



# Cam Follower

THK General Catalog

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\* Please see the separate "B Product Specifications".

## Features of the Cam Follower

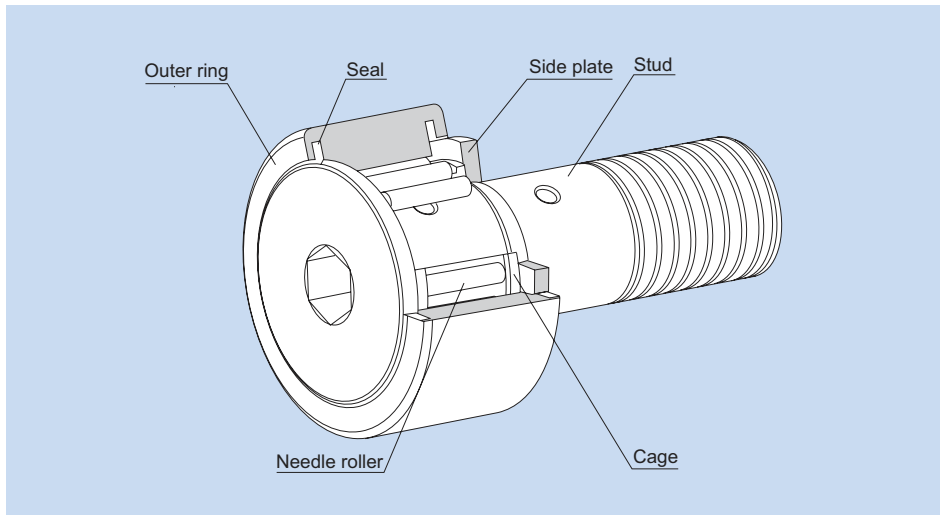


Fig.1 Structure of Cam Follower Model CF...UU-A

### Structure and Features

The Cam Follower is a compact and highly rigid bearing with a shaft. It contains needle bearings and is used as a guide roller for cam mechanisms or 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.

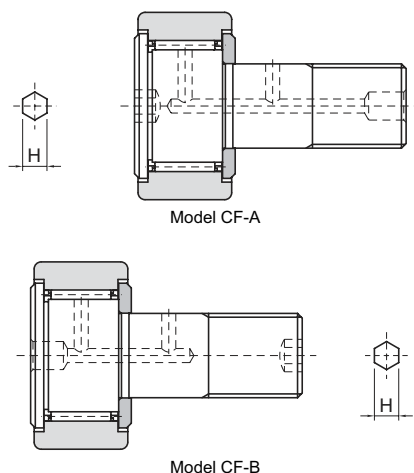
Inside the outer ring, needle rollers and a precision cage are incorporated. This prevents the product from skewing and achieves a superb rotation performance. And, as a result, the product is capable of easily withstanding high-speed rotation.

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 Cam 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.

## Cam Follower with a Hexagon Socket

For Cam Follower model CF, Cam Follower Containing Thrust Balls model CFN and Eccentric Cam Follower model CFH, hexagon socket studs that allow easy eccentricity adjustment are available. If desiring a hexagon socket on the stud head, add "A" to the end of the model number. If desiring a hexagon socket on the stud thread, add "B". ("B" applies to model CF12 or higher.)



The Same Dimension of the Hexagonal Width Across Flats (H Dimension) Applies to Both Type A and Type B.

## Cam Follower Containing Thrust Balls

Even a slight mounting error in a high speed cam mechanism operating in a harsh environment could cause abnormal wear to the thrust unit of the cam follower. In such a case, using Cam Follower Containing Thrust Balls model CFN will bring about a significant effect in increasing the durability.

Models CFN5 to 12 are standard-stock items. If desiring a size other than the standard items, contact THK.

Model CFN is capable of receiving a thrust load caused by a slight mounting error. However, it is necessary to minimize a component of thrust force, or prevent it from occurring, when designing the cam mechanism and installing the Cam Follower.

