowable limit. Then decide the material.

YES ▼ NO ▲

Confirmation of existing data and characteristics of the bearing

Confirm initial characteristics based on the test data and verify estimated service life and durability of the bearing.

▼

Determination of recommended Oiles bearings

For customized products and inquires, please contact an Oiles representative.

■P / V / PV value

P : Contact pressure P which is obtained by dividing maximum load (w) by projected loading area. (ϕdxL)

V : Relative velocity between the bearing and the mating shaft.

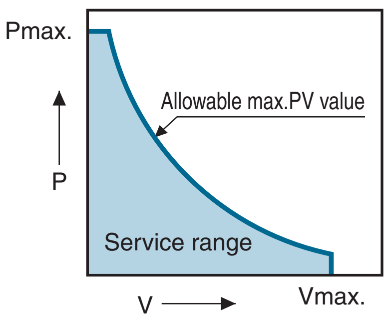
PV value: Product of the contact pressure P and the velocity V. This is the most important value in selecting bearing.

These values are not independent allowable values but are interrelated design values. When designing, values should fall under the range as shown in this graph.

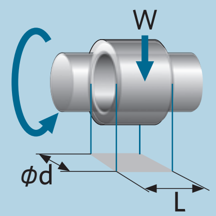
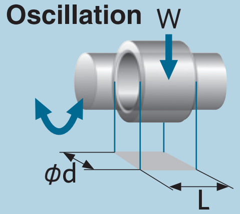
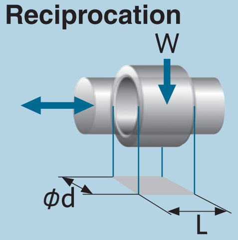
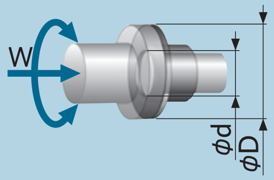
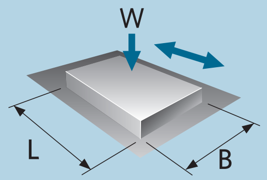
Allowable max. PV value < allowable max. contact pressure : P max. × allowable max. velocity : V max.

Each value should be obtained based on the formula listed on the next page.

Allowable PV value



■Calculation of P / V / PV value

Bushing	P N/mm² [kgf/cm²]	V m/sec [n/min]	PV N/mm²·m/sec [kgf/cm²·n/min]
Radial journal oneway rotation 	$P=\frac{W}{\phi d\times L}$, $\left\{\frac{10^2 W}{\phi d\times L}\right\}$ Load W : N {kgf} I.D. ϕd : mm Length L : mm Case:1 I.D. 20mm, length 10mm at 1000N journal load. $\frac{1000}{20\times10}=5$ (N/mm²)	$V=\frac{\pi \phi d\ n}{10^3}$, $\left\{\frac{\pi \phi d\ n}{10^3}\right\}$ Rotating speed n : s^{-1} {rpm} I.D. ϕd : mm Case:2 I.D. 20mm, rotating speed 120rpm. $\frac{\pi\times20\times2}{10^3}=0.126$ (m/sec)	$PV=\frac{\pi\ W\ n}{10^3\times L}$, $\left\{\frac{\pi\ W\ n}{10\times L}\right\}$ Load W : N {kgf} Rotating speed n : s^{-1} {rpm} Length L : mm I.D. ϕd : mm Case:3 I.D. 20mm, length 10mm, rotating speed 120rpm, 1000N journal load. $\frac{\pi\times20\times1000\times2}{10^3\times20\times100}=0.63$ (N/mm²·m/sec)
Oscillation 	$P=\frac{W}{\phi d\times L}$, $\left\{\frac{10^2 W}{\phi d\times L}\right\}$ Load W : N {kgf} I.D. ϕd : mm Length L : mm	$V=\frac{\phi d\ c\ \theta}{10^3}$, $\left\{\frac{\pi\ \phi d\ c\ \theta}{180\times10^3}\right\}$ Oscillating cycle speed c : s^{-1} {cpm} Oscillating angle θ : rad {°} I.D. ϕd : mm	$PV=\frac{W\ \phi d\ c\ \theta}{10^3\times\phi d\times L}$, $\left\{\frac{\pi\ W\ \phi d\ c\ \theta}{18\times10^2\times\phi d\times L}\right\}$ Load W : N {kgf} Cycle speed c : s^{-1} {cpm} Oscillating angle θ : rad {°} Length L : mm I.D. ϕd : mm
Reciprocation 	$P=\frac{W}{\phi d\times L}$, $\left\{\frac{10^2 W}{\phi d\times L}\right\}$ Load W : N {kgf} I.D. ϕd : mm Length L : mm	$V=\frac{2\ c\ S}{10^3}$, $\left\{\frac{2\ c\ S}{10^3}\right\}$ Reciprocation cycle speed c : s^{-1} {cpm} Stroke distance S : mm	$PV=\frac{2\ W\ c\ S}{10^3\times\phi d\times L}$, $\left\{\frac{W\ c\ S}{5\times\phi d\times L}\right\}$ Load W : N {kgf} Cycle speed c : s^{-1} {cpm} Stroke distance S : mm I.D. ϕd : mm Length L : mm
Washer	**P N/mm² [kgf/cm²]**	**V m/sec [n/min]**	**PV N/mm²·m/sec [kgf/cm²·n/min]**
Thrust motion 	Rotation $P=\frac{4W}{\pi\times(\phi D^2-\phi d^2)}$, $\left\{\frac{400W}{\pi\times(\phi D^2-\phi d^2)}\right\}$ Oscillation $P=\frac{4W}{\pi\times(\phi D^2-\phi d^2)}$, $\left\{\frac{400W}{\pi\times(\phi D^2-\phi d^2)}\right\}$ Load W : N {kgf} I.D. ϕd : mm O.D. ϕD : mm	Rotation $V=\frac{\pi\ \phi D\ n}{10^3}$, $\left\{\frac{\pi\ \phi D\ n}{10^3}\right\}$ Oscillation $V=\frac{\phi D\ c\ \theta}{10^3}$, $\left\{\frac{\pi\ \phi D\ c\ \theta}{180\times10^3}\right\}$ Rotating speed n : s^{-1} {rpm} Cycle speed c : s^{-1} {cpm} Oscillating angle θ : rad {°} O.D. ϕD : mm	Rotation $PV=\frac{4\ W\ \phi D\ n}{10^3\times(\phi D^2-\phi d^2)}$, $\left\{\frac{400\ W\ \phi D\ n}{10^3\times(\phi D^2-\phi d^2)}\right\}$ Oscillation $PV=\frac{4\ W\ \phi D\ c\ \theta}{10^3\times\pi(\phi D^2-\phi d^2)}$, $\left\{\frac{400\ W\ \phi D\ c\ \theta}{180\times10^3\times(\phi D^2-\phi d^2)}\right\}$ Load W : N {kgf} Rotating speed n : s^{-1} {rpm} Cycle speed c : s^{-1} {cpm} Oscillating angle θ : rad {°} I.D. ϕd : mm O.D. ϕD : mm
Plate	**P N/mm² [kgf/cm²]**	**V m/sec [n/min]**	**PV N/mm²·m/sec [kgf/cm²·n/min]**
Reciprocation 	$P=\frac{W}{B\times L}$, $\left\{\frac{10^2 W}{B\times L}\right\}$ Load W : N {kgf} Length L : mm Width B : mm	$V=\frac{2\ c\ S}{10^3}$, $\left\{\frac{2\ c\ S}{10^3}\right\}$ Cycle speed c : s^{-1} {cpm} Stroke distance S : mm	$PV=\frac{2\ W\ c\ S}{10^3\times B\times L}$, $\left\{\frac{W\ c\ S}{5\times B\times L}\right\}$ Load W : N {kgf} Cycle speed c : s^{-1} {cpm} Stroke distance S : mm Length L : mm Width B : mm

Selection Guide
Product Information
Plastic Bearing
Multi-layer Bearing
Metallic Bearing
Air Bearings
Slide Shifter
Technical Information
Corporate Profile

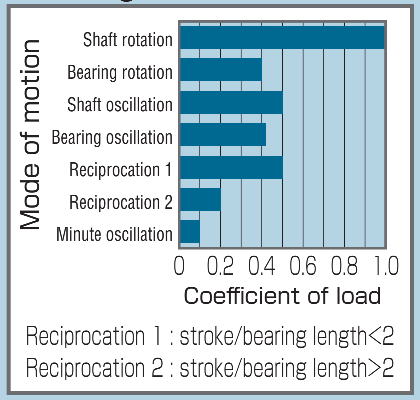
On Design

Selection and Design of Oiles Bearings

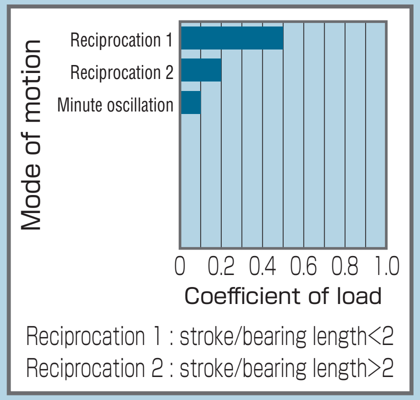
■Operating motion and PV value

PV value listed in this catalogue is allowable PV value for radial journal rotational operation. Depending on the operation motion, allowable PV value should be designed with more leeway based on the standard below.

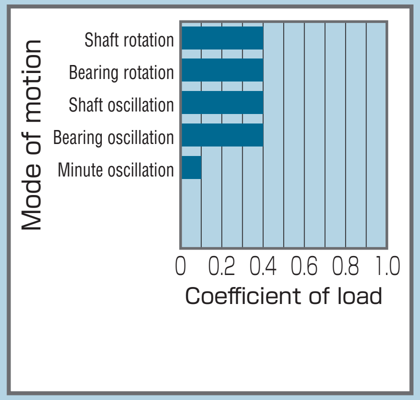
Bushing



Plate



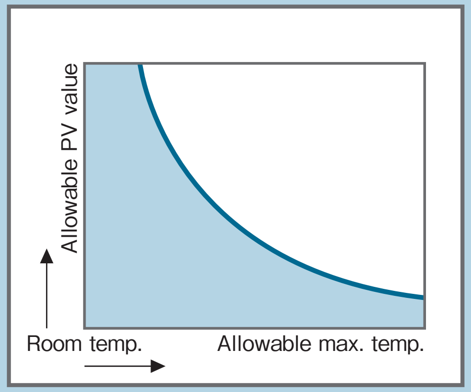
Washer



※Values in the chart are to be used only as a guide when allowable PV value of bushing at shaft rotational motion is 1.

■Environmental temperature and PV value

Service temperature range listed in the catalogue indicates heat resistance derived from the material and the structure of the bearings. Depending on the environmental temperature, it is necessary to design the bearing based on below conditions.



When a bearing is used in high temperature:

- ●PV value should be set at low level as decline of the frictional characteristics and difficulty in frictional heat diffusion may be anticipated.
- ●Decline in the hardness of the bearing material should be taken into account.
- ●Clearance decrease caused by the dimensional change of the bearing and the mating shaft due to heat expansion should be considered.
- ●In order to prevent sliding at the outer diameter and falling off of the bearing, lock screw or detent screw should be implemented taking press fitting interference decrease caused by stress relaxation of the bearing into account.

When a bearing is used in low temperature:

- ●Study impact strength and brittleness of the bearing material in low temperature
- ●Study clearance decrease caused by the heat shrinkage of the inner diameter of the bearing.
- ●Study decline of the fixed force which is brought about by the decrease in the interference with the housing.

Compared to the metallic bearing, plastic bearing (especially thermoplastic resin material) has the lower melting point and therefore, is prone to heat effect. As heat expansion coefficient is big, attention should be paid in fitting design such as stress relaxation, decrease in clearance due to temperature change and others.

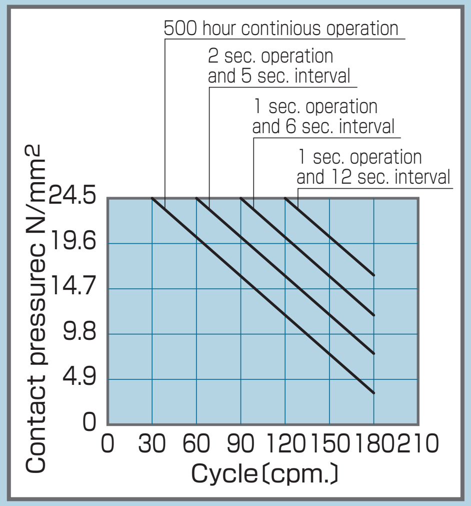
■Operation interval and PV value

In the operation of the bearing, there are continuos and intermittent operations.

In general, an intermittent operation with some intervals creates favorable condition for the better results because suspension of operation cools down the temperature of the friction surface.

However, this frequent start and stop increases wear by inadequate lubrication. It causes galling or seizure at the time of start. A self-lubricating bearing supplies lubricating oil or forms solid lubrication film onto the frictional surface and prevents drop in the bearing performance even in such an inadequate lubrication operation.

The diagram shows influence of intermittent motion and continious motion on PV characteristic in the radial journal rotational motion and oscillating motion of Oiles 500SP. Self-lubricating bearing has higher limit PV value as the stopping interval is increased.



Influence of operation mode on PV value.

■Selection of mating materials

Bearing performance is influenced by the material, hardness, surface roughness and surface treatment of the mating shaft. In order to select appropriate mating material, please refer to the below.

Bearing	Contact pressure N/mm² {kgf/cm²}	Material	Hardness	Surface roughness Ra(Ry)
Metallic Bearings	Up to 24.5{250}	Carbon steel for machine structure alloy steel(S45C, SNC415, SCM435) Stainless steel.	150HBW or over	Less than 1.6a(6,3s)
	24.5{250} to 49.0{500}	Surface hardening treatment such as induction hardening and carburizing should be implemented for carbonsteel for machine and alloy steel.	250HBW or over	
	49.0{500} to 98.0{1,000}	In addition to surface hardening treatment as above, additional surface treatment such as nitriding treatment and hard chrome plating should be implementd.	50HRC or over	
Plastic and Multi-layer Bearings	Up to 49.0{500}	Carbon steel for machine structure alloy steel(S45C, SNC415, SCM435) Corrosion resistant steel.(SUS304, SUS316)	120HBW or over	Less than 0.8a(3.2s)
	49.0{500} to 98.0{1,000}	Surface treatment such as induction hardening, quenching by carburizing and hard chrome plating should beimplemented for carbonsteel for machine and alloy steel.	45HRC or over	

For the plastic bearing OILS 480, use mating material of more than 45HRC hardness.

■Foreign particle tolerance (resistance)

Although contamination by foreign particles do not affect the performance of self-lubricating bearings compared to the ball bearings, it may deteriorate performance of the bearing. Following measures are recommended:

- ●Surface hardening treatment such as induction hardening, as well as carburizing should be implemented onto the mating shaft.
- ●At the both ends of the bearing, install dust seal and fill with grease.
- ●Periodic greasing prevents contamination of foreign particle and helps discharging of the foreign matters.

On Design

Selection and Design of Oiles Bearings

■Bearing configuration

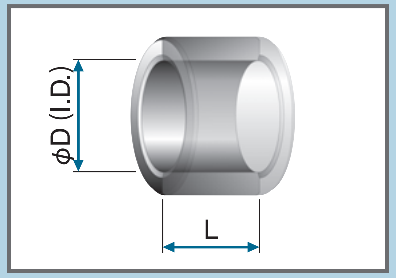
Length

In general, length of the bearings is calculated by the ratio of the bearing length (L) and I.D. (D) of the bearing. (L/D)

For geneal use : L/D= 0.5 to 2.0. For high load, high velocity, uneven contact : L/D=0.8 to 1.0.

Effect of bearing length	L / D : Small	L / D : Large
Oil film formation capability	Small	Large
Heat radiation	Large	Small
Safety margin for eccentric load	High	Low
Vibration damping	Small	Large
Space saving	Large	Small
Discharge of particles	Large	Small

※Influence of the bearing length described here is reference.

