Rod End

THK General Catalog

A Technical Descriptions of the Products

B Product Specifications (Separate)

* Please see the separate "B Product Specifications".

Features of the Rod End

Features

The Rod End is a self-aligning plain bearing that uses a spherical inner ring which has the same level of accuracy and hardness as bearing steel balls. With the combination of a spherical inner ring whose sliding surface is mirror-finished and a rationally designed holder, the Rod End ensures play-free, extremely smooth rotation and oscillation.

Special Bearing Alloy

[High Strength Zinc Alloy]

The high strength zinc alloy, developed as an alloy for bearings, is composed of Aℓ, Cu, Mg, Be and Ti as well as zinc as the base. It is excellent in mechanical properties, seizure resistance and wear resistance.

● **Composition**

Table1 Composition of the High Strength Zinc Alloy

Unit: %

Item	Description
Aℓ	3 to 4
Cu	3 to 4
Mg	0.03 to 0.06
Be	0.02 to 0.06
Ti	0.04 to 0.12
Zn	Remaining portion

● **Mechanical Properties**

Tensile strength : 275 to 314 N/mm^2
Tensile yield strength (0.2%) : 216 to 245 N/mm^2
Compressive strength : 539 to 686 N/mm^2
Compressive yield strength (0.2%) : 294 to 343 N/mm^2
Fatigue strength : 132 N/mm^2×10^7 (Schenk bending test)
Charpy impact : 0.098 to 0.49 N-m/mm^2
Elongation : 1 to 5%
Hardness : 120 to 145 HV

● Physical Properties

Specific gravity : 6.8
Melting point : 390℃
Specific heat : 460 J/ (kg・k)
Linear expansion rate : 24×10^{-6}

● Wear Resistance

The wear resistance of the high strength zinc alloy is superior to that of class-3 brass and class-3 bronze, almost equal to that of class-2 phosphor bronze.

Amsler wear-tester
Test piece rotation speed : 185 min^{-1}
Load : 392 N
Lubricant : Dynamo oil

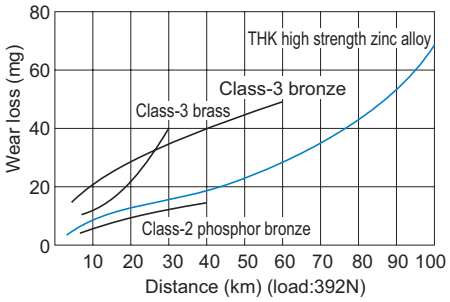


Fig.1 Wear Resistance of the High Strength Zinc Alloy

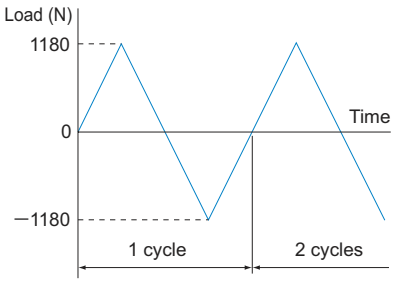
Performance Test with the Rod End

This test has been conducted to identify the difference in performance between THK Rod End model HS and an equivalent product by a competitor.

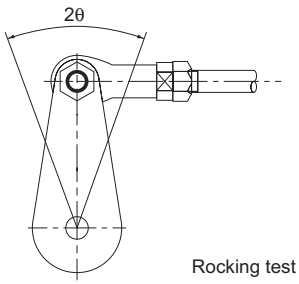
[Wear Test Conditions]

Item	Description
Subject Rod End	THK: Model HS8
	Stainless steel model equivalent of the above
Type of test	Rocking test
Applied load	±1,180 N in the radial direction
Kinematic angle	Oscillation angle: 2θ=40°(±20°)
Lubrication	No lubrication
Number of cycles per minute	60opm
Total number of cycles	1 million cycles
Testing equipment	Bench testing machine (normal temperature)

The applied load diagram is shown below.



The kinematic angle is shown below.