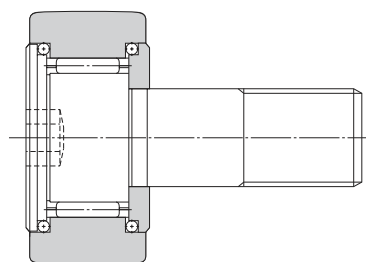


Fig.2

## Types of the Cam Follower

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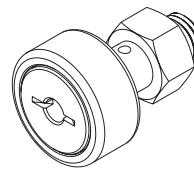
### Types and Features

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#### Popular Type Cam Follower Model CF

Specification Table⇒B-808

It is a popular type of Cam Follower provided with a driver groove on the head of the stud. A highly corrosion resistant stainless steel type (symbol M) is also available.



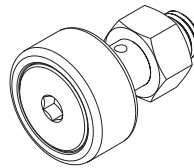
Model CF

#### Cam Follower with a Hexagon Socket Model CF-A

Specification Table⇒B-810

Since the stud head has a hexagon socket, this model can easily be installed using a hexagon wrench.

A type whose stud screw has a hexagon socket (CF-B) is also available. (applicable to stud diameter of 12 or greater)

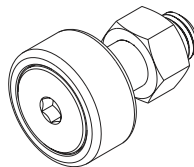


Model CF-A

#### Eccentric Cam Follower with a Hexagon Socket Model CFH-A

Specification Table⇒B-814

This model can be installed in the same mounting hole as that of model CF. Since the mounting shaft of the stud and the stud head are eccentric by 0.25 mm to 1.0 mm, the position of this model can easily be adjusted simply by turning the stud. Thus, it is a compact, highly accurate eccentric cam follower with an integral structure. As a result, the man-hours for machining and assembly can significantly be reduced because it is unnecessary to align the cam follower with the cam groove and machine the mounting-hole area with precision.

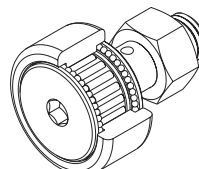


Model CFH-A

#### Cam Follower Containing Thrust Balls Model CFN

Specification Table⇒B-816

Based on the popular type Cam Follower, this model is incorporated with thrust load balls.

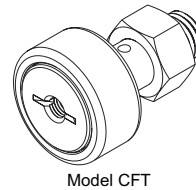


Model CFN

**Features and Types**  
Types of the Cam Follower

**Cam Follower with a Tapped Hole for Greasing Model CFT** Specification Table⇒B-818

Basically the same as the popular type Cam Follower, this model is provided with tapped holes for piping on the stud head and the thread. It is optimal for locations where an integrated piping for greasing is required.