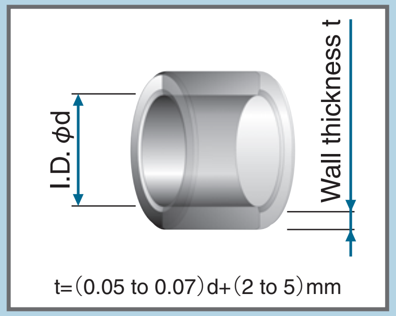


Wall thickness

Wall thicknes of the bearings can be made thinner to realize smaller design.

ID and wall thickness	ϕ10	ϕ20	ϕ50	ϕ100	ϕ300
Oil impregnatd metallic bearing	2 to 3	2 to 4	5 to 7.5	7.5 to 12.5	20 to 25
Plugged metallic bearing	3 to 4	3 to 5	7.5 to 10	10 to 15	20 to 30
Plastic bearing (machined)	2 to 3	2 to 4	5 to 7.5	7.5 to 12.5	20 to 25
Plastic bearing (molded)	1 to 2	1 to 3	3 to 5	5 to 10	(20 to 30)
Multi-layer bearing	0.5 to 1	1.5	2 to 2.5	2.5	—
Composite bearing (Hiplast)	0.5 Regardless of bearing diameter, wall thickness is 0.5mm				

(Unit : mm)

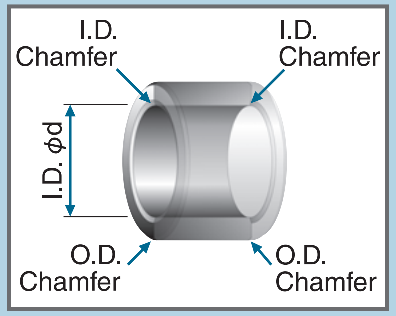


Chamfering

Both ends of bearings are chamfered to avoid stress concentration.

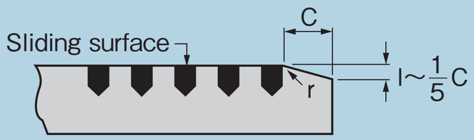
Bearing ID ϕd	Chamfer size of ID and OD
Up to ϕ80	C0.5
ϕ80 to ϕ200	C1.0
ϕ200 to ϕ300	C1.5
Over ϕ300	C2.0

(Unit : mm)



OILES 500 The shape of The Chamfering.

Placement of a solid lubricant is not plugged to both ends part.
Therefore it do chamfering to a position of a plugged solid lubricant to prevent seize by partial metallic contact.



■Advantage of greasing (oiling)

As described below, periodical greasing (or oiling) will improve the performance of self-lubricating bearings :

- ●Reduction of co-efficient of friction and wear amount
- ●Increase of allowable PV value
- ●Improved reliability and safety
- ●Discharge of wear particles and improvement of foreign particle tolerance.
- ●Rust-proof of the mating shaft
- ●Cooling effect

Lubricating oil : industrial lubricating oil ISO VG22 to 46 [kinematic viscosity 22 to 46 s+ / 40℃]
Grease : Lithium based multi-purpose grease (with consistency of NLG 2 to 0)

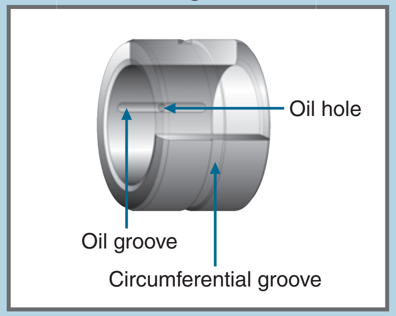
※If operating temperature goes beyond 150℃, the grease which uses polyurea or bentonite as a thickner could be specified.

■Oil hole and oil groove design

Configuration of oil holes and oil grooves of the bearings should be designed as below:

- ●An oil hole and an oil groove should be at the same location avoiding the point of maximum load.
- ●An oil groove in an axis direction should be 70 to 80 % of the bearing length and all edges should be chamfered.
- ●If lubricant is supplied from the housing, circumferential groove on the outer diameter should be designed in order to avoid inadequate lubrication from clogged oil hole caused by shifting of the oil hole from the housing oil path.

Oil hole and oil groove

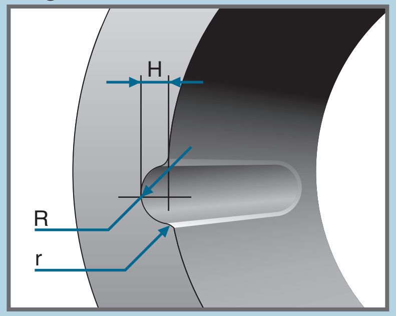


Examples of typical dimensions of oil grooves:

Bearing I.D.	R	r	H	Number of groove
30 or less	1.5	1.5	1.2	1 to 2
30 to 50	2.0	2.0	1.8	3
50 to 80	3.0	3.0	2.5	3
80 to 120	3.5	3.5	3.5	4
120 to 180	4.0	4.0	5.0	4
180 to 250	5.0	5.0	6.0	5
250 to 315	6.0	6.0	7.0	6
315 to 400	7.0	7.0	8.0	8
400 to 500	8.0	8.0	8.0	8

(Unit : mm)

Cross sectional configuraton of oil groove



On Design

Cooling Fit and Press Fitting

■Cooling fit

There are two methods to set Oiles bearings into a housing. One is called press-fitting. For press fitting, a mandrel and a press machine are used. The other is called cooling fit. The cooling fit uses liquid nitrogen or dry ice. Compared to press-fitting, cooling fit is efficient and achieves more accurate installation.

Avoid shrink fitting as it may deteriorate bearing function.

■Cooling fit procedure

1. Equipment and materials

●Refrigerant : liquid nitrogen, dry ice

●Container : A chamber covered with heat insulator which is large enough to accommodate bushings

2. Calculation of amount of shrinkage of outer diameter of bearing caused by cooling(△D)

●Where outer diameter of bearing : D

●Where coefficient of thermal expansion of bearing : α

●Where atmospheric temperature : T_0

●Where cooling temperature : T_1

$$\triangle D \fallingdotseq D \times \alpha \times (T_0 - T_1)$$

Thermal expansion of Oiles 500SP : $\alpha = 2.2 \times 10^{-5}$/℃

Thermal expansion of Oiles 500B : $\alpha = 1.8 \times 10^{-5}$/℃

Thermal expansion of Oiles 500F : $\alpha = 1.2 \times 10^{-5}$/℃

※For other materials, please refer to the mechanical properties of each product.

Example : Material Oiles 500B 100 I.D. × 130 O.D. × 100 L

By cooling, temperature goes down to −70 ℃ from 20 ℃

$\triangle D = 130 \times 1.8 \times 10^{-5} \times (20 - (-70)) = 0.211$mm

※For the bearing whose diameter exceeds ϕ500 mm, consult an Oiles representative.

3. Operation procedure

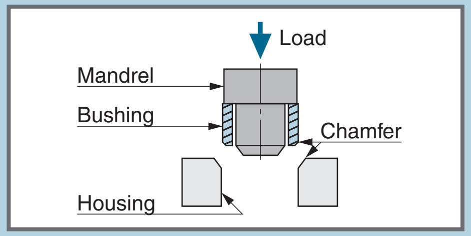
1. As a cooling agent, use liquid nitrogen or dry ice. The standard cooling temperature is −40 ℃ to −70 ℃.
2. Cooling time should be more than one hour. Cooling time needs to be longer if the interference is larger, depending on applicable fitting tolerance. In addition to the cooling fit, press fitting should be used if cooling time needs to be shortened.
3. Measure and confirm outer diameter of the bushing and inner diameter of the housing before cooling. If any defect is found during fitting, it may develop into a major trouble.
4. Bushing should be inserted into the housing soon after taking it out from the cooling agent in a chamber. If stopped during fitting, dimension of the busing goes back to its original size and it is extremely difficult to withdraw the bushing from the housing and do the fitting again.
5. Apply lubricant onto the sliding surface.

Note : Warm housing up to 20 ℃ to 30 ℃ if sufficient temperature gap could not be maintained as in winter.

■Press fitting

Usually, Oiles bearings are press-fitted into the housing. For this procedure, a mandrel and a press machine are used.

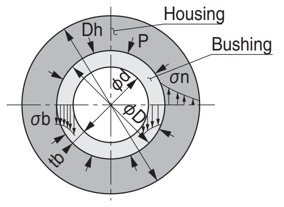
In case of a metallic bearing with large press fitting interference, chamfer outer diameter of the bearing and inner diameter of the housing. Then use a mandrel to facilitate easier press fitting.



■Press fitting procedure : Calculation of press fit force

When a bushing is press fitted into a housing with some interference, the bushing I.D. becomes smaller than the original size. Amount of this inner diameter change depends on the dimension of the housing, the bushing (thickness and shape), and the material.Testing by dimension and by material is required in order to determine precise change. However, it is not feasible to conduct tests for all the combinations of materials and dimensions. Therefore amount of inner diameter change is determined based on the below formula.

Stress distribution of cylindrical combination



●Press fit force of bushing

$$F = \pi \cdot P \cdot D \cdot L \cdot \mu$$

●Amount of inner diameter change △d of bushing after press fit

$$\triangle d = \frac{P \cdot D^2}{2Eb \cdot tb} = \frac{S \cdot D}{2Eb \cdot tb \cdot (Kb+Kh)}$$

$$Kb = \frac{(1-Vb)+(1+Vb) \cdot (1-2tb/D)^2}{\{(Eb \cdot 4tb)/D\} \cdot (1-tb/D)}$$

$$Kh = \frac{(1-Vh)+(1+Vh) \cdot (Dh/D)^2}{Eh \cdot \{(Dh/D)^2-1\}}$$

$$P = \frac{S}{D} \cdot \frac{1}{Kb+Kh}$$

Vb : Poisson's ratio of bushing (refer to table 1)
tb : Wall thickness of bushing (mm)
Eb : Young's modulus of bushing (kgf/mm²) (refer to table 1)
D : Outer diameter of bushing=Inner diameter of housing (mm)
Vh : Poisson's ratio of housing (refer to table 1)
Eh : Young's modulus of housing (kgf/mm²) (refer to table 1)
Dh : Outer diameter of housing (mm)
P : Pressure in radius direction at the boundary generated by interference (kgf/mm²)
Kb : Coefficient of combined sleeves (kgf/mm²) (for bushing)
Kh : Coefficient of combined sleeves (kgf/mm²) (for housing)
F : Press fit force of bushing (kgf)
L : Length of bushing (mm)
μ : Coefficient of friction between bushing and housing (refer to table 2)
S : Interference of bushing against housing (mm)
△d : Amount of inner diameter change of bushing after press fit (mm) (amount of shrinkage)

Table-1 **Poisson's ratio and Young's modulus**

Material	Poisson's ratio	Young's modulus (kgf/mm²)	Material	Poisson's ratio	Young's modulus (kgf/mm²)
SS400	0.30	21,000	CAC703	0.32	12,000
FCD 450 to 500	0.30	16,500 to 18,000	CAC304	0.35	11,000
Cermet M	0.12	5,000	500B	0.25	6,600
Cermet G	0.05	2,400	500SP	0.35	7,700
FC 250	0.30	11,000 to 13,000	500AB	0.32	8,400
SCM 440	0.30	21,000	2000	0.30	21,000
SUS 304	0.28	19,700	300	0.25	6,000
SUS 420J2	0.31	20,400	250-07	0.17	700
CAC403 (BC3)	0.25	10,500	Fiberflon	0.20	1,800 to 3,000
CAC406 (BC6)	0.25	9,450	80	0.35	288

Table-2 **Coefficient of friection between bushing and housing**

Meallic bushing vs. metallic housing	0.20
Plastic bushing vs. metalic housing	0.15
Plastic bushing and plastic housing	0.15

Selection Guide
Product Information
Plastic Bearing
Multi-layer Bearing
Metallic Bearing
Air Bearings
Slide Shifter
Technical Information
Corporate Profile

On Design

Service Life of Oiles Bearings and Clearance

■Service life of Oiles bearings

Service life of Oiles bearings depends on application atmosphere and other relevant conditions. Below formula is determined from the relationship between the load and the sliding distance and should be regarded as rough standard for designing. Please inquire an Oiles representative for details.

Assumed wear amount (mm) ： $W = K \times P \times V \times T$

Specific wear amount K：mm/(N/mm^2·m/s·Hr) {mm/(kgf/cm^2·m/min·Hr)}
Design pressure P：N/mm^2 {kgf/cm^2}
Sliding velocity V：m/s {m/min}
Sliding hours T：Hr

Specific wear rate depending on lubrication conditions

Lubrication conditions	mm/(N/mm^2·m/s·Hr)	mm/(kgf/cm^2·m/min·Hr)
Dry	6×10^{-4} to 3×10^{-3}	5×10^{-6} to 1
Periodic lubrication	6×10^{-5} to 3×10^{-4}	5×10^{-7} to 1
Oil lubrication	6×10^{-6} to 3×10^{-5}	5×10^{-8} to 1

⚠ Caution

This formula for determining wear amount is derived from the idea that the wear is proportional to load and sliding distance. Other factors such as velocity, load, mode of motion, kind of lubrication, clearance, surface roughness of mating material and foreign particles are disregarded.
This should be treated as rough standard.

■Clearance design

Clearance for Oiles bearings should be designed larger than those for regular plain bearings used under hydrodynamic lubrication. This is because frictional heat and thickness of solid lubricant film generated in solid lubrication conditions is larger compared to hydrodynamic lubrication. Clearance should be corrected for the bearings where swelling is expected such as underwater applications, chemical submersion and in high temperature applications.

Fitting design for high temperature applications

●When metallic bearing is to be used at over 100 degree C, design the clearance by adding heat expansion amount indicated below to the inner diameter dimension tolerance at the room temperature indicated in the standard fitting table.

Heat expansion amount ＝
Coefficient of thermal expansion of shaft × shaft diameter ×(ambient temperature － room temperature)

Coefficient of thermal linear expansion of the shaft

Shaft material	Coefficient of thermal expansion
Soft steel	1.12×10^{-5}/℃ (20 to 300℃)
Ni-Cr steel	1.29×10^{-5}/℃ (20 to 300℃)
SUS304	1.78×10^{-5}/℃ (20 to 300℃)
SUS431	1.21×10^{-5}/℃ (20 to 300℃)
SUS316	1.62×10^{-5}/℃ (20 to 300℃)

●When temperature goes down to a room temperature after exposed in high temperature, interference may disappear by stress relaxation and the bearing may come off or sliding at outer diameter of the bearing may occur. As a prevention measure, implement detent screwing.

※For plastic bearings, please inquire an Oiles representative for the details

Correction value for swelling of bearing

If submerged underwater, Oiles 425 and Oiles 470 are swelled due to moisture absorption. For details, please refer to page 349 and 350.

