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)

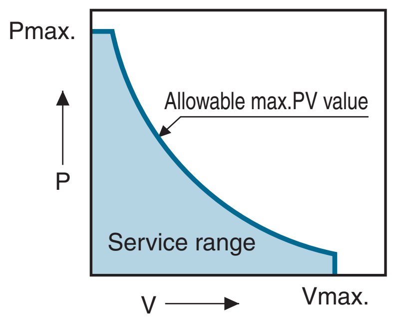
V : Relative velocity between the bearing and the mating shaft.

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.

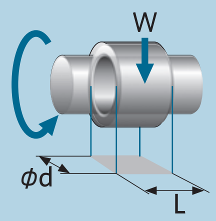
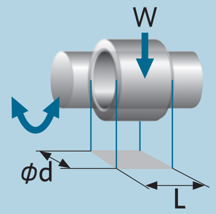
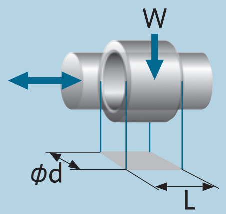
Allowable max. PV value < allowable max. contact pressure : P max. × allowable max. velocity : V max.

Allowable PV value



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

■Calculation of P / V / PV value

Bushing	P N/mm²	V m/sec	PV N/mm²·m/sec
Radial journal oneway rotation 	$P=\frac{W}{\phi d \times L}$ Load W : N I.D. ϕd : mm Length L : mm Example I.D 20mm, length 10mm at 1000N journal load. $\frac{1000}{20\times10}=5$ (N/mm²)	$V=\frac{\pi \phi d n}{10^3}$ Rotating speed n : s^{-1} I.D. ϕd : mm Example I.D 20mm, Rotating speed $2S^{-1}$. $\frac{\pi\times20\times2}{10^3}=0.126$ (m/s)	$PV=\frac{W\times\pi \phi d n}{\phi d\times L\times10^3}$ Load W : N Rotating Speed n : s^{-1} Length L : mm I.D. ϕd : mm Example I.D 20mm, length 10mm ,rotating speed $2S^{-1}$, 1000N journal load. P×V=5×0.126=0.63 (N/mm²·m/s)
Oscillation 	$P=\frac{W}{\phi d \times L}$ Load W : N {kgf} I.D. ϕd : mm Length L : mm Example I.D 20mm, length 10mm at 1000N journal load. $\frac{1000}{20\times10}=5$ (N/mm²)	$V=\frac{\pi \phi d\times\theta\times c}{10^3\times360}$ Oscillating cycle speed c : s^{-1} Oscillating angle per 1 cycle θ : ° I.D. ϕd : mm Example I.D. 20mm, Oscillating cycle $3s^{-1}$, 180° per 1 cycle. $\frac{\pi\times20}{1000}\times\frac{180}{360}\times3=0.094$ (m/s)	$PV=\frac{W\times\pi \phi d\times\theta\times c}{\phi d\times L\times10^3\times360}$ Load W : N Cycle speed c : s^{-1} Oscillating angle per 1 cycle θ : ° Length L : mm I.D. ϕd : mm Example I.D 20mm, length 10mm at 1000N journal load, Oscillating cycle $3s^{-1}$, 180°per 1 cycle. P×V=5×0.094=0.47(N/mm²·m/s)
Reciprocation 	$P=\frac{W}{\phi d \times L}$ Load W : N I.D. ϕd : mm Length L : mm Example I.D 20mm, length 10mm at 1000N journal load. $\frac{1000}{20\times10}=5$ (N/mm²)	$V=\frac{cS}{10^3}$ Reciprocation cycle speed c : s^{-1} Stroke distance per 1 cycle S : mm Example Reciprocation cycle speed $3s^{-1}$, 20mm stroke distance per 1 cycle. $\frac{3\times20}{1000}=0.06$ (m/s)	$PV=\frac{W\times cS}{\phi d\times L\times10^3}$ Load W : N Cycle speed c : s^{-1} Stroke distance per 1 cycle S : mm I.D. ϕd : mm Length L : mm Example I.D 20mm, length 10mm at 1000N journal load,Reciprocation cycle speed $3s^{-1}$, 20mm stroke distance per 1 cycle. P×V=5×0.06=0.3(N/mm²·m/s)

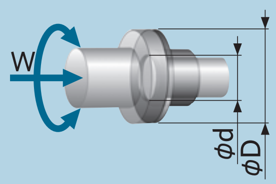
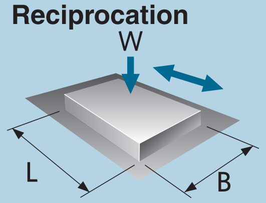
Washer	P N/mm²	V m/sec	PV N/mm²·m/sec
Thrust motion 	Rotation $P=\frac{4W}{\pi\times(\phi D^2-\phi d^2)}$ Oscillation $P=\frac{4W}{\pi\times(\phi D^2-\phi d^2)}$ Load W : N I.D. ϕd : mm O.D. ϕD : mm	Rotation $V=\frac{\pi \phi D n}{10^3}$ Oscillation $V=\frac{\pi \phi D\times\theta\times c}{10^3\times360}$ Rotating speed n : s^{-1} Cycle speed c : s^{-1} Oscillating angle per 1 cycle θ : ° O.D. ϕD : mm	Rotation $PV=\frac{4W\times\phi D n}{(\phi D^2-\phi d^2)\times10^3}$ Oscillation $PV=\frac{4W\times\pi \phi d\times\theta\times c}{\pi(\phi D^2-\phi d^2)\times10^3\times360}$ Load W : N Rotating speed n : s^{-1} Cycle speed c : s^{-1} Oscillating angle per 1 cycle θ : ° I.D. ϕd : mm O.D. ϕD : mm

Plate	P N/mm²	V m/sec	PV N/mm²·m/sec
Reciprocation 	$P=\frac{W}{B\times L}$ Load W : N Length L : mm Width B : mm	$V=\frac{cS}{10^3}$ Cycle speed c : s^{-1} Stroke distance per 1 cycle S : mm	$PV=\frac{W\times cS}{B\times L\times10^3}$ Load W : N Cycle speed c : s^{-1} Stroke distance per 1 cycle S : mm Length L : mm Width B : mm