



Roller Follower

THK General Catalog

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* Please see the separate "B Product Specifications".

Features of the Roller Follower

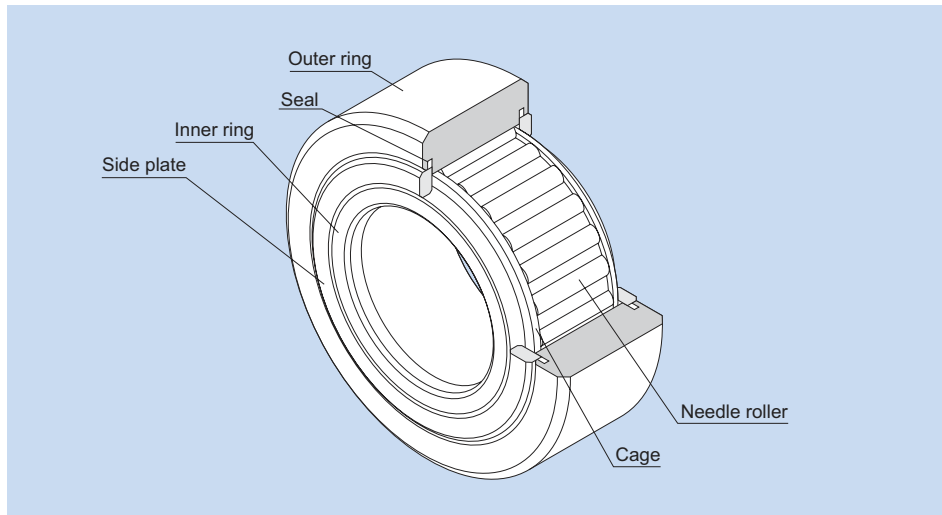


Fig.1 Structure of Roller Follower Model NAST-ZZUU

Structure and Features

The Roller Follower is a compact and highly rigid bearing system. It contains needle bearings and is used as a guide roller for cam discs and straight motion.

Since its outer ring rotates while keeping direct contact with the mating surface, this product is thick-walled and designed to bear an impact load.

Inside the outer ring, needle rollers and a precision cage are incorporated. This prevents the product from skewing and achieves a superb rotation performance. And, as a result, the product is capable of easily withstanding high-speed rotation.

Roller Followers are divided into two types: separable type whose inner ring can be separated, and non-separable type whose inner ring cannot be separated.

There are two types of the outer ring in shape: spherical and cylindrical. The spherical outer ring easily absorbs a distortion of the shaft center when the cam follower is installed and helps lighten a biased load.

The Roller Follower is used in a wide range of applications such as cam mechanisms of automatic machines, dedicated machines as well as carrier systems, conveyors, bookbinding machines, tool changers of machining centers, pallet changers, automatic coating machines, and sliding forks of automatic warehouses.

Features and Types
Features of the Roller Follower

Roller Follower



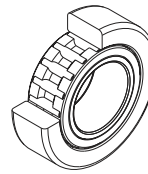
Types of the Roller Follower

Types and Features

Model NAST (Separable Type)

Model NAST is a separable type of bearing system that combines a thick-wall outer ring, an inner ring and needle rollers equipped with a precision cage.

Specification Table⇒B-822



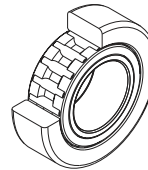
Model NAST

Model NAST-R (Separable Type)

This model is a spherical outer ring type of model NAST.

Since the circumference of the outer ring is spherically ground, it helps lighten a biased load (symbol R).

Specification Table⇒B-822

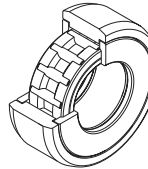


Model NAST-R

Model NAST-ZZ (Separable Type)

This separable type of bearing system has a labyrinth seal consisting of a pair of side plates formed on both sides of the inner ring of model NAST. (Model number of the type attached with seals is NAST-ZZUU.)

Specification Table⇒B-823



Model NAST-ZZ

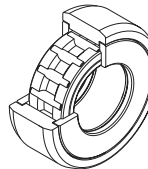
Model NAST-ZZR (Separable Type)

This model is a spherical outer ring type of model NAST-ZZ.

It easily corrects a distortion of the shaft center when the roller follower is installed.

Since the circumference of the outer ring is spherically ground, it helps lighten a biased load (symbol R). (Model number of the type attached with seals is NAST-ZZUUR.)