Fitting Standard Table

Oiles 80 / Lutech E / 480 (Machined products)

Bearing dimension		Dimension tolerance						Clearance		Dimension tolerance				Interference	
		Recommended shaft (h7)		I.D. before press fit		I.D. after press fit (ref.value)				Recommended hole (H7)		Bearing O.D.			
I.D.	O.D.	(+)	(−)	(+)	(+)	(+)	(+)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Up to 10	Up to 10	0	0.015	0.195	0.112	0.128	0.045	0.143	0.045	0.015	0	0.103	0.045	0.103	0.030
	Exceeding 10 & up to 18	0	0.015	0.212	0.129	0.128	0.045	0.143	0.045	0.018	0	0.128	0.058	0.128	0.040
Exceeding 10 & up to 18	Exceeding 10 & up to 18	0	0.018	0.245	0.144	0.161	0.060	0.179	0.060	0.018	0	0.128	0.058	0.128	0.040
	Exceeding 18 & up to 24	0	0.018	0.264	0.163	0.161	0.060	0.179	0.060	0.021	0	0.155	0.071	0.155	0.050
Exceeding 18 & up to 24	Exceeding 18 & up to 24	0	0.021	0.299	0.178	0.196	0.075	0.216	0.075	0.021	0	0.155	0.071	0.155	0.050
	Exceeding 24 & up to 30	0	0.021	0.309	0.188	0.196	0.075	0.216	0.075	0.021	0	0.165	0.081	0.165	0.060
Exceeding 24 & up to 30	Exceeding 24 & up to 30	0	0.021	0.324	0.203	0.211	0.090	0.231	0.090	0.021	0	0.165	0.081	0.165	0.060
	Exceeding 30 & up to 40	0	0.021	0.344	0.223	0.211	0.090	0.231	0.090	0.025	0	0.195	0.095	0.195	0.070
Exceeding 30 & up to 40	Exceeding 30 & up to 40	0	0.025	0.392	0.248	0.259	0.115	0.284	0.115	0.025	0	0.195	0.095	0.195	0.070
	Exceeding 40 & up to 50	0	0.025	0.412	0.268	0.259	0.115	0.284	0.115	0.025	0	0.215	0.115	0.215	0.090
Exceeding 40 & up to 50	Exceeding 40 & up to 50	0	0.025	0.432	0.288	0.279	0.135	0.304	0.135	0.025	0	0.215	0.115	0.215	0.090
	Exceeding 50 & up to 65	0	0.025	0.454	0.310	0.279	0.135	0.304	0.135	0.030	0	0.250	0.130	0.250	0.100
Exceeding 50 & up to 65	Exceeding 50 & up to 65	0	0.030	0.512	0.340	0.337	0.165	0.367	0.165	0.030	0	0.250	0.130	0.250	0.100
	Exceeding 65 & up to 80	0	0.030	0.527	0.355	0.337	0.165	0.367	0.165	0.030	0	0.280	0.130	0.280	0.100
Exceeding 65 & up to 80	Exceeding 65 & up to 80	0	0.030	0.604	0.390	0.414	0.200	0.444	0.200	0.030	0	0.280	0.130	0.280	0.100

※When used at low temperature (lower than-0℃), larger interference (larger than the those indicated in the Fitting Standard Table) may be required. For details, please inquire an Oiles representative.
(Unit : mm)

Oiles Glitron F

Bearing dimension		Dimension tolerance						Clearance		Dimension tolerance				Interference	
		Recommended shaft (h7)		I.D. before press fit		I.D. after press fit (ref.value)				Recommended hole (H7)		Bearing O.D.			
I.D.	O.D.	(+)	(−)	(+)	(+)	(+)	(+)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Up to 10	Up to 10	0	0.015	0.208	0.150	0.157	0.099	0.172	0.099	0.015	0	0.076	0.040	0.076	0.025
	Exceeding 10 & up to 18	0	0.015	0.220	0.162	0.157	0.099	0.172	0.099	0.018	0	0.093	0.050	0.093	0.032
Exceeding 10 & up to 18	Exceeding 10 & up to 18	0	0.018	0.220	0.150	0.157	0.087	0.172	0.087	0.018	0	0.093	0.050	0.093	0.032
	Exceeding 18 & up to 30	0	0.018	0.238	0.168	0.157	0.087	0.172	0.087	0.021	0	0.117	0.065	0.117	0.044
Exceeding 18 & up to 30	Exceeding 18 & up to 30	0	0.021	0.244	0.160	0.163	0.079	0.184	0.079	0.021	0	0.117	0.065	0.117	0.044
	Exceeding 30 & up to 50	0	0.021	0.262	0.178	0.163	0.079	0.184	0.079	0.025	0	0.142	0.080	0.142	0.055
Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.025	0.280	0.180	0.181	0.081	0.206	0.081	0.025	0	0.142	0.080	0.142	0.055
	Exceeding 50 & up to 80	0	0.025	0.303	0.203	0.181	0.081	0.206	0.081	0.030	0	0.174	0.100	0.174	0.070
Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.030	0.320	0.200	0.198	0.078	0.228	0.078	0.030	0	0.174	0.100	0.174	0.070
	Exceeding 80 & up to 120	0	0.030	0.344	0.224	0.198	0.078	0.228	0.078	0.035	0	0.207	0.120	0.207	0.085
Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.035	0.380	0.240	0.234	0.094	0.269	0.094	0.035	0	0.207	0.120	0.207	0.085
	Exceeding120 & up to180	0	0.035	0.409	0.269	0.234	0.094	0.269	0.094	0.040	0	0.245	0.145	0.245	0.105
Exceeding120 & up to180	Exceeding120 & up to180	0	0.040	0.470	0.310	0.295	0.135	0.335	0.135	0.040	0	0.245	0.145	0.245	0.105

※Smaller clearance, smaller by approximately 1/1000·d, may be achieved if oil lubrication is used.
(Unit : mm)

On Design

Oiles 250

Bearing dimension		Dimension tolerance						Clearance		Dimension tolerance				Interference	
		Recommended shaft (h7)		I.D. before press fit		I.D. after press fit (ref.value)				Recommended hole (H7)		Bearing O.D.			
I.D.	O.D.	(+)	(−)	(+)	(+)	(+)	(+)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Up to 10	Up to 10	0	0.015	0.109	0.079	0.075	0.045	0.090	0.045	0.015	0	0.054	0.029	0.054	0.014
	Exceeding 10 & up to 18	0	0.015	0.112	0.082	0.075	0.045	0.090	0.045	0.018	0	0.058	0.033	0.058	0.015
Exceeding 10 & up to 18	Exceeding 10 & up to 18	0	0.018	0.130	0.095	0.093	0.058	0.111	0.058	0.018	0	0.058	0.033	0.058	0.015
	Exceeding 18 & up to 30	0	0.018	0.136	0.101	0.093	0.058	0.111	0.058	0.021	0	0.068	0.038	0.068	0.017
Exceeding 18 & up to 30	Exceeding 18 & up to 30	0	0.021	0.171	0.128	0.128	0.085	0.149	0.085	0.021	0	0.068	0.038	0.068	0.017
	Exceeding 30 & up to 50	0	0.021	0.180	0.137	0.128	0.085	0.149	0.085	0.025	0	0.084	0.044	0.084	0.019
Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.025	0.223	0.172	0.171	0.120	0.196	0.120	0.025	0	0.084	0.044	0.084	0.019
	Exceeding 50 & up to 80	0	0.025	0.232	0.181	0.171	0.120	0.196	0.120	0.030	0	0.101	0.051	0.101	0.021
Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.030	0.296	0.236	0.235	0.175	0.265	0.175	0.030	0	0.101	0.051	0.101	0.021
	Exceeding 80 & up to 120	0	0.030	0.309	0.249	0.235	0.175	0.265	0.175	0.035	0	0.121	0.061	0.121	0.026
Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.035	0.395	0.324	0.321	0.250	0.356	0.250	0.035	0	0.121	0.061	0.121	0.026
	Exceeding 120 & up to 180	0	0.035	0.409	0.338	0.321	0.250	0.356	0.250	0.040	0	0.143	0.073	0.143	0.033
Exceeding 120 & up to 180	Exceeding 120 & up to 180	0	0.040	0.530	0.448	0.442	0.360	0.482	0.360	0.040	0	0.143	0.073	0.143	0.033
	Exceeding 180 & up to 250	0	0.040	0.546	0.464	0.442	0.360	0.482	0.360	0.046	0	0.167	0.087	0.167	0.041
Exceeding 180 & up to 250	Exceeding 180 & up to 250	0	0.046	0.678	0.584	0.574	0.480	0.620	0.480	0.046	0	0.167	0.087	0.167	0.041
	Exceeding 250 & up to 315	0	0.046	0.697	0.603	0.574	0.480	0.620	0.480	0.052	0	0.194	0.104	0.194	0.052
Exceeding 250 & up to 315	Exceeding 250 & up to 315	0	0.052	0.839	0.733	0.716	0.610	0.768	0.610	0.052	0	0.194	0.104	0.194	0.052
	Exceeding 315 & up to 400	0	0.052	0.861	0.755	0.716	0.610	0.768	0.610	0.057	0	0.228	0.118	0.228	0.061
Exceeding 315 & up to 400	Exceeding 315 & up to 400	0	0.057	1.030	0.915	0.885	0.770	0.942	0.770	0.057	0	0.228	0.118	0.228	0.061
	Exceeding 400 & up to 500	0	0.057	1.050	0.935	0.885	0.770	0.942	0.770	0.063	0	0.256	0.136	0.256	0.073
Exceeding 400 & up to 500	Exceeding 400 & up to 500	0	0.063	1.211	1.085	1.046	0.920	1.109	0.920	0.063	0	0.256	0.136	0.256	0.073

(Unit : mm)

■Swelling characteristics

When designing for fitting for underwater use bearings (Oiles 425 and 470), dimensional change by swelling must be taken into account. In case of bushings, clearance may be changed due to swelling. Add swelling correction value described below to inner diameter tolerance indicated in the fitting standard table.

●Swelling correction value

t : bushing wall thickness(mm)

Material	425-03, 06, 07	425-13, 17
Room temperature	2×t×0.015	2×t×0.006
50℃ or over	2×t×0.030	2×t×0.012

Example : Oiles 470-02 bushing of 100 I.D. × 120 O.D. × 100 ℓ applied in 30℃ water

Based on above swelling correction value,
2×10 (t:bushing wall thickness)×0.008=0.160

$\phi100^{+0.260}_{+0.188}$ +correction value : 0.160 ⇨ $\phi100^{+0.420}_{+0.348}$

Dimensional change by swelling

Swelling testing conditions

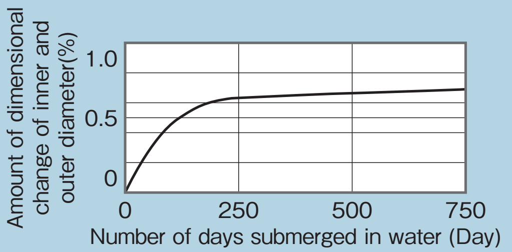
Test piece dimensions

ϕ98×ϕ118× ℓ 100

ϕ135×ϕ155× ℓ 100

ϕ155×ϕ185× ℓ 100

Atmosphere : room temperature and in purified water



Oiles 470-02

Bearing dimension		Dimension tolerance						Clearance		Dimension tolerance				Interference	
		Recommended shaft (h7)		I.D. before press fit		I.D. after press fit (ref.value)				Recommended hole (H7)		Bearing O.D.			
I.D.	O.D.	(+)	(−)	(+)	(+)	(+)	(+)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Up to 10	Up to 10	0	0.015	0.102	0.080	0.068	0.046	0.083	0.046	0.015	0	0.054	0.029	0.054	0.014
	Exceeding 10 & up to 18	0	0.015	0.105	0.083	0.068	0.046	0.083	0.046	0.018	0	0.058	0.033	0.058	0.015
Exceeding 10 & up to 18	Exceeding 10 & up to 18	0	0.018	0.122	0.095	0.085	0.058	0.113	0.058	0.018	0	0.058	0.033	0.058	0.015
	Exceeding 18 & up to 30	0	0.018	0.128	0.101	0.085	0.058	0.113	0.058	0.021	0	0.068	0.038	0.068	0.017
Exceeding 18 & up to 30	Exceeding 18 & up to 30	0	0.021	0.143	0.110	0.100	0.067	0.121	0.067	0.021	0	0.068	0.038	0.068	0.017
	Exceeding 30 & up to 50	0	0.021	0.152	0.113	0.100	0.067	0.121	0.067	0.025	0	0.084	0.044	0.084	0.019
Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.025	0.169	0.130	0.117	0.078	0.142	0.078	0.025	0	0.084	0.044	0.084	0.019
	Exceeding 50 & up to 80	0	0.025	0.178	0.139	0.117	0.078	0.142	0.078	0.030	0	0.101	0.051	0.101	0.021
Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.030	0.208	0.156	0.147	0.095	0.177	0.095	0.030	0	0.101	0.051	0.101	0.021
	Exceeding 80 & up to 120	0	0.030	0.221	0.169	0.147	0.095	0.177	0.095	0.035	0	0.121	0.061	0.121	0.026
Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.035	0.260	0.188	0.186	0.114	0.221	0.114	0.035	0	0.121	0.061	0.121	0.026
	Exceeding120 & up to 180	0	0.035	0.274	0.202	0.186	0.114	0.221	0.114	0.040	0	0.143	0.073	0.143	0.033
Exceeding120 & up to 180	Exceeding120 & up to 180	0	0.040	0.330	0.236	0.242	0.148	0.282	0.148	0.040	0	0.143	0.073	0.143	0.033
	Exceeding180 & up to 250	0	0.040	0.346	0.252	0.242	0.148	0.282	0.148	0.046	0	0.167	0.087	0.167	0.041
Exceeding180 & up to 250	Exceeding180 & up to 250	0	0.046	0.402	0.292	0.298	0.188	0.344	0.188	0.046	0	0.167	0.087	0.167	0.041
	Exceeding250 & up to 315	0	0.046	0.421	0.311	0.298	0.188	0.344	0.188	0.052	0	0.194	0.104	0.194	0.052
Exceeding250 & up to 315	Exceeding250 & up to 315	0	0.052	0.472	0.346	0.349	0.223	0.401	0.223	0.052	0	0.194	0.104	0.194	0.052
	Exceeding315 & up to 400	0	0.052	0.494	0.368	0.349	0.223	0.401	0.223	0.057	0	0.228	0.118	0.228	0.061
Exceeding315 & up to 400	Exceeding315 & up to 400	0	0.057	0.530	0.393	0.385	0.248	0.442	0.248	0.057	0	0.228	0.118	0.228	0.061
	Exceeding400 & up to 500	0	0.057	0.550	0.413	0.385	0.248	0.442	0.248	0.063	0	0.256	0.136	0.256	0.073
Exceeding400 & up to 500	Exceeding400 & up to 500	0	0.063	0.595	0.440	0.430	0.275	0.493	0.275	0.063	0	0.256	0.136	0.256	0.073

※For multi-layer type (470-02W), use fitting table for Oiles 250.

(Unit : mm)

●Swelling correction value

t : bushing wall thickness(mm)

Material	470-02	470-02W
Room temperature	2×t×0.008	2×t×0.012
50℃ or over	2×t×0.012	2×t×0.025

On Design

Oiles 500 (Room temp./contact pressure P=9.8N/mm²{100kgf/cm²} or less)
Oiles Cermet G (Room temp. to 100°C or less)

Bearing dimension		Dimension tolerance						Clearance		Dimension tolerance				Interference	
		Recommended shaft (h7)		I.D. before press fit		I.D. after press fit (ref.value)				Recommended hole (H7)		Bearing O.D.			
I.D.	O.D.	(+)	(−)	(+)	(+)	(+)	(+)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Up to 10	Up to 10	0	0.015	0.057	0.035	0.040	0.018	0.055	0.018	0.015	0	0.034	0.019	0.034	0.004
	Exceeding 10 & up to 18	0	0.015	0.061	0.039	0.040	0.018	0.055	0.018	0.018	0	0.041	0.023	0.041	0.005
Exceeding 10 & up to 18	Exceeding 10 & up to 18	0	0.018	0.078	0.051	0.057	0.030	0.075	0.030	0.018	0	0.041	0.023	0.041	0.005
	Exceeding 18 & up to 30	0	0.018	0.082	0.055	0.057	0.030	0.075	0.030	0.021	0	0.049	0.028	0.049	0.007
Exceeding 18 & up to 30	Exceeding 18 & up to 30	0	0.021	0.105	0.072	0.080	0.047	0.101	0.047	0.021	0	0.049	0.028	0.049	0.007
	Exceeding 30 & up to 50	0	0.021	0.111	0.078	0.080	0.047	0.101	0.047	0.025	0	0.059	0.034	0.059	0.009
Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.025	0.144	0.105	0.113	0.074	0.138	0.074	0.025	0	0.059	0.034	0.059	0.009
	Exceeding 50 & up to 80	0	0.025	0.151	0.112	0.113	0.074	0.138	0.074	0.030	0	0.073	0.041	0.073	0.011
Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.030	0.190	0.144	0.152	0.106	0.182	0.106	0.030	0	0.073	0.041	0.073	0.011
	Exceeding 80 & up to 120	0	0.030	0.199	0.153	0.152	0.106	0.182	0.106	0.035	0	0.089	0.051	0.089	0.016
Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.035	0.242	0.188	0.195	0.141	0.230	0.141	0.035	0	0.089	0.051	0.089	0.016
	Exceeding120 & up to 180	0	0.035	0.254	0.200	0.195	0.141	0.230	0.141	0.040	0	0.108	0.063	0.108	0.023
Exceeding120 & up to 180	Exceeding120 & up to 180	0	0.040	0.308	0.245	0.249	0.186	0.289	0.186	0.040	0	0.108	0.063	0.108	0.023
	Exceeding180 & up to 250	0	0.040	0.321	0.258	0.249	0.186	0.289	0.186	0.046	0	0.130	0.077	0.130	0.031
Exceeding180 & up to 250	Exceeding180 & up to 250	0	0.046	0.372	0.300	0.300	0.228	0.346	0.228	0.046	0	0.130	0.077	0.130	0.031
	Exceeding250 & up to 315	0	0.046	0.386	0.314	0.300	0.228	0.346	0.228	0.052	0	0.150	0.094	0.150	0.042
Exceeding250 & up to 315	Exceeding250 & up to 315	0	0.052	0.450	0.369	0.364	0.283	0.416	0.283	0.052	0	0.150	0.094	0.150	0.042
	Exceeding315 & up to 400	0	0.052	0.464	0.383	0.364	0.283	0.416	0.283	0.057	0	0.171	0.108	0.171	0.051
Exceeding315 & up to 400	Exceeding315 & up to 400	0	0.057	0.539	0.450	0.439	0.350	0.496	0.350	0.057	0	0.171	0.108	0.171	0.051
	Exceeding400 & up to 500	0	0.057	0.555	0.466	0.439	0.350	0.496	0.350	0.063	0	0.195	0.126	0.195	0.063
Exceeding400 & up to 500	Exceeding400 & up to 500	0	0.063	0.638	0.541	0.522	0.425	0.585	0.425	0.063	0	0.195	0.126	0.195	0.063

※Above chart can be used for low speed conditions of under 0.008 m/s {0.5 m/min}, even if contact pressure is over 9.8 N./mm² (Unit : mm)
※Above chart can be applied to BCB Oiles 500 B standard product. However it does not correspond to the fitting standard of other 500SP standard products such as SPB, SPBL, SPF, SPFG, SGF, SGB.