Model CFT

**Types and Model Numbers of Cam Followers**

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

Table1 Types and Model Numbers of Cam Followers

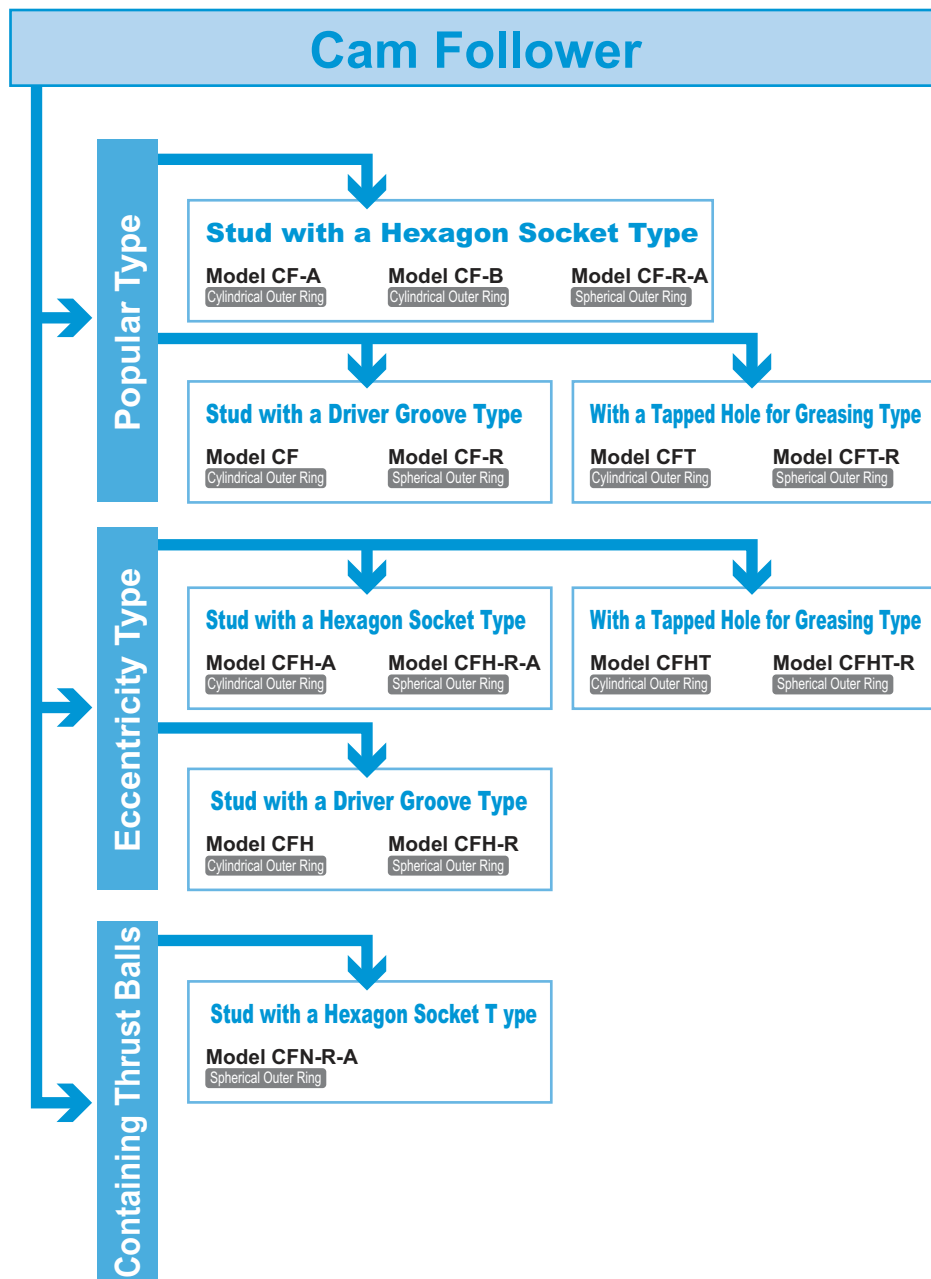
Type		Popular Type	Eccentric Cam Follower	Containing Thrust Balls
Shape				
Cylindrical outer ring	Stud with a hexagon socket	CF-A (CF...UU-A)	CFH-A (CFH...UU-A)	—
	Stud with a driver groove	CF (CF...UU)	CFH (CFH...UU)	—
	With a tapped hole for greasing	CFT (CFT...UU)	CFHT (CFHT...UU)	—
	Made of stainless steel	CF-M (CF...MUU)	CFH-M (CFH...MUU)	—
Spherical outer ring	Stud with a hexagon socket	CF-R-A (CF...UUR-A)	CFH-R-A (CFH...UUR-A)	CFN-R-A
	Stud with a driver groove	CF-R (CF...UUR)	CFH-R (CFH...UUR)	—
	With a tapped hole for greasing	CFT-R (CFT...UUR)	CFHT-R (CFHT...UUR)	—
	Made of stainless steel	CF-MR (CF...MUUR)	CFH-MR (CFH...MUUR)	—

Cam Follower

Note1) The symbols in the parentheses indicate model numbers of types with seals.  
 Note2) THK also manufactures low-speed full-roller types with long service lives. For these full-roller types, symbol "V" is indicated.  
 Note3) Symbol M indicates stainless steel type.