[Result of the Wear Test]

Table2 Change in the Spherical Clearance Unit: mm

Abrasion loss after 1-million-cycle test			
Model No.	Number of times	Rocking test	
		Radial direction	Axial direction
HS 8	Initial stage (at start-up)	0.008	0.01
	1 million cycles	0.035	0.075
	Change	0.027	0.065
Stainless steel model equivalent of the above	Initial stage (at start-up)	0.005	0.005
	40,000 cycles	0.22	0.2
	Change after 40,000 cycles	0.215	0.065
	Note: The holder is elongated and fractured after 76,300 cycles.		

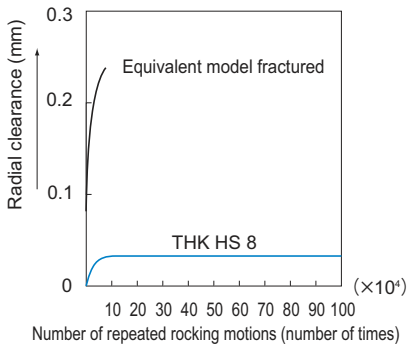


Fig.2 Wear Diagram

(1) Although model HS8 withstood the repeated durability test with an applied load of ±1,180 N and the total number of cycles being 1 million, the holder of the stainless steel equivalent model was elongated and fractured after only 76,300 cycles.

(2) The result shows that the increase in wear of model HS8 in the radial direction since the initial wear (approximately 100,000 cycles) was minimal.

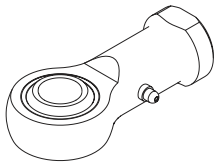
Types of the Rod End

Types and Features

Type Provided with a Female Threading - Model PHS

Specification Table⇒B-846

With model PHS, a special copper alloy with high conformability is inserted between the chromate treatment steel holder and the spherical inner ring in which only the circumference of the spherical area is hard chrome plated. This structure ensures high rigidity, high wear resistance and high corrosion resistance.
The grease nipple on the holder allows grease to be applied to the sliding surface as necessary.

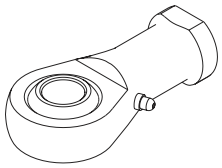


Model PHS

Die Cast, Low Price Type - Model RBH

Specification Table⇒B-848

This model is a high-accuracy, low cost rod end in which the spherical inner ring serves as the core and the holder is formed by die casting.
The holder is made of a high strength zinc alloy (see A-942), which is superb in mechanical properties and bearing characteristics.

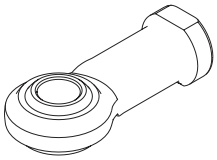


Model RBH

No Lubrication Type - Model NHS-T

Specification Table⇒B-850

This no lubrication rod end uses self-lubricating synthetic resin formed between the steel holder and the spherical inner ring.
Since the clearance on the sliding surface is minimized, an accurate link motion is achieved.

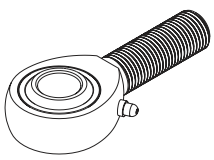


Model NHS-T

Male thread Type - Model POS

Specification Table⇒B-852

This model is a highly rigid rod end that is basically the same as the female threading type model PHS, but has a male thread on the holder end.

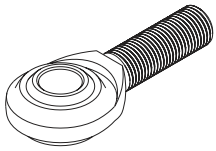


Model POS

No Lubrication, Male thread Type - Model NOS-T

Specification Table⇒B-854

This model is a no lubrication rod end that is basically the same as the female threading type model NHS-T, but has a male thread on the holder end.

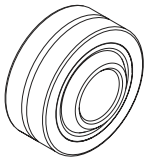


Model NOS-T

Standard Type - Model PB

Specification Table⇒B-856

With model PB, a special copper alloy with high conformability is inserted between the steel outer ring and the spherical inner ring in which only the spherical area is hard chrome plated. This structure makes this model a high rigid Spherical Plain Bearing with high corrosion resistance and high wear resistance.
The oil groove and the greasing hole on the outer ring allow grease to be applied to the sliding surface as necessary.