Oiles Cermet M (Room temp. to 100℃ or less)

Bearing dimension		Dimension tolerance						Clearance		Dimension tolerance				Interference	
		Recommended shaft (h7)		I.D. before press fit		I.D. after press fit (ref.value)				Recommended hole (H7)		Bearing O.D.			
I.D.	O.D.	(+)	(−)	(+)	(+)	(+)	(+)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Up to 3	Up to 3	0	0.010	0.024	0.014	0.019	0.009	0.029	0.009	0.010	0	0.020	0.010	0.020	0.000
	Exceeding 3 & up to 6	0	0.010	0.026	0.016	0.019	0.009	0.029	0.009	0.012	0	0.027	0.015	0.027	0.003
Exceeding 3 & up to 6	Exceeding 3 & up to 6	0	0.012	0.032	0.020	0.025	0.013	0.037	0.013	0.012	0	0.027	0.015	0.027	0.003
	Exceeding 6 & up to 10	0	0.012	0.034	0.022	0.025	0.013	0.037	0.013	0.015	0	0.034	0.019	0.034	0.004
Exceeding 6 & up to 10	Exceeding 6 & up to 10	0	0.015	0.040	0.025	0.031	0.016	0.046	0.016	0.015	0	0.034	0.019	0.034	0.004
	Exceeding 10 & up to 18	0	0.015	0.042	0.027	0.031	0.016	0.046	0.016	0.018	0	0.041	0.023	0.041	0.005
Exceeding 10 & up to 18	Exceeding 10 & up to 18	0	0.018	0.050	0.032	0.039	0.021	0.057	0.021	0.018	0	0.041	0.023	0.041	0.005
	Exceeding 18 & up to 30	0	0.018	0.053	0.035	0.039	0.021	0.057	0.021	0.021	0	0.049	0.028	0.049	0.007
Exceeding 18 & up to 30	Exceeding 18 & up to 30	0	0.021	0.061	0.040	0.047	0.026	0.068	0.026	0.021	0	0.049	0.028	0.049	0.007
	Exceeding 30 & up to 50	0	0.021	0.064	0.043	0.047	0.026	0.068	0.026	0.025	0	0.059	0.034	0.059	0.009
Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.025	0.075	0.050	0.058	0.033	0.083	0.033	0.025	0	0.059	0.034	0.059	0.009

※For fitting design with temperature over 100℃, please inquire an OILES representative. (Unit : mm)

Oiles 500 (Over room temp. and up to 200°C / or contact pressure P=9.8N/mm²{100kgf/cm²} or over)
Oiles Cermet G (Over 100°C and up to 200°C)

Bearing dimension		Dimension tolerance						Clearance		Dimension tolerance				Interference	
		Recommended shaft(h7)		I.D. before press fit		I.D. after press fit (ref.value)				Recommended hole(H7)		Bearing O.D.			
I.D.	O.D.	(+)	(−)	(+)	(+)	(+)	(+)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Up to 10	Up to 10	0	0.015	0.072	0.050	0.057	0.035	0.072	0.035	0.015	0	0.034	0.019	0.034	0.004
	Exceeding 10 & up to 18	0	0.015	0.075	0.053	0.057	0.035	0.072	0.035	0.018	0	0.041	0.023	0.041	0.005
Exceeding 10 & up to 18	Exceeding 10 & up to 18	0	0.018	0.110	0.083	0.092	0.065	0.110	0.065	0.018	0	0.041	0.023	0.041	0.005
	Exceeding 18 & up to 30	0	0.018	0.114	0.087	0.092	0.065	0.110	0.065	0.021	0	0.049	0.028	0.049	0.007
Exceeding 18 & up to 30	Exceeding 18 & up to 30	0	0.021	0.155	0.122	0.133	0.100	0.154	0.100	0.021	0	0.049	0.028	0.049	0.007
	Exceeding 30 & up to 50	0	0.021	0.160	0.127	0.133	0.100	0.154	0.100	0.025	0	0.059	0.034	0.059	0.009
Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.025	0.216	0.177	0.189	0.150	0.214	0.150	0.025	0	0.059	0.034	0.059	0.009
	Exceeding 50 & up to 80	0	0.025	0.223	0.184	0.189	0.150	0.214	0.150	0.030	0	0.073	0.041	0.073	0.011
Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.030	0.300	0.254	0.266	0.220	0.296	0.220	0.030	0	0.073	0.041	0.073	0.011
	Exceeding 80 & up to 120	0	0.030	0.308	0.262	0.266	0.220	0.296	0.220	0.035	0	0.089	0.051	0.089	0.016
Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.035	0.396	0.342	0.354	0.300	0.389	0.300	0.035	0	0.089	0.051	0.089	0.016
	Exceeding120 & up to 180	0	0.035	0.406	0.352	0.354	0.300	0.389	0.300	0.040	0	0.108	0.063	0.108	0.023
Exceeding120 & up to 180	Exceeding120 & up to 180	0	0.040	0.510	0.447	0.458	0.395	0.498	0.395	0.040	0	0.108	0.063	0.108	0.023
	Exceeding180 & up to 250	0	0.040	0.522	0.459	0.458	0.395	0.498	0.395	0.046	0	0.130	0.077	0.130	0.031
Exceeding180 & up to 250	Exceeding180 & up to 250	0	0.046	0.636	0.564	0.572	0.500	0.618	0.500	0.046	0	0.130	0.077	0.130	0.031
	Exceeding250 & up to 315	0	0.046	0.649	0.577	0.572	0.500	0.618	0.500	0.052	0	0.150	0.094	0.150	0.042
Exceeding250 & up to 315	Exceeding250 & up to 315	0	0.052	0.728	0.647	0.651	0.570	0.703	0.570	0.052	0	0.150	0.094	0.150	0.042
	Exceeding315 & up to 400	0	0.052	0.740	0.659	0.651	0.570	0.703	0.570	0.057	0	0.171	0.108	0.171	0.051
Exceeding315 & up to 400	Exceeding315 & up to 400	0	0.057	0.818	0.729	0.729	0.640	0.786	0.640	0.057	0	0.171	0.108	0.171	0.051
	Exceeding400 & up to 500	0	0.057	0.832	0.743	0.729	0.640	0.786	0.640	0.063	0	0.195	0.126	0.195	0.063
Exceeding400 & up to 500	Exceeding400 & up to 500	0	0.063	0.950	0.853	0.847	0.750	0.910	0.750	0.063	0	0.195	0.126	0.195	0.063

※If applied over 100℃ conditions, clearance should be designed by adding below heat expansion amount to the inner diameter tolerance at room temperature. (Unit : mm)
Heat expansion amount = heat expansion co-efficient of shaft (α) × shaft diameter (d) × (ambience temperature − room temperature)
α of soft steel : 1.12×10^{-5}/℃
※If applied above 100℃ conditions, interference of the outer diameter may be reduced due to stress relaxation. Detent screwing is recommended.
※For fitting design with temperature over 200℃, please inquire an OILES representative.

On Design

Oiles 500 for Gate Applications (Shaft tolerance h7)

Bearing dimension		Dimension tolerance						Clearance		Dimension tolerance				Interference	
		Recommended shaft(h7)		I.D. before press fit		I.D. after press fit (ref.value)				Recommended hole(H7)		Bearing O.D.			
I.D.	O.D.	(+)	(−)	(+)	(+)	(+)	(+)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Up to 10	Up to 10	0	0.015	0.097	0.075	0.082	0.060	0.097	0.060	0.015	0	0.034	0.019	0.034	0.004
	Exceeding 10 & up to 18	0	0.015	0.100	0.078	0.082	0.060	0.097	0.060	0.018	0	0.041	0.023	0.041	0.005
Exceeding 10 & up to 18	Exceeding 10 & up to 18	0	0.018	0.142	0.115	0.124	0.097	0.142	0.097	0.018	0	0.041	0.023	0.041	0.005
	Exceeding 18 & up to 30	0	0.018	0.146	0.119	0.124	0.097	0.142	0.097	0.021	0	0.049	0.028	0.049	0.007
Exceeding 18 & up to 30	Exceeding 18 & up to 30	0	0.021	0.195	0.162	0.173	0.140	0.194	0.140	0.021	0	0.049	0.028	0.049	0.007
	Exceeding 30 & up to 50	0	0.021	0.200	0.167	0.173	0.140	0.194	0.140	0.025	0	0.059	0.034	0.059	0.009
Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.025	0.266	0.227	0.239	0.200	0.264	0.200	0.025	0	0.059	0.034	0.059	0.009
	Exceeding 50 & up to 80	0	0.025	0.273	0.234	0.239	0.200	0.264	0.200	0.030	0	0.073	0.041	0.073	0.011
Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.030	0.360	0.314	0.326	0.280	0.356	0.280	0.030	0	0.073	0.041	0.073	0.011
	Exceeding 80 & up to 120	0	0.030	0.368	0.322	0.326	0.280	0.356	0.280	0.035	0	0.089	0.051	0.089	0.016
Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.035	0.468	0.414	0.426	0.372	0.461	0.372	0.035	0	0.089	0.051	0.089	0.016
	Exceeding120 & up to 180	0	0.035	0.478	0.424	0.426	0.372	0.461	0.372	0.040	0	0.108	0.063	0.108	0.023
Exceeding120 & up to 180	Exceeding120 & up to 180	0	0.040	0.595	0.532	0.543	0.480	0.583	0.480	0.040	0	0.108	0.063	0.108	0.023
	Exceeding180 & up to 250	0	0.040	0.607	0.544	0.543	0.480	0.583	0.480	0.046	0	0.130	0.077	0.130	0.031
Exceeding180 & up to 250	Exceeding180 & up to 250	0	0.046	0.736	0.664	0.672	0.600	0.718	0.600	0.046	0	0.130	0.077	0.130	0.031
	Exceeding250 & up to 315	0	0.046	0.749	0.677	0.672	0.600	0.718	0.600	0.052	0	0.150	0.094	0.150	0.042
Exceeding250 & up to 315	Exceeding250 & up to 315	0	0.052	0.838	0.757	0.761	0.680	0.813	0.680	0.052	0	0.150	0.094	0.150	0.042
	Exceeding315 & up to 400	0	0.052	0.850	0.769	0.761	0.680	0.813	0.680	0.057	0	0.171	0.108	0.171	0.051
Exceeding315 & up to 400	Exceeding315 & up to 400	0	0.057	0.943	0.854	0.854	0.765	0.911	0.765	0.057	0	0.171	0.108	0.171	0.051
	Exceeding400 & up to 500	0	0.057	0.957	0.868	0.854	0.765	0.911	0.765	0.063	0	0.195	0.126	0.195	0.063
Exceeding400 & up to 500	Exceeding400 & up to 500	0	0.063	1.085	0.988	0.982	0.885	1.045	0.885	0.063	0	0.195	0.126	0.195	0.063

※This tolerance table follows Technical Standard on Dam & Weir Equipment (of Japan)

(Unit : mm)

Oiles 500 Large Diameter Bushings (Room temp. / pressure P = less than 9.8N/mm² {100kgf/cm²})

Bearing dimension		Dimension tolerance						Clearance		Dimension tolerance				Interference	
		Recommended shaft(h7)		I.D. before press fit		I.D. after press fit				Recommended hole(H7)		Bearing O.D.			
I.D.	O.D.	(+)	(−)	(+)	(+)	(+)	(+)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Exceeding500 & up to 630	Less than500 & up to 630	0	0.070	0.726	0.616	0.565	0.455	0.635	0.455	0.070	0	0.235	0.158	0.235	0.088
	Exceeding630 & up to 800	0	0.070	0.761	0.651	0.565	0.455	0.635	0.455	0.080	0	0.280	0.192	0.280	0.112
Exceeding630 & up to 800	Exceeding630 & up to 800	0	0.080	0.806	0.681	0.610	0.485	0.690	0.485	0.080	0	0.280	0.192	0.280	0.112
	Exceeding800 & up to 1000	0	0.080	0.844	0.719	0.610	0.485	0.690	0.485	0.090	0	0.329	0.230	0.329	0.140
Exceeding800 & up to 1000	Exceeding800 & up to 1000	0	0.090	0.889	0.749	0.655	0.515	0.745	0.515	0.090	0	0.329	0.230	0.329	0.140
	Exceeding1000 & up to 1250	0	0.090	0.940	0.800	0.655	0.515	0.745	0.515	0.105	0	0.395	0.280	0.395	0.175
Exceeding1000 & up to 1250	Exceeding1000 & up to 1250	0	0.105	0.995	0.830	0.710	0.545	0.815	0.545	0.105	0	0.395	0.280	0.395	0.175
	Exceeding1250 & up to 1600	0	0.105	1.065	0.900	0.710	0.545	0.815	0.545	0.125	0	0.486	0.349	0.486	0.224
Exceeding1250 & up to 1600	Exceeding1250 & up to 1600	0	0.125	1.135	0.940	0.780	0.585	0.905	0.585	0.125	0	0.486	0.349	0.486	0.224
	Exceeding1600 & up to 2000	0	0.125	1.217	1.022	0.780	0.585	0.905	0.585	0.150	0	0.595	0.430	0.595	0.280
Exceeding1600 & up to 2000	Exceeding1600 & up to 2000	0	0.150	1.292	1.062	0.855	0.625	1.005	0.625	0.150	0	0.595	0.430	0.595	0.280
	Exceeding2000 & up to 2500	0	0.150	1.388	1.158	0.855	0.625	1.005	0.625	0.175	0	0.717	0.525	0.717	0.350
Exceeding2000 & up to 2500	Exceeding2000 & up to 2500	0	0.175	1.488	1.208	0.955	0.675	1.130	0.675	0.175	0	0.717	0.525	0.717	0.350
	Exceeding2500 & up to 3150	0	0.175	1.616	1.336	0.955	0.675	1.130	0.675	0.210	0	0.882	0.651	0.882	0.441
Exceeding2500 & up to 3150	Exceeding2500 & up to 3150	0	0.210	1.706	1.376	1.045	0.715	1.255	0.715	0.210	0	0.882	0.651	0.882	0.441

(Unit : mm)

Oiles 500 Large Diameter Bushings (Over room temp. and up to 200℃ / or pressure P = over 9.8N/mm² {100kgf/cm²})