Specification Table⇒B-823

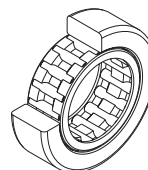


Model NAST-ZZR

Model RNAS (Separable Type)

Specification Table⇒B-824

This model is basically the same as model NAST, but does not have an inner ring.

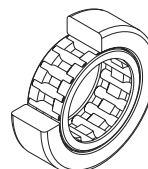


Model RNAS

Model RNAS-R (Separable Type)

Specification Table⇒B-824

This model is basically the same as model NAST-R, but does not have an inner ring. Since the circumference of the outer ring is spherically ground, it helps lighten a biased load (symbol R).



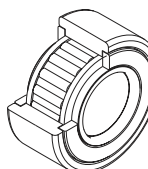
Model RNAS-R

Model NART-R (Non-separable Type)

Specification Table⇒B-825

This model is a non-separable type of bearing system whose inner ring is fixed to the side plates.

Since the circumference of the outer ring is spherically ground, it helps lighten a biased load (symbol R). (Model number of the type attached with seals is NART-UUR.)



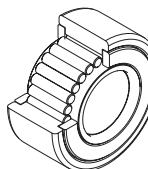
Model NART-R

Model NART-VR (Non-separable Type)

Specification Table⇒B-825

Based on model NART-R, this model is a full-roller bearing suitable for locations where a heavy load is applied in low speed operation.

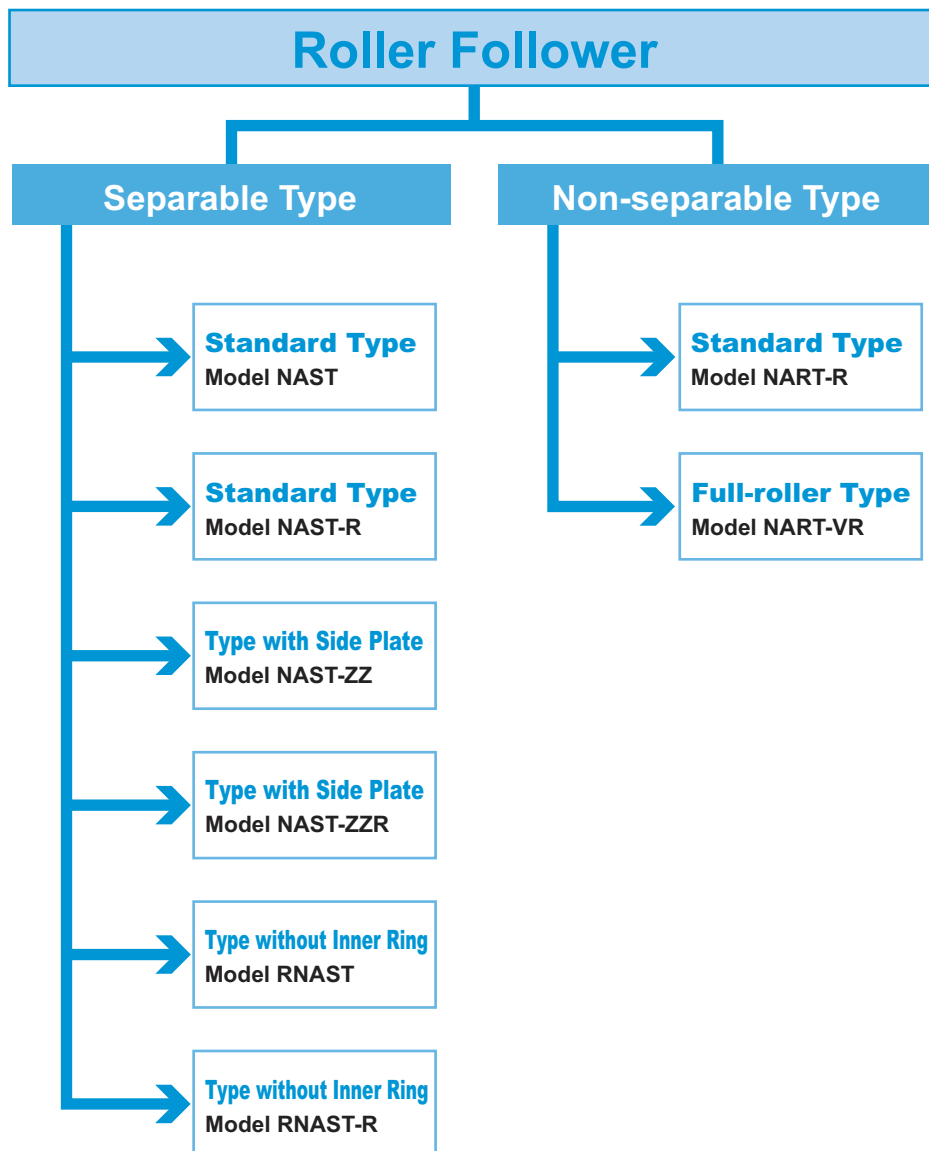
Since the circumference of the outer ring is spherically ground, it helps lighten a biased load (symbol R). (Model number of the type attached with seals is NART-VUUR.)