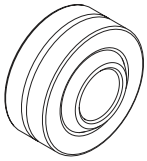


Model PB

Die Cast Type - Model PBA

Specification Table⇒B-857

This model is a high-accuracy, low cost Spherical Plain Bearing in which the spherical inner ring serves as the core and the outer ring is formed by die casting.
The outer ring is made of a high strength zinc alloy (see A-942), which is superb in bearing characteristics.

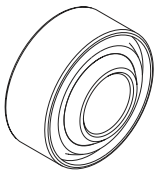


Model PBA

No Lubrication Type - Model NB-T

Specification Table⇒B-858

This no lubrication bearing uses self-lubricating synthetic resin formed between the steel outer ring and the spherical inner ring.



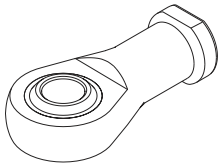
Model NB-T

[Build to Order]

No Lubrication, Corrosion-resistant Type - Model HS

Specification Table⇒B-860

This no lubrication Spherical Plain Bearing uses a special fluorine sheet adhering to the holder's spherical area. The holder is made of an aluminum alloy.
This product is built to order. Contact THK for details.



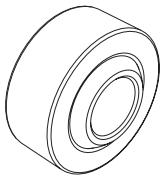
Model HS

[Build to Order]

No Lubrication Type - Model HB

Specification Table⇒B-862

This no lubrication Spherical Plain Bearing uses a special fluorine sheet adhering to the outer ring's spherical area.
This product is built to order. Contact THK for details.



Model HB

Selecting a Rod End

[Permissible Load P]

The static load capacity (C_s) indicated in the specification tables, is presented as a guide for the mechanical strength of the Rod End. Select a bearing while taking into account the safety factor (f_s) indicated in Table1 according to the type of the load.

Table1 Safety Factor (f_s)

Type of load	Lower limit of f_s
Constant load in a constant direction	2 to 3
Fluctuating load in a constant direction	3 to 5
Load in varying directions	5 to 8

According to the type of load, select a bearing that satisfies the following equation from a mechanical strength's viewpoint.

$$P \leqq \frac{C_s}{f_s} \quad \cdots\cdots\cdots (1)$$

P : Permissible Load (N)
C_s : Static load capacity (N)
f_s : Safety factor (see Table1)

[Dynamic Load Capacity C_d]

The dynamic load capacity refers to the upper limit of load that the spherical area can receive without showing seizure while the Rod End is rotating or oscillating. The dynamic load capacity is obtained from the following approximation formula using the static load capacity (C_s) (note 1) indicated in the specification table.

$$C_d = \frac{C_s}{\sqrt[3]{n}} \quad \cdots\cdots\cdots (2)$$

C_d : Dynamic load capacity (N)
C_s : Static load capacity (N)
n : Rotation speed per minute (min^{-1})

The selected bearing must meet both the permissible load obtained from equation (1) and the dynamic load capacity obtained from equation (2).

Note1) Static load capacity (C_s) refers to the value obtained by multiplying the projected area on the spherical section by the permissible surface pressure, and is used to obtain the dynamic load capacity.

Permissible Tilt Angles

The permissible tilt angles α_1, α_2 and α_3 of the Rod End are indicated in Table1.