Bearing dimension		Dimension tolerance						Clearance		Dimension tolerance				Interference	
		Recommended shaft(h7)		I.D. before press fit		I.D. after press fit (ref.value)				Recommended hole(H7)		Bearing O.D.			
I.D.	O.D.	(+)	(−)	(+)	(+)	(+)	(+)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Exceeding500 & up to 630	Less than500 & up to 630	0	0.070	1.051	0.941	0.890	0.780	0.960	0.780	0.070	0	0.235	0.158	0.235	0.088
	Exceeding630 & up to 800	0	0.070	1.086	0.976	0.890	0.780	0.960	0.780	0.080	0	0.280	0.192	0.280	0.112
Exceeding630 & up to 800	Exceeding630 & up to 800	0	0.080	1.131	1.006	0.935	0.810	1.015	0.810	0.080	0	0.280	0.192	0.280	0.112
	Exceeding800 & up to 1000	0	0.080	1.169	1.044	0.935	0.810	1.015	0.810	0.090	0	0.329	0.230	0.329	0.140
Exceeding800 & up to 1000	Exceeding800 & up to 1000	0	0.090	1.214	1.074	0.980	0.840	1.070	0.840	0.090	0	0.329	0.230	0.329	0.140
	Exceeding1000 & up to 1250	0	0.090	1.265	1.125	0.980	0.840	1.070	0.840	0.105	0	0.395	0.280	0.395	0.175
Exceeding1000 & up to 1250	Exceeding1000 & up to 1250	0	0.105	1.320	1.155	1.035	0.870	1.140	0.870	0.105	0	0.395	0.280	0.395	0.175
	Exceeding1250 & up to 1600	0	0.105	1.390	1.225	1.035	0.870	1.140	0.870	0.125	0	0.486	0.349	0.486	0.224
Exceeding1250 & up to 1600	Exceeding1250 & up to 1600	0	0.125	1.460	1.265	1.105	0.910	1.230	0.910	0.125	0	0.486	0.349	0.486	0.224
	Exceeding1600 & up to 2000	0	0.125	1.542	1.347	1.105	0.910	1.230	0.910	0.150	0	0.595	0.430	0.595	0.280
Exceeding1600 & up to 2000	Exceeding1600 & up to 2000	0	0.150	1.617	1.387	1.180	0.950	1.330	0.950	0.150	0	0.595	0.430	0.595	0.280
	Exceeding2000 & up to 2500	0	0.150	1.713	1.483	1.180	0.950	1.330	0.950	0.175	0	0.717	0.525	0.717	0.350
Exceeding2000 & up to 2500	Exceeding2000 & up to 2500	0	0.175	1.813	1.533	1.280	1.000	1.455	1.000	0.175	0	0.717	0.525	0.717	0.350
	Exceeding2500 & up to 3150	0	0.175	1.941	1.661	1.280	1.000	1.455	1.000	0.210	0	0.882	0.651	0.882	0.441
Exceeding2500 & up to 3150	Exceeding2500 & up to 3150	0	0.210	2.031	1.701	1.370	1.040	1.580	1.040	0.210	0	0.882	0.651	0.882	0.441

(Unit : mm)

Oiles 300 / 600

Bearing dimension		Dimension tolerance						Clearance		Dimension tolerance				Interference	
		Recommended shaft(h7)		I.D. before press fit		I.D. after press fit (ref.value)				Recommended hole(H7)		Bearing O.D.			
I.D.	O.D.	(+)	(−)	(+)	(+)	(+)	(+)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Up to 10	Up to 10	0	0.015	0.051	0.029	0.034	0.012	0.049	0.012	0.015	0	0.034	0.019	0.034	0.004
	Exceeding 10 & up to 18	0	0.015	0.055	0.033	0.034	0.012	0.049	0.012	0.018	0	0.041	0.023	0.041	0.005
Exceeding 10 & up to 18	Exceeding 10 & up to 18	0	0.018	0.068	0.041	0.047	0.020	0.065	0.020	0.018	0	0.041	0.023	0.041	0.005
	Exceeding 18 & up to 30	0	0.018	0.072	0.045	0.047	0.020	0.065	0.020	0.021	0	0.049	0.028	0.049	0.007
Exceeding 18 & up to 30	Exceeding 18 & up to 30	0	0.021	0.088	0.055	0.063	0.030	0.084	0.030	0.021	0	0.049	0.028	0.049	0.007
	Exceeding 30 & up to 50	0	0.021	0.094	0.061	0.063	0.030	0.084	0.030	0.025	0	0.059	0.034	0.059	0.009
Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.025	0.113	0.074	0.082	0.043	0.107	0.043	0.025	0	0.059	0.034	0.059	0.009
	Exceeding 50 & up to 80	0	0.025	0.120	0.081	0.082	0.043	0.107	0.043	0.030	0	0.073	0.041	0.073	0.011
Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.030	0.144	0.098	0.106	0.060	0.136	0.060	0.030	0	0.073	0.041	0.073	0.011
	Exceeding 80 & up to 120	0	0.030	0.153	0.107	0.106	0.060	0.136	0.060	0.035	0	0.089	0.051	0.089	0.016
Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.035	0.188	0.134	0.141	0.087	0.176	0.087	0.035	0	0.089	0.051	0.089	0.016
	Exceeding120 & up to 180	0	0.035	0.200	0.146	0.141	0.087	0.176	0.087	0.040	0	0.108	0.063	0.108	0.023
Exceeding120 & up to 180	Exceeding120 & up to 180	0	0.040	0.246	0.183	0.187	0.124	0.227	0.124	0.040	0	0.108	0.063	0.108	0.023
	Exceeding180 & up to 250	0	0.040	0.259	0.196	0.187	0.124	0.227	0.124	0.046	0	0.130	0.077	0.130	0.031
Exceeding180 & up to 250	Exceeding180 & up to 250	0	0.046	0.307	0.235	0.235	0.163	0.281	0.163	0.046	0	0.130	0.077	0.130	0.031
	Exceeding250 & up to 315	0	0.046	0.321	0.249	0.235	0.163	0.281	0.163	0.052	0	0.150	0.094	0.150	0.042
Exceeding250 & up to 315	Exceeding250 & up to 315	0	0.052	0.372	0.291	0.286	0.205	0.338	0.205	0.052	0	0.150	0.094	0.150	0.042
	Exceeding315 & up to 400	0	0.052	0.386	0.305	0.286	0.205	0.338	0.205	0.057	0	0.171	0.108	0.171	0.051
Exceeding315 & up to 400	Exceeding315 & up to 400	0	0.057	0.449	0.360	0.349	0.260	0.406	0.260	0.057	0	0.171	0.108	0.171	0.051
	Exceeding400 & up to 500	0	0.057	0.465	0.376	0.349	0.260	0.406	0.260	0.063	0	0.195	0.126	0.195	0.063
Exceeding400 & up to 500	Exceeding400 & up to 500	0	0.063	0.538	0.441	0.422	0.325	0.485	0.325	0.063	0	0.195	0.126	0.195	0.063

※When used in oil lubrication, clearance may be smaller by 1/1000·d.

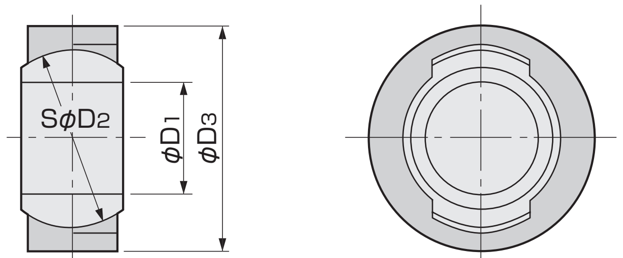
(Unit : mm)

On Design

Selection Guide
Product Information
Plastic Bearing
Multi-layer Bearing
Metallic Bearing
Air Bearings
Slide Shifter
Technical Information
Corporate Profile

Oiles 500 Spherical Bearings

(Window type spherical bearing with nominal dimension of less than ϕ100)
(Room temp. / pressure P = up to 9.8N/mm² {100kgf/cm² })



Bearing dimension (D1)			Recommended shaft (h7)		I.D. tolerance (D1)		Clearance		Inner race O.D. (D2) Outer race I.D. (H7)		Inner race O.D. (e7)		Clearance		Recommended hole (H7)		O.D. tolerance (D3) js7	Interference	
I.D.	S.D.	O.D.	(+)	(−)	(+)	(+)	max.	min.	(+)	(−)	(−)	(−)	max.	min.	(+)	(−)	±	max.	min.
Exceeding 10 & up to 14	Exceeding 10 & up to 18	Exceeding 18 & up to 30	0	0.018	0.057	0.030	0.075	0.030	0.018	0	0.032	0.050	0.068	0.032	0.021	0	0.0105	0.011	0.032
	Exceeding 18 & up to 30	Exceeding 30 & up to 50	0	0.018	0.057	0.030	0.075	0.030	0.021	0	0.040	0.061	0.082	0.040	0.025	0	0.0125	0.013	0.038
Exceeding 14 & up to 18	Exceeding 18 & up to 30	Exceeding 18 & up to 30	0	0.018	0.057	0.030	0.075	0.030	0.021	0	0.040	0.061	0.082	0.040	0.021	0	0.0105	0.011	0.032
	Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.018	0.057	0.030	0.075	0.030	0.025	0	0.050	0.075	0.100	0.050	0.025	0	0.0125	0.013	0.038
Exceeding 18 & up to 24	Exceeding 18 & up to 30	Exceeding 30 & up to 50	0	0.021	0.080	0.047	0.101	0.047	0.021	0	0.040	0.061	0.082	0.040	0.025	0	0.0125	0.013	0.038
	Exceeding 30 & up to 50	Exceeding 50 & up to 80	0	0.021	0.080	0.047	0.101	0.047	0.025	0	0.050	0.075	0.100	0.050	0.030	0	0.0150	0.015	0.045
Exceeding 24 & up to 30	Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.021	0.080	0.047	0.101	0.047	0.025	0	0.050	0.075	0.100	0.050	0.025	0	0.0125	0.013	0.038
	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.021	0.080	0.047	0.101	0.047	0.030	0	0.060	0.090	0.120	0.060	0.030	0	0.0150	0.015	0.045
Exceeding 30 & up to 40	Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.025	0.113	0.074	0.138	0.074	0.025	0	0.050	0.075	0.100	0.050	0.025	0	0.0125	0.013	0.038
	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.025	0.113	0.074	0.138	0.074	0.030	0	0.060	0.090	0.120	0.060	0.030	0	0.0150	0.015	0.045
Exceeding 40 & up to 50	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.025	0.113	0.074	0.138	0.074	0.030	0	0.060	0.090	0.120	0.060	0.030	0	0.0150	0.015	0.045
	Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.025	0.113	0.074	0.138	0.074	0.035	0	0.072	0.107	0.142	0.072	0.035	0	0.0175	0.018	0.053
Exceeding 50 & up to 65	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.030	0.152	0.106	0.182	0.106	0.030	0	0.060	0.090	0.120	0.060	0.030	0	0.0150	0.015	0.045
	Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.030	0.152	0.106	0.182	0.106	0.035	0	0.072	0.107	0.142	0.072	0.035	0	0.0175	0.018	0.053
Exceeding 65 & up to 80	Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.030	0.152	0.106	0.182	0.106	0.035	0	0.072	0.107	0.142	0.072	0.035	0	0.0175	0.018	0.053
	Exceeding 120 & up to 180	Exceeding 120 & up to 180	0	0.030	0.152	0.106	0.182	0.106	0.040	0	0.085	0.125	0.165	0.085	0.040	0	0.0200	0.020	0.060
Exceeding 80 & up to 100	Exceeding 80 & up to 120	Exceeding 120 & up to 180	0	0.035	0.195	0.141	0.230	0.141	0.035	0	0.072	0.107	0.142	0.072	0.040	0	0.0200	0.020	0.060
	Exceeding 120 & up to 180	Exceeding 120 & up to 180	0	0.035	0.195	0.141	0.230	0.141	0.040	0	0.085	0.125	0.165	0.085	0.040	0	0.0200	0.020	0.060

(Unit : mm)

Oiles 500 Spherical Bearings

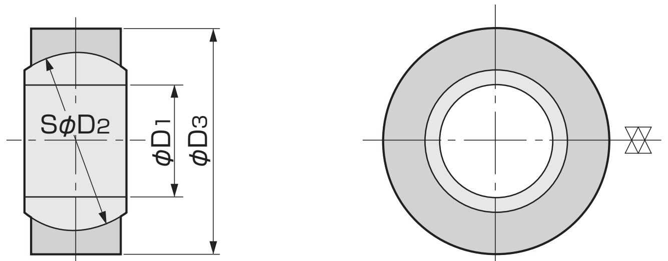
(Window type spherical bearing with nominal dimension of less than ϕ100)
(Over room temp. and up to 200℃ / or pressure P = over 9.8N/mm² {100kgf/cm² })

Bearing dimension (D1)			Recommended shaft (h7)		I.D. tolerance (D1)		Clearance		Inner race O.D. (D2) Outer race I.D. (H7)		Inner race O.D. (e7)		Clearance		Recommended hole (H7)		O.D. tolerance (D3) js7	Interference	
I.D.	S.D.	O.D.	(+)	(−)	(+)	(+)	max.	min.	(+)	(−)	(−)	(−)	max.	min.	(+)	(−)	±	max.	min.
Exceeding 10 & up to 14	Exceeding 10 & up to 18	Exceeding 18 & up to 30	0	0.018	0.092	0.065	0.110	0.065	0.018	0	0.032	0.050	0.068	0.032	0.021	0	0.0105	0.011	0.032
	Exceeding 18 & up to 30	Exceeding 30 & up to 50	0	0.018	0.092	0.065	0.110	0.065	0.021	0	0.040	0.061	0.082	0.040	0.025	0	0.0125	0.013	0.038
Exceeding 14 & up to 18	Exceeding 18 & up to 30	Exceeding 18 & up to 30	0	0.018	0.092	0.065	0.110	0.065	0.021	0	0.040	0.061	0.082	0.040	0.021	0	0.0105	0.011	0.032
	Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.018	0.092	0.065	0.110	0.065	0.025	0	0.050	0.075	0.100	0.050	0.025	0	0.0125	0.013	0.038
Exceeding 18 & up to 24	Exceeding 18 & up to 30	Exceeding 30 & up to 50	0	0.021	0.133	0.100	0.154	0.100	0.021	0	0.040	0.061	0.082	0.040	0.025	0	0.0125	0.013	0.038
	Exceeding 30 & up to 50	Exceeding 50 & up to 80	0	0.021	0.133	0.100	0.154	0.100	0.025	0	0.050	0.075	0.100	0.050	0.030	0	0.0150	0.015	0.045
Exceeding 24 & up to 30	Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.021	0.133	0.100	0.154	0.100	0.025	0	0.050	0.075	0.100	0.050	0.025	0	0.0125	0.013	0.038
	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.021	0.133	0.100	0.154	0.100	0.030	0	0.060	0.090	0.120	0.060	0.030	0	0.0150	0.015	0.045
Exceeding 30 & up to 40	Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.025	0.189	0.150	0.214	0.150	0.025	0	0.050	0.075	0.100	0.050	0.025	0	0.0125	0.013	0.038
	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.025	0.189	0.150	0.214	0.150	0.030	0	0.060	0.090	0.120	0.060	0.030	0	0.0150	0.015	0.045
Exceeding 40 & up to 50	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.025	0.189	0.150	0.214	0.150	0.030	0	0.060	0.090	0.120	0.060	0.030	0	0.0150	0.015	0.045
	Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.025	0.189	0.150	0.214	0.150	0.035	0	0.072	0.107	0.142	0.072	0.035	0	0.0175	0.018	0.053
Exceeding 50 & up to 65	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.030	0.266	0.220	0.296	0.220	0.030	0	0.060	0.090	0.120	0.060	0.030	0	0.0150	0.015	0.045
	Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.030	0.266	0.220	0.296	0.220	0.035	0	0.072	0.107	0.142	0.072	0.035	0	0.0175	0.018	0.053
Exceeding 65 & up to 80	Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.030	0.266	0.220	0.296	0.220	0.035	0	0.072	0.107	0.142	0.072	0.035	0	0.0175	0.018	0.053
	Exceeding 120 & up to 180	Exceeding 120 & up to 180	0	0.030	0.266	0.220	0.296	0.220	0.040	0	0.085	0.125	0.165	0.085	0.040	0	0.0200	0.020	0.060
Exceeding 80 & up to 100	Exceeding 80 & up to 120	Exceeding 120 & up to 180	0	0.035	0.354	0.300	0.389	0.300	0.035	0	0.072	0.107	0.142	0.072	0.040	0	0.0200	0.020	0.060
	Exceeding 120 & up to 180	Exceeding 120 & up to 180	0	0.035	0.354	0.300	0.389	0.300	0.040	0	0.085	0.125	0.165	0.085	0.040	0	0.0200	0.020	0.060