Model NART-VR

- Stainless steel types are available for all the above models. (symbol M)

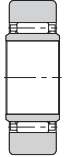



Types of the Roller Follower



Types and Model Numbers of the Roller Follower

The Roller Follower is divided into several types as indicated in Table1.

Table1 Types of Roller Follower

Classification		Separable type			Non-separable type
		Standard type	Type with side plate	Type without inner ring	Standard type Full-roller type
Main model No.		NAST	NAST-ZZ	RNAST	NART
Shape					
Cylindrical outer ring	Without seal	NAST NAST-M	NAST-ZZ NAST-ZZM	RNAST RNAST-M	—
	With seal	—	NAST-ZZUU NAST-ZZMUU	—	—
Spherical outer ring	Without seal	NAST-R NAST-MR	NAST-ZZR NAST-ZZMR	RNAST-R RNAST-MR	NART-R NART-MR
	With seal	—	NAST-ZZUUR NAST-ZZMUUR	—	NART-UUR NART-MUUR
Full rollers	Without seal	—	—	—	NART-VR NART-VMR
	With seal	—	—	—	NART-VUUR NART-VMUUR

Symbol M indicates stainless steel type.

Nominal Life

[Static Safety Factor]

The basic static load rating C_0 refers to the static load with constant direction and magnitude, under which the calculated contact stress in the center of the contact area between the roller and the raceway under the maximum load is 4000 MPa. (If the contact stress exceeds this level, it will affect the rotation.) This value is indicated as "C" in the specification tables. When a load is statically or dynamically applied, it is necessary to consider the static safety factor as shown below.

$$\frac{C_0}{P_0} = f_s$$

f_s : Static safety factor (see Table2)
 C_0 : Basic static load rating (kN)
 P_0 : Radial load (kN)

Table2 Static Safety Factor (f_s)

Load conditions	Lower limit of f_s
Normal load	1 to 3
Impact load	3 to 5

[Nominal Life]

The service life of the Roller Follower is obtained from the following equation.

$$L = \left(\frac{f_r \cdot C}{f_w \cdot P_c} \right)^{\frac{10}{3}} \times 10^6$$

L : Nominal life
 (The total number of revolutions that 90% of a group of identical Roller Follower units independently operating under the same conditions can achieve without showing flaking from rolling fatigue)
 C : Basic dynamic load rating* (kN)
 P_c : Radial load (kN)
 f_r : Temperature factor
 (see Fig.1 on A-903)
 f_w : Load factor (see Table3 on A-903)

* The basic dynamic load rating (C) of the Roller Follower shows the load with interlocked direction and magnitude, under which the nominal life (L) is 1 million revolutions when a group of identical Roller Follower units independently operate. The basic dynamic load rating (C) is indicated in the corresponding specification table.

[Calculating the Service Life Time]

When the nominal life (L) has been obtained, the service life time (L_h) is obtained from the following equation.

● For Linear Motion

$$L_h = \frac{D \cdot \pi \cdot L}{2 \times l_s \cdot n_1 \times 60} \quad (\text{h})$$

L_h : Service life time (h)
 L : Nominal life (mm)
 D : Bearing outer diameter (mm)
 l_s : Stroke length (mm)
 n₁ : Number of reciprocations per minute (min⁻¹)

● For Rotary Motion

$$L_h = \frac{D \cdot L}{D_1 \cdot n \times 60} \quad (\text{h})$$

D₁ : Outer ring contact average diameter of the cam (mm)
 n : Rotation speed per minute of the cam (min⁻¹)

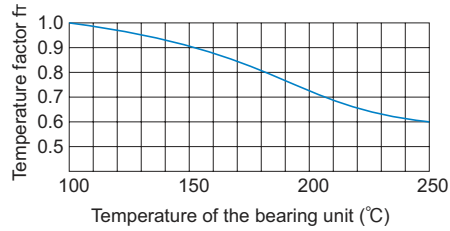


Fig.1 Temperature Factor (ft)

Note) The normal service temperature is 80 °C or below. If the product is to be used at a higher temperature, contact THK.