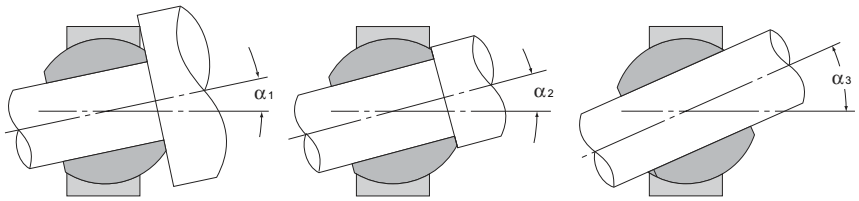


Table1 Permissible Tilt Angles

Model No.	Permissible tilt angles		
	α_1	α_2	α_3
NHS 3T, NOS 3T	8	10	42
NHS 4T, NOS 4T	9	11	35
PHS 5, RBH 5, NHS 5T, POS 5, NOS 5T, PB 5, PBA 5	8	13	30
PHS 6, RBH 6, NHS 6T, POS 6, NOS 6T, PB 6, PBA 6	8	13	30
PHS 8, RBH 8, NHS 8T, POS 8, NOS 8T, PB 8, PBA 8	8	14	25
PHS 10, RBH 10, NHS 10T, POS 10, NOS 10T, PB 10, PBA 10	8	14	25
PHS 12, RBH 12, NHS 12T, POS 12, NOS 12T, PB 12, PBA 12	8	13	25
PHS 14, RBH 14, NHS 14T, POS 14, NOS 14T, PB 14, PBA 14, NB 14T	10	16	24
PHS 16, RBH 16, NHS 16T, POS 16, NOS 16T, PB 16, PBA 16, NB 16T	9	15	24
PHS 18, RBH 18, NHS 18T, POS 18, NOS 18T, PB 18, PBA 18, NB 18T	9	15	24
PHS 20, RBH 20, NHS 20T, POS 20, NOS 20T, PB 20, PBA 20, NB 20T	9	15	24
PHS 22, RBH 22, NHS 22T, POS 22, NOS 22T, PB 22, PBA 22, NB 22T	10	15	23
PHS 25, POS 25, PB 25	9	15	23
PHS 30, POS 30, PB 30	10	17	23

Installation

Please note that the Rod End is not capable of receiving a thrust load indicated in Fig.1.

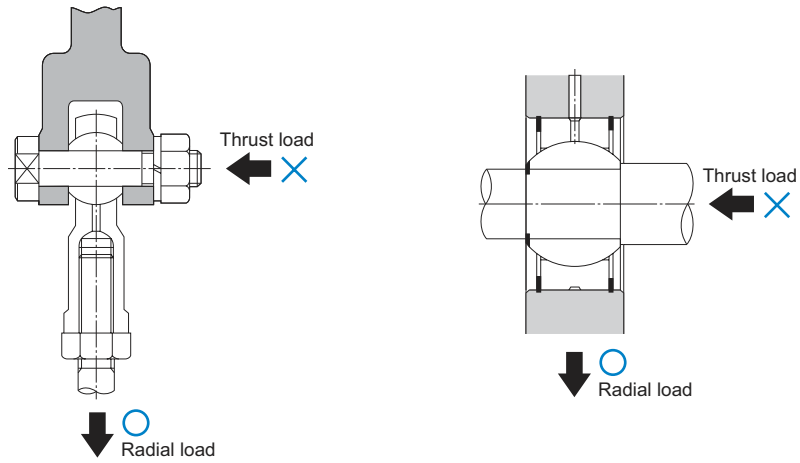


Fig.1 Examples of Installing the Rod End

[Service Temperature]
If any of models RBH, PBA, HS and HB, all of which use the high strength zinc alloy and an aluminum alloy in the holder and the outer ring, and of models NHS-T, NOS-T and NB-T, which use synthetic-resin bushes, is to be used at temperature of 80 ℃ or higher, or receives an impact at low temperature, contact THK.

[Handling]
Dropping or hitting the Rod End may damage it. Giving an impact to it could also cause damage to its function even if the product looks intact.

[Lubrication]
All Rod End models except lubrication-free types must be greased before being used (lithium soap-based grease No. 2 is recommended). When greasing the Rod End before using it, do not mix lubricants of different physical properties. In addition, replenish a lubricant also during operation as necessary.

[Precautions on Use]
(1) Do not use the product in the manner that the permissible tilting angle is exceeded since doing so may damage the product.
(2) When using the product in locations exposed to vibrations or an impact load or in a special environment such as a clean room, vacuum and low/high temperature, contact THK in advance.
(3) Entrance of foreign material such as dust between the holder and the inner ring may cause damage or functional loss. Prevent foreign material, such as dust and cutting chips, from entering the product.
(4) The Rod End is designed for use under a radial load. Do not use the product under a thrust load.

[Storage]
When storing the Rod End, avoid high temperature, low temperature and high humidity.