(Unit : mm)

Oiles 500 Spherical Bearings

(Split outer race type with the I.D. of up to ϕ100 mm / room temperature)
(pressure; up to P=9.8N/mm² {100kgf/cm² })



Bearing dimension (D1)			Recommended shaft (h7)		I.D. tolerance (D1)		Clearance		Inner race O.D. (D2) Outer race I.D. (H7)		Inner race O.D. (e8)		Clearance		Recommended hole (H7)		O.D. tolerance (D3) p7		Interference	
I.D.	S.D.	O.D.	(+)	(−)	(+)	(+)	max.	min.	(+)	(+)	(−)	(−)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Exceeding 10 & up to 14	Exceeding 10 & up to 18	Exceeding 18 & up to 30	0	0.018	0.057	0.030	0.075	0.030	0.049	0.022	0.032	0.059	0.086	0.032	0.021	0	0.043	0.022	0.043	0.001
	Exceeding 18 & up to 30	Exceeding 30 & up to 50	0	0.018	0.057	0.030	0.075	0.030	0.059	0.026	0.040	0.073	0.106	0.040	0.025	0	0.051	0.026	0.051	0.001
Exceeding 14 & up to 18	Exceeding 18 & up to 30	Exceeding 18 & up to 30	0	0.018	0.057	0.030	0.075	0.030	0.055	0.022	0.040	0.073	0.106	0.040	0.021	0	0.043	0.022	0.043	0.001
	Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.018	0.057	0.030	0.075	0.030	0.051	0.026	0.050	0.089	0.114	0.050	0.025	0	0.051	0.026	0.051	0.001
Exceeding 18 & up to 24	Exceeding 18 & up to 30	Exceeding 30 & up to 50	0	0.021	0.080	0.047	0.101	0.047	0.059	0.026	0.040	0.073	0.106	0.040	0.025	0	0.051	0.026	0.051	0.001
	Exceeding 30 & up to 50	Exceeding 50 & up to 80	0	0.021	0.080	0.047	0.101	0.047	0.071	0.032	0.050	0.089	0.128	0.050	0.030	0	0.062	0.032	0.062	0.002
Exceeding 24 & up to 30	Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.021	0.080	0.047	0.101	0.047	0.065	0.026	0.050	0.089	0.128	0.050	0.025	0	0.051	0.026	0.051	0.001
	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.021	0.080	0.047	0.101	0.047	0.078	0.032	0.060	0.106	0.152	0.060	0.030	0	0.062	0.032	0.062	0.002
Exceeding 30 & up to 40	Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.025	0.113	0.074	0.138	0.074	0.065	0.026	0.050	0.089	0.128	0.050	0.025	0	0.051	0.026	0.051	0.001
	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.025	0.113	0.074	0.138	0.074	0.078	0.032	0.060	0.106	0.152	0.060	0.030	0	0.062	0.032	0.062	0.002
Exceeding 40 & up to 50	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.025	0.113	0.074	0.138	0.074	0.078	0.032	0.060	0.106	0.152	0.060	0.030	0	0.062	0.032	0.062	0.002
	Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.025	0.113	0.074	0.138	0.074	0.091	0.037	0.072	0.126	0.180	0.072	0.035	0	0.072	0.037	0.072	0.002
Exceeding 50 & up to 65	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.030	0.152	0.106	0.182	0.106	0.078	0.032	0.060	0.106	0.152	0.060	0.030	0	0.062	0.032	0.062	0.002
	Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.030	0.152	0.106	0.182	0.106	0.091	0.037	0.072	0.126	0.180	0.072	0.035	0	0.072	0.037	0.072	0.002
Exceeding 65 & up to 80	Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.030	0.152	0.106	0.182	0.106	0.091	0.037	0.072	0.126	0.180	0.072	0.035	0	0.072	0.037	0.072	0.002
	Exceeding 120 & up to 180	Exceeding 120 & up to 180	0	0.030	0.152	0.106	0.182	0.106	0.106	0.043	0.085	0.148	0.211	0.085	0.040	0	0.083	0.043	0.083	0.003
Exceeding 80 & up to 100	Exceeding 80 & up to 120	Exceeding 120 & up to 180	0	0.035	0.195	0.141	0.230	0.141	0.097	0.043	0.072	0.126	0.180	0.072	0.040	0	0.083	0.043	0.083	0.003
	Exceeding 120 & up to 180	Exceeding 120 & up to 180	0	0.035	0.195	0.141	0.230	0.141	0.106	0.043	0.085	0.148	0.211	0.085	0.040	0	0.083	0.043	0.083	0.003

※I.D. dimension of outer race of spherical bearing is H8 after it is set into a housing. (Unit : mm)

Oiles 500 Spherical Bearings

(Split outer race type with the I.D. of over ϕ100 to ϕ1,250 mm / room temperature)
(pressure; up to P=9.8N/mm² {100kgf/cm² })

Bearing dimension (D1)			Recommended shaft (h7)		I.D. tolerance (D1)		Clearance		Inner race O.D. (D2) Outer race I.D. (H7)		Inner race O.D. (e8)		Clearance		Recommended hole (H7)		O.D. tolerance (D3) p7		Interference	
I.D.	S.D.	O.D.	(+)	(−)	(+)	(+)	max.	min.	(+)	(+)	(−)	(−)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Exceeding 100 & up to 120	Exceeding 120 & up to 180	Exceeding 120 & up to 180	0	0.035	0.195	0.141	0.230	0.141	0.106	0.043	0.085	0.148	0.211	0.085	0.040	0	0.083	0.043	0.083	0.003
	Exceeding 180 & up to 250	Exceeding 180 & up to 250	0	0.035	0.195	0.141	0.230	0.141	0.122	0.050	0.100	0.172	0.244	0.100	0.046	0	0.096	0.050	0.096	0.004
Exceeding 120 & up to 180	Exceeding 120 & up to 180	Exceeding 180 & up to 250	0	0.040	0.249	0.186	0.289	0.186	0.113	0.050	0.085	0.148	0.211	0.085	0.046	0	0.096	0.050	0.096	0.004
	Exceeding 180 & up to 250	Exceeding 250 & up to 315	0	0.040	0.249	0.186	0.289	0.186	0.128	0.056	0.100	0.172	0.244	0.100	0.052	0	0.108	0.056	0.108	0.004
Exceeding 180 & up to 250	Exceeding 250 & up to 315	Exceeding 250 & up to 315	0	0.046	0.300	0.228	0.346	0.228	0.137	0.056	0.110	0.191	0.272	0.110	0.052	0	0.108	0.056	0.108	0.004
	Exceeding 315 & up to 400	Exceeding 315 & up to 400	0	0.046	0.300	0.228	0.346	0.228	0.151	0.062	0.125	0.214	0.303	0.125	0.057	0	0.119	0.062	0.119	0.005
Exceeding 250 & up to 315	Exceeding 315 & up to 400	Exceeding 315 & up to 400	0	0.052	0.364	0.283	0.416	0.283	0.151	0.062	0.125	0.214	0.303	0.125	0.057	0	0.119	0.062	0.119	0.005
	Exceeding 400 & up to 500	Exceeding 400 & up to 500	0	0.052	0.364	0.283	0.416	0.283	0.165	0.068	0.135	0.232	0.329	0.135	0.063	0	0.131	0.068	0.131	0.005
Exceeding 315 & up to 400	Exceeding 400 & up to 500	Exceeding 400 & up to 500	0	0.057	0.439	0.350	0.496	0.350	0.165	0.068	0.135	0.232	0.329	0.135	0.063	0	0.131	0.068	0.131	0.005
	Exceeding 500 & up to 630	Exceeding 500 & up to 630	0	0.057	0.439	0.350	0.496	0.350	0.188	0.078	0.145	0.255	0.365	0.145	0.070	0	0.148	0.078	0.148	0.008
Exceeding 400 & up to 500	Exceeding 500 & up to 630	Exceeding 500 & up to 630	0	0.063	0.522	0.425	0.585	0.425	0.188	0.078	0.145	0.255	0.365	0.145	0.070	0	0.148	0.078	0.148	0.008
	Exceeding 630 & up to 800	Exceeding 630 & up to 800	0	0.063	0.522	0.425	0.585	0.425	0.213	0.088	0.160	0.285	0.410	0.160	0.080	0	0.168	0.088	0.168	0.008
Exceeding 500 & up to 630	Exceeding 500 & up to 630	Exceeding 630 & up to 800	0	0.070	0.565	0.455	0.635	0.455	0.198	0.088	0.145	0.255	0.365	0.145	0.080	0	0.168	0.088	0.168	0.008
	Exceeding 630 & up to 800	Exceeding 800 & up to 1000	0	0.070	0.565	0.455	0.635	0.455	0.225	0.100	0.160	0.285	0.410	0.160	0.090	0	0.190	0.100	0.190	0.010
Exceeding 630 & up to 800	Exceeding 630 & up to 800	Exceeding 800 & up to 1000	0	0.080	0.610	0.485	0.690	0.485	0.225	0.100	0.160	0.285	0.410	0.160	0.090	0	0.190	0.100	0.190	0.010
	Exceeding 800 & up to 1000	Exceeding 1000 & up to 1250	0	0.080	0.610	0.485	0.690	0.485	0.260	0.120	0.170	0.310	0.450	0.170	0.105	0	0.225	0.120	0.225	0.015
Exceeding 800 & up to 1000	Exceeding 1000 & up to 1250	Exceeding 1250 & up to 1600	0	0.090	0.655	0.515	0.745	0.515	0.305	0.140	0.195	0.360	0.525	0.195	0.125	0	0.265	0.140	0.265	0.015
	Exceeding 1250 & up to 1600	Exceeding 1600 & up to 2000	0	0.090	0.655	0.515	0.745	0.515	0.365	0.170	0.220	0.415	0.610	0.220	0.150	0	0.320	0.170	0.320	0.020
Exceeding 1000 & up to 1250	Exceeding 1000 & up to 1250	Exceeding 1250 & up to 1600	0	0.105	0.710	0.545	0.815	0.545	0.305	0.140	0.195	0.360	0.525	0.195	0.125	0	0.265	0.140	0.265	0.015
	Exceeding 1250 & up to 1600	Exceeding 1600 & up to 2000	0	0.105	0.710	0.545	0.815	0.545	0.365	0.170	0.220	0.415	0.610	0.220	0.150	0	0.320	0.170	0.320	0.020

※I.D. dimension of outer race of spherical bearing is H8 after it is set into a housing. (Unit : mm)

On Design

Oiles 500 Spherical Bearings

(Split outer race type with the I.D. of up to ϕ100 mm / room temperature up to 200℃)
(pressure; P=9.8N/mm² {100kgf/cm² } and over)

Bearing dimension (D_1)			Recommended shaft (h7)		I.D. tolerance (D_1)		Clearance		Inner race O.D. (D_2)						Recommended hole (H7)		O.D. tolerance (D_3)p7		Interference	
									Outer race I.D. (H7)		Inner race O.D. (e8)		Clearance							
I.D.	S.D.	O.D.	(+)	(−)	(+)	(+)	max.	min.	(+)	(+)	(−)	(−)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Exceeding 10 & up to 14	Exceeding 10 & up to 18	Exceeding 18 & up to 30	0	0.018	0.092	0.065	0.110	0.065	0.049	0.022	0.032	0.059	0.086	0.032	0.021	0	0.043	0.022	0.043	0.001
	Exceeding 18 & up to 30	Exceeding 30 & up to 50	0	0.018	0.092	0.065	0.110	0.065	0.059	0.026	0.040	0.073	0.106	0.040	0.025	0	0.051	0.026	0.051	0.001
Exceeding 14 & up to 18	Exceeding 18 & up to 30	Exceeding 18 & up to 30	0	0.018	0.092	0.065	0.110	0.065	0.055	0.022	0.040	0.073	0.106	0.040	0.021	0	0.043	0.022	0.043	0.001
	Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.018	0.092	0.065	0.110	0.065	0.051	0.026	0.050	0.089	0.114	0.050	0.025	0	0.051	0.026	0.051	0.001
Exceeding 18 & up to 24	Exceeding 18 & up to 30	Exceeding 30 & up to 50	0	0.021	0.133	0.100	0.154	0.100	0.059	0.026	0.040	0.073	0.106	0.040	0.025	0	0.051	0.026	0.051	0.001
	Exceeding 30 & up to 50	Exceeding 50 & up to 80	0	0.021	0.133	0.100	0.154	0.100	0.071	0.032	0.050	0.089	0.128	0.050	0.030	0	0.062	0.032	0.062	0.002
Exceeding 24 & up to 30	Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.021	0.133	0.100	0.154	0.100	0.065	0.026	0.050	0.089	0.128	0.050	0.025	0	0.051	0.026	0.051	0.001
	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.021	0.133	0.100	0.154	0.100	0.078	0.032	0.060	0.106	0.152	0.060	0.030	0	0.062	0.032	0.062	0.002
Exceeding 30 & up to 40	Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.025	0.189	0.150	0.214	0.150	0.065	0.026	0.050	0.089	0.128	0.050	0.025	0	0.051	0.026	0.051	0.001
	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.025	0.189	0.150	0.214	0.150	0.078	0.032	0.060	0.106	0.152	0.060	0.030	0	0.062	0.032	0.062	0.002
Exceeding 40 & up to 50	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.025	0.189	0.150	0.214	0.150	0.078	0.032	0.060	0.106	0.152	0.060	0.030	0	0.062	0.032	0.062	0.002
	Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.025	0.189	0.150	0.214	0.150	0.091	0.037	0.072	0.126	0.180	0.072	0.035	0	0.072	0.037	0.072	0.002
Exceeding 50 & up to 65	Exceeding 50 & up to 80	Exceeding 50 & up to 80	0	0.030	0.266	0.220	0.296	0.220	0.078	0.032	0.060	0.106	0.152	0.060	0.030	0	0.062	0.032	0.062	0.002
	Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.030	0.266	0.220	0.296	0.220	0.091	0.037	0.072	0.126	0.180	0.072	0.035	0	0.072	0.037	0.072	0.002
Exceeding 65 & up to 80	Exceeding 80 & up to 120	Exceeding 80 & up to 120	0	0.030	0.266	0.220	0.296	0.220	0.091	0.037	0.072	0.126	0.180	0.072	0.035	0	0.072	0.037	0.072	0.002
	Exceeding 120 & up to 180	Exceeding 120 & up to 180	0	0.030	0.266	0.220	0.296	0.220	0.106	0.043	0.085	0.148	0.211	0.085	0.040	0	0.083	0.043	0.083	0.003
Exceeding 80 & up to 100	Exceeding 80 & up to 120	Exceeding 120 & up to 180	0	0.035	0.354	0.300	0.389	0.300	0.097	0.043	0.072	0.126	0.180	0.072	0.040	0	0.083	0.043	0.083	0.003
	Exceeding 120 & up to 180	Exceeding 120 & up to 180	0	0.035	0.354	0.300	0.389	0.300	0.106	0.043	0.085	0.148	0.211	0.085	0.040	0	0.083	0.043	0.083	0.003

※I.D. dimension of outer race of spherical bearing is H8 after it is set into a housing. (Unit : mm)

Oiles 500 Spherical Bearings

(Split outer race types with the I.D. of over ϕ100 to ϕ1,250 mm)
(room temperature up to 200℃/ pressure; up to P=9.8N/mm² {100kgf/cm² } and over)