Table3 Load Factor (f_w)

Service condition	f _w
Smooth motion without impact	1 to 1.2
Normal motion	1.2 to 1.5
Motion with severe impact	1.5 to 3

Accuracy Standards

Roller Followers are manufactured with accuracies in accordance with the following.

- Dimensional tolerance of the spherical outer ring in outer diameter D: $\begin{matrix} 0 \\ -0.05 \end{matrix}$
- Dimensional tolerance of model RNAS in inscribed bore diameter dr: F6
- Dimensional tolerance of model NART in bearing width B_i: Table4
- Accuracy of the inner ring and accuracy of the outer ring in width: Table5
- Accuracy of the outer ring: Table6

Table5 Accuracy of the Inner Ring and Accuracy of the Outer Ring in Width (JIS Class 0)

Unit: μm

Nominal dimension of the bearing inner diameter (di) (mm)	Tolerance of the bearing in outer diameter (dm) ^(note)	Tolerance of the inner ring (or outer ring) in width		Tolerance of the inner ring in radial runout (max)
		Upper	Lower	
2.5	10	0	-8	0
10	18	0	-8	0
18	30	0	-10	0
30	50	0	-12	0

Note) "dm" represents the arithmetic average of the maximum and minimum diameters obtained in measuring the bearing inner diameter at two points.

Table4 Dimensional tolerance of model NART in bearing width B_i

Model No. NART	Dimensional tolerance (h12)	
	Upper limit	Lower limit
5 to 12	0	-0.18
15 to 35	0	-0.21
40 to 50	0	-0.25

Table6 Accuracy of the Outer Ring (JIS Class 0)

Unit: μm

Nominal dimension of the bearing outer diameter (D) (mm)		Tolerance of the bearing in outer diameter (Dm) ^(note)		Tolerance of the outer ring in radial runout (max)
Above	Or less	Upper	Lower	
6	18	0	-9	15
18	30	0	-9	15
30	50	0	-11	20
50	80	0	-13	25
80	120	0	-15	35

Note) "Dm" represents the arithmetic average of the maximum and minimum diameters obtained in measuring the bearing outer diameter at two points.

Track Load Capacity

The track load capacity means the permissible load at which the outer ring of a Roller Follower and the mating surface are capable of withstanding repeated use over a long period.

The track load capacity provided in the specification table, indicates the value when using a steel material with tensile strength of 1.2 kN/mm² as the mating material. Therefore, it is possible to increase the track load capacity by increasing the hardness of the material. Fig.2 shows the hardness of the mating material and the track capacity factor in relation to tensile strength. To obtain the track load capacity of each mating material, multiply the track load capacity shown in the corresponding specification table by the respective track load factor.

Note) For the mating material, we recommend using those materials with the raceway hardness of 20 HRC or higher and the tensile strength of 775 N/mm² or higher.

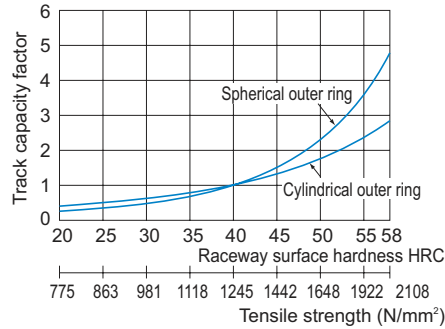


Fig.2 Track Capacity Factor

[Example of Calculating a Track Load Capacity]

Obtain the track load capacity when heat-treating the mating material, which a bearing whose outer ring has a track load capacity of 5.29 kN contacts, to hardness of 50 HRC.
 The track capacity factor when the hardness is 50 HRC is 2.32, as indicated in Fig.2. Therefore, the desired track load capacity is calculated as follows.
 The track load capacity=5.29kN×2.32=12.3kN

Radial Clearance

The radial clearances of Roller Followers meet the clearance indicated in the table below. (Normal clearance applies to full-roller types.)

Model NAST, NAST-ZZ Unit: μm

Model No.	Clearance C2 (with cage)	
	Min.	Max.
6	5	20
8 to 12	5	25
15 to 25	10	30
30 to 40	10	40
45 to 50	15	50

Model RNAS T Unit: μm

Model No.	Clearance C2 (with cage)	
	Min.	Max.
5 to 6	5	20
8 to 12	5	25
15 to 25	10	30
30 to 40	10	40
45 to 50	15	50

Model NART Unit: μm

Model No.	Clearance C2 (with cage)		Normal clearance (full rollers)	
	Min.	Max.	Min.	Max.
5 to 6	5	20	15	30
8 to 12	5	25	15	35
15 to 20	10	30	20	40
25 to 40	10	40	25	55
45 to 50	15	50	30	65

Fit

For the fitting of the Roller Follower with the shaft, we recommend the combinations indicated in Table1.