Bearing dimension (D_1)			Recommended shaft (h7)		I.D. tolerance (D_1)		Clearance		Inner race O.D. (D_2)						Recommended hole (H7)		O.D. tolerance (D_3)p7		Interference	
									Outer race I.D. (H7)		Inner race O.D. (e8)		Clearance							
I.D.	S.D.	O.D.	(+)	(−)	(+)	(+)	max.	min.	(+)	(+)	(−)	(−)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Exceeding 100 & up to 120	Exceeding 120 & up to 180	Exceeding 120 & up to 180	0	0.035	0.354	0.300	0.389	0.300	0.106	0.043	0.085	0.148	0.211	0.085	0.040	0	0.083	0.043	0.083	0.003
	Exceeding 180 & up to 250	Exceeding 180 & up to 250	0	0.035	0.354	0.300	0.389	0.300	0.122	0.050	0.100	0.172	0.244	0.100	0.046	0	0.096	0.050	0.096	0.004
Exceeding 120 & up to 180	Exceeding 120 & up to 180	Exceeding 180 & up to 250	0	0.040	0.458	0.395	0.498	0.395	0.113	0.050	0.085	0.148	0.211	0.085	0.046	0	0.096	0.050	0.096	0.004
	Exceeding 180 & up to 250	Exceeding 250 & up to 315	0	0.040	0.458	0.395	0.498	0.395	0.128	0.056	0.100	0.172	0.244	0.100	0.052	0	0.108	0.056	0.108	0.004
Exceeding 180 & up to 250	Exceeding 250 & up to 315	Exceeding 250 & up to 315	0	0.046	0.572	0.500	0.618	0.500	0.137	0.056	0.110	0.191	0.272	0.110	0.052	0	0.108	0.056	0.108	0.004
	Exceeding 315 & up to 400	Exceeding 315 & up to 400	0	0.046	0.572	0.500	0.618	0.500	0.151	0.062	0.125	0.214	0.303	0.125	0.057	0	0.119	0.062	0.119	0.005
Exceeding 250 & up to 315	Exceeding 315 & up to 400	Exceeding 315 & up to 400	0	0.052	0.651	0.570	0.703	0.570	0.151	0.062	0.125	0.214	0.303	0.125	0.057	0	0.119	0.062	0.119	0.005
	Exceeding 400 & up to 500	Exceeding 400 & up to 500	0	0.052	0.651	0.570	0.703	0.570	0.165	0.068	0.135	0.232	0.329	0.135	0.063	0	0.131	0.068	0.131	0.005
Exceeding 315 & up to 400	Exceeding 400 & up to 500	Exceeding 400 & up to 500	0	0.057	0.729	0.640	0.786	0.640	0.165	0.068	0.135	0.232	0.329	0.135	0.063	0	0.131	0.068	0.131	0.005
	Exceeding 500 & up to 630	Exceeding 500 & up to 630	0	0.057	0.729	0.640	0.786	0.640	0.188	0.078	0.145	0.255	0.365	0.145	0.070	0	0.148	0.078	0.148	0.008
Exceeding 400 & up to 500	Exceeding 500 & up to 630	Exceeding 500 & up to 630	0	0.063	0.847	0.750	0.910	0.750	0.188	0.078	0.145	0.255	0.365	0.145	0.070	0	0.148	0.078	0.148	0.008
	Exceeding 630 & up to 800	Exceeding 630 & up to 800	0	0.063	0.847	0.750	0.910	0.750	0.213	0.088	0.160	0.285	0.410	0.160	0.080	0	0.168	0.088	0.168	0.008
Exceeding 500 & up to 630	Exceeding 500 & up to 630	Exceeding 630 & up to 800	0	0.070	0.890	0.780	0.960	0.780	0.198	0.088	0.145	0.255	0.365	0.145	0.080	0	0.168	0.088	0.168	0.008
	Exceeding 630 & up to 800	Exceeding 800 & up to 1000	0	0.070	0.890	0.780	0.960	0.780	0.225	0.100	0.160	0.285	0.410	0.160	0.090	0	0.190	0.100	0.190	0.010
Exceeding 630 & up to 800	Exceeding 630 & up to 800	Exceeding 800 & up to 1000	0	0.080	0.935	0.810	1.015	0.810	0.225	0.100	0.160	0.285	0.410	0.160	0.090	0	0.190	0.100	0.190	0.010
	Exceeding 800 & up to 1000	Exceeding 1000 & up to 1250	0	0.080	0.935	0.810	1.015	0.810	0.260	0.120	0.170	0.310	0.450	0.170	0.105	0	0.225	0.120	0.225	0.015
Exceeding 800 & up to 1000	Exceeding 1000 & up to 1250	Exceeding 1250 & up to 1600	0	0.090	0.980	0.840	1.070	0.840	0.305	0.140	0.195	0.360	0.525	0.195	0.125	0	0.265	0.140	0.265	0.015
	Exceeding 1250 & up to 1600	Exceeding 1600 & up to 2000	0	0.090	0.980	0.840	1.070	0.840	0.365	0.170	0.220	0.415	0.610	0.220	0.150	0	0.320	0.170	0.320	0.020
Exceeding 1000 & up to 1250	Exceeding 1000 & up to 1250	Exceeding 1250 & up to 1600	0	0.105	1.035	0.870	1.140	0.870	0.305	0.140	0.195	0.360	0.525	0.195	0.125	0	0.265	0.140	0.265	0.015
	Exceeding 1250 & up to 1600	Exceeding 1600 & up to 2000	0	0.105	1.035	0.870	1.140	0.870	0.365	0.170	0.220	0.415	0.610	0.220	0.150	0	0.320	0.170	0.320	0.020

※I.D. dimension of outer race of spherical bearing is H8 after it is set into a housing. (Unit : mm)

Oiles 500 Split Bearings

(room temperature / pressure; up to P=9.8N/mm² {100kgf/cm² })

Bearing dimension	Dimension tolerance				Clearance		Dimension tolerance			
	Recommended shaft (h7)		I.D.				Recommended hole (H7)		O.D. js7	
	(+)	(−)	(+)	(+)	max.	min.	(+)	(−)	(+)	(−)
Up to 10	0	0.015	0.040	0.018	0.055	0.018	0.015	0	0.0075	0.0075
Exceeding 10 & up to 18	0	0.018	0.057	0.030	0.075	0.030	0.018	0	0.0090	0.0090
Exceeding 18 & up to 30	0	0.021	0.080	0.047	0.101	0.047	0.021	0	0.0105	0.0105
Exceeding 30 & up to 50	0	0.025	0.113	0.074	0.138	0.074	0.025	0	0.0125	0.0125
Exceeding 50 & up to 80	0	0.030	0.152	0.106	0.182	0.106	0.030	0	0.0150	0.0150
Exceeding 80 & up to 120	0	0.035	0.195	0.141	0.230	0.141	0.035	0	0.0175	0.0175
Exceeding 120 & up to 180	0	0.040	0.249	0.186	0.289	0.186	0.040	0	0.0200	0.0200
Exceeding 180 & up to 250	0	0.046	0.300	0.228	0.346	0.228	0.046	0	0.0230	0.0230
Exceeding 250 & up to 315	0	0.052	0.364	0.283	0.416	0.283	0.052	0	0.0260	0.0260
Exceeding 315 & up to 400	0	0.057	0.439	0.350	0.496	0.350	0.057	0	0.0285	0.0285
Exceeding 400 & up to 500	0	0.063	0.522	0.425	0.585	0.425	0.063	0	0.0315	0.0315
Exceeding 500 & up to 630	0	0.070	0.565	0.455	0.635	0.455	0.070	0	0.0350	0.0350
Exceeding 630 & up to 800	0	0.080	0.610	0.485	0.690	0.485	0.080	0	0.0400	0.0400
Exceeding 800 & up to 1000	0	0.090	0.655	0.515	0.745	0.515	0.090	0	0.0450	0.0450
Exceeding 1000 & up to 1250	0	0.105	0.710	0.545	0.815	0.545	0.105	0	0.0525	0.0525
Exceeding 1250 & up to 1600	0	0.125	0.780	0.585	0.905	0.585	0.125	0	0.0625	0.0625
Exceeding 1600 & up to 2000	0	0.150	0.855	0.625	1.005	0.625	0.150	0	0.0750	0.0750
Exceeding 2000 & up to 2500	0	0.175	0.955	0.675	1.130	0.675	0.175	0	0.0875	0.0875
Exceeding 2500 & up to 3150	0	0.210	1.045	0.715	1.255	0.715	0.210	0	0.1050	0.1050

※Dimensions above are measured when bushing is chucked on lathe. (Unit : mm)

Oiles 500 Split Bearings

(room temperature up to 200℃/ pressure; P=9.8N/mm² {100kgf/cm² } and over)

Bearing dimension	Dimension tolerance				Clearance		Dimension tolerance			
	Recommended shaft (h7)		I.D.				Recommended hole (H7)		O.D. js7	
	(+)	(−)	(+)	(+)	max.	min.	(+)	(−)	(+)	(−)
Up to 10	0	0.015	0.057	0.035	0.072	0.035	0.015	0	0.0075	0.0075
Exceeding 10 & up to 18	0	0.018	0.092	0.065	0.110	0.065	0.018	0	0.0090	0.0090
Exceeding 18 & up to 30	0	0.021	0.133	0.100	0.154	0.100	0.021	0	0.0105	0.0105
Exceeding 30 & up to 50	0	0.025	0.189	0.150	0.214	0.150	0.025	0	0.0125	0.0125
Exceeding 50 & up to 80	0	0.030	0.266	0.220	0.296	0.220	0.030	0	0.0150	0.0150
Exceeding 80 & up to 120	0	0.035	0.354	0.300	0.389	0.300	0.035	0	0.0175	0.0175
Exceeding 120 & up to 180	0	0.040	0.458	0.395	0.498	0.395	0.040	0	0.0200	0.0200
Exceeding 180 & up to 250	0	0.046	0.572	0.500	0.618	0.500	0.046	0	0.0230	0.0230
Exceeding 250 & up to 315	0	0.052	0.651	0.570	0.703	0.570	0.052	0	0.0260	0.0260
Exceeding 315 & up to 400	0	0.057	0.729	0.640	0.786	0.640	0.057	0	0.0285	0.0285
Exceeding 400 & up to 500	0	0.063	0.847	0.750	0.910	0.750	0.063	0	0.0315	0.0315
Exceeding 500 & up to 630	0	0.070	0.890	0.780	0.960	0.780	0.070	0	0.0350	0.0350
Exceeding 630 & up to 800	0	0.080	0.935	0.810	1.015	0.810	0.080	0	0.0400	0.0400
Exceeding 800 & up to 1000	0	0.090	0.980	0.840	1.070	0.840	0.090	0	0.0450	0.0450
Exceeding 1000 & up to 1250	0	0.105	1.035	0.870	1.140	0.870	0.105	0	0.0525	0.0525
Exceeding 1250 & up to 1600	0	0.125	1.105	0.910	1.230	0.910	0.125	0	0.0625	0.0625
Exceeding 1600 & up to 2000	0	0.150	1.180	0.950	1.330	0.950	0.150	0	0.0750	0.0750
Exceeding 2000 & up to 2500	0	0.175	1.280	1.000	1.455	1.000	0.175	0	0.0875	0.0875
Exceeding 2500 & up to 3150	0	0.210	1.370	1.040	1.580	1.040	0.210	0	0.1050	0.1050

※Dimensions above are measured when bushing is chucked on lathe. (Unit : mm)

On Design

Oiles 2000
(room temperature / pressure; up to P=9.8N/mm² {100kgf/cm² })

Bearing dimension		Dimension tolerance						Clearance		Dimension tolerance				Interference	
		Recommended shaft(h7)		I.D. before press fit		I.D. after press fit (ref.value)				Recommended hole(H7)		Bearing O.D. (r6)			
I.D.	O.D.	(+)	(−)	(+)	(+)	(+)	(+)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Up to 10	Exceeding 10 & up to 18	0	0.015	0.057	0.042	0.038	0.023	0.053	0.023	0.018	0	0.034	0.023	0.034	0.005
Exceeding 10 & up to 18	Exceeding 10 & up to 18	0	0.018	0.066	0.048	0.046	0.028	0.064	0.028	0.018	0	0.034	0.023	0.034	0.005
	Exceeding 18 & up to 30	0	0.018	0.070	0.052	0.046	0.028	0.064	0.028	0.021	0	0.041	0.028	0.041	0.007
Exceeding 18 & up to 30	Exceeding 18 & up to 30	0	0.021	0.081	0.060	0.057	0.036	0.078	0.036	0.021	0	0.041	0.028	0.041	0.007
	Exceeding 30 & up to 50	0	0.021	0.086	0.065	0.057	0.036	0.078	0.036	0.025	0	0.050	0.034	0.050	0.009
Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.025	0.100	0.075	0.070	0.045	0.095	0.045	0.025	0	0.050	0.034	0.050	0.009
	Exceeding 50 & up to 65	0	0.025	0.105	0.080	0.070	0.045	0.095	0.045	0.030	0	0.060	0.041	0.060	0.011
	Exceeding 65 & up to 80	0	0.025	0.107	0.082	0.070	0.045	0.095	0.045	0.030	0	0.062	0.043	0.062	0.013
Exceeding 50 & up to 80	Exceeding 50 & up to 65	0	0.030	0.120	0.090	0.084	0.054	0.114	0.054	0.030	0	0.060	0.041	0.060	0.011
	Exceeding 65 & up to 80	0	0.030	0.121	0.092	0.084	0.054	0.114	0.054	0.030	0	0.062	0.043	0.062	0.013
	Exceeding 80 & up to 100	0	0.030	0.128	0.099	0.084	0.054	0.114	0.054	0.035	0	0.073	0.051	0.073	0.016
	Exceeding100 & up to 120	0	0.030	0.131	0.102	0.084	0.054	0.114	0.054	0.035	0	0.076	0.054	0.076	0.019
Exceeding 80 & up to 120	Exceeding 80 & up to 100	0	0.035	0.145	0.110	0.100	0.065	0.135	0.065	0.035	0	0.073	0.051	0.073	0.016
	Exceeding100 & up to 120	0	0.035	0.147	0.112	0.100	0.065	0.135	0.065	0.035	0	0.076	0.054	0.076	0.019
	Exceeding120 & up to 140	0	0.035	0.155	0.120	0.100	0.065	0.135	0.065	0.040	0	0.088	0.063	0.088	0.023
	Exceeding140 & up to 160	0	0.035	0.157	0.122	0.100	0.065	0.135	0.065	0.040	0	0.090	0.065	0.090	0.025
	Exceeding160 & up to 180	0	0.035	0.160	0.125	0.100	0.065	0.135	0.065	0.040	0	0.093	0.068	0.093	0.028
Exceeding120 & up to 180	Exceeding120 & up to 140	0	0.040	0.174	0.134	0.118	0.078	0.158	0.078	0.040	0	0.088	0.063	0.088	0.023
	Exceeding140 & up to 160	0	0.040	0.175	0.135	0.118	0.078	0.158	0.078	0.040	0	0.090	0.065	0.090	0.025
	Exceeding160 & up to 180	0	0.040	0.178	0.138	0.118	0.078	0.158	0.078	0.040	0	0.093	0.068	0.093	0.028
	Exceeding180 & up to 200	0	0.040	0.186	0.146	0.118	0.078	0.158	0.078	0.046	0	0.106	0.077	0.106	0.031
	Exceeding200 & up to 225	0	0.040	0.189	0.149	0.118	0.078	0.158	0.078	0.046	0	0.109	0.080	0.109	0.034
	Exceeding225 & up to 250	0	0.040	0.193	0.153	0.118	0.078	0.158	0.078	0.046	0	0.113	0.084	0.113	0.038
Exceeding180 & up to 250	Exceeding180 & up to 200	0	0.046	0.205	0.159	0.136	0.090	0.182	0.090	0.046	0	0.106	0.077	0.106	0.031
	Exceeding200 & up to 225	0	0.046	0.208	0.162	0.136	0.090	0.182	0.090	0.046	0	0.109	0.080	0.109	0.034
	Exceeding225 & up to 250	0	0.046	0.212	0.166	0.136	0.090	0.182	0.090	0.046	0	0.113	0.084	0.113	0.038
	Exceeding250 & up to 280	0	0.046	0.220	0.174	0.136	0.090	0.182	0.090	0.052	0	0.126	0.094	0.126	0.042
	Exceeding280 & up to 315	0	0.046	0.224	0.178	0.136	0.090	0.182	0.090	0.052	0	0.130	0.098	0.130	0.046
Exceeding250 & up to 315	Exceeding250 & up to 280	0	0.052	0.238	0.186	0.154	0.102	0.206	0.102	0.052	0	0.126	0.094	0.126	0.042
	Exceeding280 & up to 315	0	0.052	0.242	0.190	0.154	0.102	0.206	0.102	0.052	0	0.130	0.098	0.130	0.046
	Exceeding315 & up to 355	0	0.052	0.251	0.199	0.154	0.102	0.206	0.102	0.057	0	0.144	0.108	0.144	0.051
	Exceeding355& up to 400	0	0.052	0.257	0.205	0.154	0.102	0.206	0.102	0.057	0	0.150	0.114	0.150	0.057
Exceeding315 & up to 400	Exceeding315 & up to 355	0	0.057	0.268	0.211	0.171	0.114	0.228	0.114	0.057	0	0.144	0.108	0.144	0.051
	Exceeding355& up to 400	0	0.057	0.274	0.217	0.171	0.114	0.228	0.114	0.057	0	0.150	0.114	0.150	0.057

(Unit : mm)

Oiles 2000
(room temperature up to 120℃/ pressure; P=9.8N/mm² {100kgf/cm² } and over)

Bearing dimension		Dimension tolerance						Clearance		Dimension tolerance				Interference	
		Recommended shaft(h7)		I.D. before press fit		I.D. after press fit (ref.value)				Recommended hole(H7)		Bearing O.D. (r6)			
I.D.	O.D.	(+)	(−)	(+)	(+)	(+)	(+)	max.	min.	(+)	(−)	(+)	(+)	max.	min.
Up to 10	Exceeding 10 & up to 18	0	0.015	0.071	0.050	0.052	0.031	0.067	0.031	0.018	0	0.034	0.023	0.034	0.005
Exceeding 10 & up to 18	Exceeding 10 & up to 18	0	0.018	0.083	0.058	0.063	0.038	0.081	0.038	0.018	0	0.034	0.023	0.034	0.005
	Exceeding 18 & up to 30	0	0.018	0.087	0.062	0.063	0.038	0.081	0.038	0.021	0	0.041	0.028	0.041	0.007
Exceeding 18 & up to 30	Exceeding 18 & up to 30	0	0.021	0.102	0.073	0.078	0.049	0.099	0.049	0.021	0	0.041	0.028	0.041	0.007
	Exceeding 30 & up to 50	0	0.021	0.107	0.078	0.078	0.049	0.099	0.049	0.025	0	0.050	0.034	0.050	0.009
Exceeding 30 & up to 50	Exceeding 30 & up to 50	0	0.025	0.125	0.091	0.095	0.061	0.120	0.061	0.025	0	0.050	0.034	0.050	0.009
	Exceeding 50 & up to 65	0	0.025	0.130	0.096	0.095	0.061	0.120	0.061	0.030	0	0.060	0.041	0.060	0.011
	Exceeding 65 & up to 80	0	0.025	0.132	0.098	0.095	0.061	0.120	0.061	0.030	0	0.062	0.043	0.062	0.013
Exceeding 50 & up to 80	Exceeding 50 & up to 65	0	0.030	0.151	0.110	0.115	0.074	0.145	0.074	0.030	0	0.060	0.041	0.060	0.011
	Exceeding 65 & up to 80	0	0.030	0.152	0.112	0.115	0.074	0.145	0.074	0.030	0	0.062	0.043	0.062	0.013
	Exceeding 80 & up to 100	0	0.030	0.159	0.119	0.115	0.074	0.145	0.074	0.035	0	0.073	0.051	0.073	0.016
	Exceeding100 & up to 120	0	0.030	0.162	0.122	0.115	0.074	0.145	0.074	0.035	0	0.076	0.054	0.076	0.019
Exceeding 80 & up to 120	Exceeding 80 & up to 100	0	0.035	0.182	0.134	0.137	0.089	0.172	0.089	0.035	0	0.073	0.051	0.073	0.016
	Exceeding100 & up to 120	0	0.035	0.184	0.136	0.137	0.089	0.172	0.089	0.035	0	0.076	0.054	0.076	0.019
	Exceeding120 & up to 140	0	0.035	0.192	0.144	0.137	0.089	0.172	0.089	0.040	0	0.088	0.063	0.088	0.023
	Exceeding140 & up to 160	0	0.035	0.194	0.146	0.137	0.089	0.172	0.089	0.040	0	0.090	0.065	0.090	0.025
	Exceeding160 & up to 180	0	0.035	0.197	0.149	0.137	0.089	0.172	0.089	0.040	0	0.093	0.068	0.093	0.028
Exceeding120 & up to 180	Exceeding120 & up to 140	0	0.040	0.218	0.163	0.162	0.107	0.202	0.107	0.040	0	0.088	0.063	0.088	0.023
	Exceeding140 & up to 160	0	0.040	0.219	0.164	0.162	0.107	0.202	0.107	0.040	0	0.090	0.065	0.090	0.025
	Exceeding160 & up to 180	0	0.040	0.222	0.167	0.162	0.107	0.202	0.107	0.040	0	0.093	0.068	0.093	0.028
	Exceeding180 & up to 200	0	0.040	0.230	0.175	0.162	0.107	0.202	0.107	0.046	0	0.106	0.077	0.106	0.031
	Exceeding200 & up to 225	0	0.040	0.233	0.178	0.162	0.107	0.202	0.107	0.046	0	0.109	0.080	0.109	0.034
	Exceeding225 & up to 250	0	0.040	0.237	0.182	0.162	0.107	0.202	0.107	0.046	0	0.113	0.084	0.113	0.038
Exceeding180 & up to 250	Exceeding180 & up to 200	0	0.046	0.257	0.194	0.188	0.125	0.234	0.125	0.046	0	0.106	0.077	0.106	0.031
	Exceeding200 & up to 225	0	0.046	0.260	0.197	0.188	0.125	0.234	0.125	0.046	0	0.109	0.080	0.109	0.034
	Exceeding225 & up to 250	0	0.046	0.264	0.201	0.188	0.125	0.234	0.125	0.046	0	0.113	0.084	0.113	0.038
	Exceeding250 & up to 280	0	0.046	0.272	0.209	0.188	0.125	0.234	0.125	0.052	0	0.126	0.094	0.126	0.042
	Exceeding280 & up to 315	0	0.046	0.276	0.213	0.188	0.125	0.234	0.125	0.052	0	0.130	0.098	0.130	0.046
Exceeding250 & up to 315	Exceeding250 & up to 280	0	0.052	0.297	0.225	0.213	0.141	0.265	0.141	0.052	0	0.126	0.094	0.126	0.042
	Exceeding280 & up to 315	0	0.052	0.301	0.229	0.213	0.141	0.265	0.141	0.052	0	0.130	0.098	0.130	0.046
	Exceeding315 & up to 355	0	0.052	0.310	0.238	0.213	0.141	0.265	0.141	0.057	0	0.144	0.108	0.144	0.051
	Exceeding355& up to 400	0	0.052	0.316	0.244	0.213	0.141	0.265	0.141	0.057	0	0.150	0.114	0.150	0.057
Exceeding315 & up to 400	Exceeding315 & up to 355	0	0.057	0.333	0.255	0.236	0.158	0.293	0.158	0.057	0	0.144	0.108	0.144	0.051
	Exceeding355& up to 400	0	0.057	0.339	0.261	0.236	0.158	0.293	0.158	0.057	0	0.150	0.114	0.150	0.057

(Unit : mm)

On Design

Corrosion Resistance of Base Resin and Base Metal used for Oiles Bearings

This table describes characteristics of each base material.
Characteristics may vary depending on the filler mixed. For actual selection, please ask an Oiles representative.

Corrosion resistance

Classification		Plastic bearings and multi-layer bearings					
Base resin		Polyacetal	Polyolefine	Polyamide	PTFE	PPS	Phenol resin
Product		80 Lutech 480 ※Drymet ST	81	83	Glitron F Fiberflon ※Drymet LF ※Techmet Hiplast	Glitron S, SE	250 425 470
Acid	10% Sulphric acid	C	A	C	A	A	A
	30% Sulphric acid	C	A	C	A	A	A
	Concentrated sulphric acid	D	C	D	A	B	C
	Hydrochloric acid	D	A	C	A	A	B
	10% nitric acid	C	B	D	A	B	C
	40% nitric acid	D	C	D	A	C	D
	Formic acid	D	A	D	A	A	A
	75% phosphate acid	C	A	D	A	A	A
	10% chromic acid	D	C	D	A	A	B
	Lactic acid	—	A	B	A	A	A
	Hydrogen peroxide	B	B	C	A	B	C
	Liquefied chlorine	D	B	B	B	B	C
Alkaline	Ammonia (liquid)	C	A	C	A	B	C
	Iron chloride	A	A	A	A	A	C
	Calcium chloride	A	A	A	A	A	C
	Sulfur	A	A	A	A	A	C
	Calcium Hydroxide	A	A	A	A	A	C
Solvent	Methanol	C	B	C	A	A	C
	Acetone	C	C	C	A	A	A
	Benzene	C	C	B	A	A	A
	Carbon tetracholoride	D	D	C	A	B	A
	Ethylene glycol	B	A	A	A	A	A
Oil, grease and others	Petroleum	B	C	A	A	B	A
	Diesel engine oil	B	—	A	A	A	—
	Lubricating oil	B	C	B	A	A	A
	Animal oil	A	A	A	A	A	A
	Vegetable oil	B	A	A	A	A	A
	Oleic acid	B	C	A	A	A	A
	Gasoline	B	B	A	A	B	A
	Kerosene	A	D	A	A	A	A
	Naphtha	C	C	A	A	A	A
	Lacquer	C	C	B	A	C	A
	Water	A	A	A	A	A	A
	Sea water	A	A	A	A	A	A

A : Excellent　B : Good　C : fair　D : no resistance　— : No data
※Corrosion resistance of the base resin of sliding surface only

Corrosion resistance

Classification		Metallic bearings			
Base metal		High strength brass cast	Bronze cast	Aluminum bronze	Cast iron
Product		500SP 500SP1 Spherical bearing ※ 500 Guide unit ※ (BK, BT Type)	500B	500AB	500F
Acid	40% to 80% Sulfuric acid	D	B	B	D
	80% to 95% Sulfuric acid	D	C	C	D
	Hydrochloric acid	D	C	C	D
	Nitric acid	D	D	D	D
	Phosphoric acid	D	B	B	D
	Chromic acid	D	D	D	D
	Lactic acid	D	B	B	D
	Hydrogen peroxide	C	B	B	D
	Chlorine (moist)	D	C	C	—
	Chlorine (dry)	A	A	A	—
Alkaline	Ammonia (moist)	D	D	D	B
	Ammonia (dry)	A	A	A	B
	Ferrous chloride	D	B	B	D
	Calcium chloride	D	B	B	C
	Sulfur (moist)	D	D	D	C
	Sulfur (dry)	A	B	B	C
	Calcium Hydroxide	B	A	A	B
Solvent	Methanol	A	A	A	B
	Acetone	A	A	A	B
	Toluene	A	A	A	B
	Carbon tetracholoride (moist)	D	B	B	D
	Carbon tetracholoride (dry)	A	A	A	D
	Ethylene glycol	B	A	A	C
Oil, grease, and others	Crude oil	C	B	B	B
	Heavy oil	B	A	A	B
	Lubricating oil	A	A	A	A
	Animal oil	A	A	A	—
	Vegetable oil	A	A	A	C
	Gasoline	A	A	A	B
	Kerosene	A	A	A	B
	Lacquer	A	A	A	C
	Water	B	A	A	C
	Sea water	C	B	B	D

A : Excellent　B : Good　C : fair　D : no resistance　— : No data
※Limited to Oiles 500 which is used only for 500SP1 spherical bearing and 500 guide unit (BK, BT Type).

Design Materials

Unit Conversion Table

This catalog shows values in the conventional units in parentheses as the second stage of introducing the SI unit system specified in JIS. The table below shows the conversion expressions of the SI units and other major units.

Quantity	Conversion formula
Length	1mm=0.03937in,　1in=25.400mm
Mass	1kg=2.2046 lb,　1lb=0.45359kg
Force	$1N=1.01972\times10^{-1}kgf$,　1kgf=9.80665N 1N=0.22481lbf,　1lbf=4.4483N
Stress	$1N/mm^2=1MPa=1.01972\times10kgf/cm^2$ $1kgf/cm^2=9.80665\times10^{-2}N/mm^2$ $1N/mm^2=145.00psi$,　$1psi=0.00690N/mm^2$
Velocity	1m/s=60m/min,　1m/min=0.01667m/s 1m/s=196.850f/min,　1f/min=0.00508m/s
Rotational frequency	$1s^{-1}=60rpm$,　$1rpm=0.01667s^{-1}$
Cycle speed	$1s^{-1}=60cpm$,　$1cpm=0.01667s^{-1}$
Angle	$1rad=\frac{180^\circ}{\pi}$,　$1^\circ=\frac{\pi}{180}rad$
Temperature	$^\circ F=\frac{9\times^\circ C}{5}+32$,　$^\circ C=\frac{5}{9}(^\circ F-32)$
Viscosity	$1Pa\cdot S=1\times10P$,　$1P=1\times10^{-1}Pa\cdot S$
Kinetic viscosity	$1m^2/s=1\times10^4St$,　$1St=1\times10^{-4}m^2/s$
Work, energy, thermal	$1J=1W\cdot S=1N\cdot m=1.01972\times10^{-1}kgf\cdot m=2.38889\times10^{-4}kcal$ $1kcal=4.2858\times10^2kgf\cdot m=4.18605\times10^3N\cdot m=4.18605\times10^3W\cdot S=4.18605J$
Thermal conductivity	$1W/(m\cdot k)=8.6000\times10^{-1}kcal/(h\cdot m\cdot{}^\circ C)$ $1kcal/(h\cdot m\cdot{}^\circ C)=1.16279W/(m\cdot k)$
Specific heat	$1J/(kg\cdot K)=2.38889\times10^{-4}kcal/(kg\cdot{}^\circ C)$ $1kcal/(kg\cdot{}^\circ C)=4.18605\times10^3J/(kg\cdot K)$

International System of Units (SI)
An international unified unit system adopted and recommended in the 11th International Conference of Weights and Measures in 1960 for international unification of the metric MKS system and yard-pound unit system.

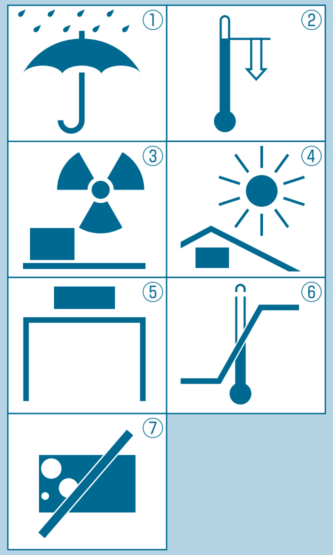
Storage Instructions

■ Basis of Storage Instructions

- Do not have bearings lose their functions such as leak of impregnated lubricating oil and change of the sliding surface materials.
- Do not allow the bearings to deform.
- Do not allow rust, corrosion, or other harmful chemical changes to the bearings.

■ Storage Places

① Store the bearings indoors free from rainwater in a dust-free place.
② Store the bearings in a cool place not subject to high temperatures.
③ Store the bearings in a well-ventilated place not subject to high humidity.
④ Do not expose the bearings to direct sunlight.
⑤ Do not place the bearings directly on the ground. Place them on shelves, etc.
⑥ Do not store the bearings in a place subject to remarkable temperature changes or dew condensation.
⑦ Do not store the bearings in an environment with corrosive atmosphere.



■ Other Precautions

① Do not place any heavy objects on the bearings.
② Do not unpack each bearing until you are going to use it.
③ Do not touch the bearing directly with the hand until you are going to use it.
④ Do not hit any other objects against the bearings.
⑤ Observe the first-in, first-out principle when using in-stock bearings.