Table1 Fitting with the Shaft

No Inner Ring	Inner Ring
k5, k6	g6, h6

Mounting Section

- To protect the side plate of models NART and NAST-ZZ, the height of the mounting section must be equal to or greater than the "a" dimension indicated in the specification table
- The surface hardness of the shaft to be used with a Roller Follower without inner ring must be between 54 and 64 HRC. For the surface roughness, we recommend 0.2 μm Ra or below.
- For the mating raceway, see "Track Load Capacity" on A-904.
- If the outer ring unilaterally or unevenly contacts the mating raceway, we recommend using a type whose outer ring circumference is spherically ground.
- The side plate of model NART is press-fit onto the inner ring. If the plate is pressed under an external force, it may cause abnormal rotation. Do not use the product in the manner that the side plate is pressed.
- The structure of the Roller Follower is designed to receive a radial load. If it receives a thrust load, the side plates or the outer ring may be damaged. Therefore, it is necessary to design the system and install the product so that the generation of a component of the thrust is limited to a minimum.

Mounting Procedure and Maintenance Roller Follower

Installation

Fig.1 shows examples of installing the Roller Follower.

- If the Roller Follower is to be used under a heavy load, it is necessary to install the product so that the greasing hole of the inner ring is out of the loaded area.

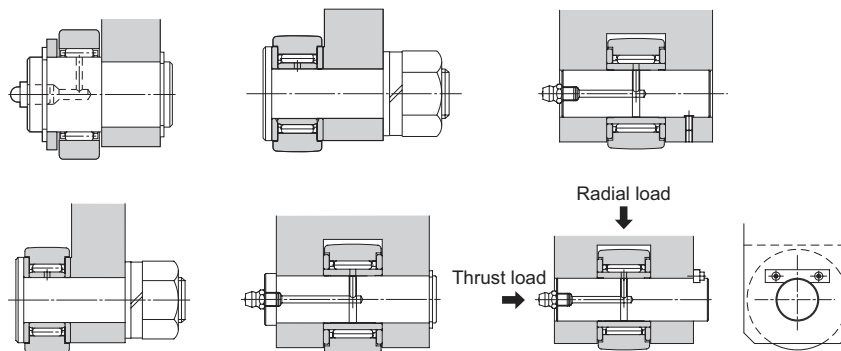


Fig.1 Examples of Installing the Roller Follower

Contamination Protection and Lubrication

The Roller Follower models include seal types (model numbers: "...UU"), which are incorporated with special synthetic rubber seals that are highly resistant to wear in order to prevent foreign material from entering the interior of the roller follower and the lubricant from leaking.

Some models are not filled with grease when assembled. When using a model not filled with grease, apply and fill grease to the interior first (lithium-based grease with consistency of No. 2).

Model No.		Grease
NAST(R)	No seal setting	Not filled with grease
RNAST(R)		
NAST-ZZ(R)	Without seal	Filled with grease
NART-(V)R	With seal	

The lubrication interval varies depending on the operating conditions. As a guide, however, replenish grease of the same group every six months to two years for types with a cage, or every one to six months for full-roller types.

Even with types equipped with seals ("...UU"), surplus grease may seep during the initial operation period or immediately after resumption of grease replenishment. If desiring to avoid contamination of the surrounding area of the machine by grease, first perform seasoning or the like in advance, and then wipe the seeping surplus grease.

[Handling]

- (1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
- (2) Dropping or hitting the Roller Follower may damage it. Giving an impact to it could also cause damage to its function even if the product looks intact.

[Lubrication]

- (1) Some types of the Roller Follower do not contain grease depending on the model number. Carefully refer to A-906, and if the desired model does not contain grease, apply grease to the product as necessary before using it. Lithium soap-based grease No. 2 is available as standard.
- (2) Do not mix lubricants of different physical properties. In addition, replenish a lubricant also during operation as necessary.
- (3) We recommend applying a lubricant to the mating surface where the Roller Follower travels.

[Precautions on Use]

- (1) 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.
- (2) Entrance of foreign material such as dust may cause damage or functional loss. Prevent foreign material, such as dust and cutting chips, from entering the product.
- (3) Roller Followers are designed for use under a radial load. Do not use the product under a thrust load.

[Storage]

When storing the Roller Follower, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