Example: CF 12 V UUR  
 Full-roller type

## Classification Table



## 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<sub>0</sub>" in the dimensional 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 in relation to  $C_0$   
(see Table1)

$C_0$  : Basic static load rating (kN)

$P_0$  : Radial load (kN)

The permissible load ( $F_0$ ) indicates the permissible value of the applied load determined by the strength of the stud section of the Cam Follower. Therefore, it is necessary to consider the static safety factor  $f_m$  against  $F_0$  as well as  $f_s$ .

$$\frac{F_0}{P_0} = f_m$$

$f_m$  : Static safety factor in relation to  $F_0$   
(see Table1)

$F_0$  : Permissible load (kN)

$P_0$  : Radial load (kN)

Table1 Static Safety Factor ( $f_s, f_m$ )

Load conditions	Lower limit of $f_s$ and $f_m$
Normal load	1 to 2
Impact load	2 to 3

### [Nominal Life]

The service life of the Cam 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 Cam 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-886)

$f_w$  : Load factor (see Table2 on A-886)

\* The basic dynamic load rating ( $C$ ) of the Cam Follower shows the load with interlocked direction and magnitude, under which the nominal life ( $L$ ) is 1 million revolutions when a group of identical Cam 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<sub>h</sub>) is obtained from the following equation.

● **For Linear Motion**

$$L_h = \frac{D \cdot \pi \cdot L}{2 \times l_s \cdot n_1 \times 60}$$

- L<sub>h</sub> : Service life time (h)
- L : Nominal life
- D : Bearing outer diameter (mm)
- l<sub>s</sub> : Stroke length (mm)
- n<sub>1</sub> : Number of reciprocations per minute (min<sup>-1</sup>)

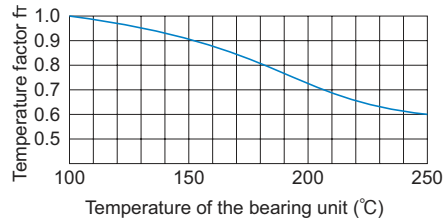


Fig.1 Temperature Factor (f<sub>t</sub>)

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

● **For Rotary Motion**

$$L_h = \frac{D \cdot L}{D_1 \cdot n \times 60}$$

- D<sub>1</sub> : Outer ring contact average diameter of the cam (mm)
- n : Revolutions per minute of the cam (min<sup>-1</sup>)

Table2 Load Factor (f<sub>w</sub>)

Condition	f <sub>w</sub>
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

Cam Followers are manufactured with accuracies according to Table3.

- (1) Dimensional tolerance of the cylindrical outer ring in outer diameter D: Table3
- (2) Dimensional tolerance of the spherical outer ring in outer diameter D:  $\begin{smallmatrix} 0 \\ -0.05 \end{smallmatrix}$
- (3) Dimensional tolerance of the Cam Follower in stud diameter d: h7
- (4) Dimensional tolerance of the outer ring in width B:  $\begin{smallmatrix} 0 \\ -0.12 \end{smallmatrix}$

Table3 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) <sup>(note)</sup>		Tolerance of the outer ring in radial runout (max)
Above	Or less	Upper	Lower	
6	18	0	-8	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 bearing 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 1.24 kN/mm<sup>2</sup> 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.

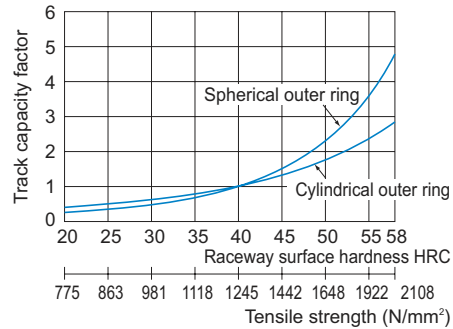


Fig.2 Track Capacity Factor

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/mm<sup>2</sup> or higher.

### [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 Cam Followers meet clearance C2 (see Table4).  
(Normal clearance applies to full-roller types.)

Table4 Radial Clearance Unit: μm

Model No.	Clearance C2 (with cage)		Normal clearance (full rollers)	
	Min.	Max.	Min.	Max.
CF, CFN, CFH, CFT and CFHT				
3 to 4	3	17	10	25
5 to 8	5	20	15	30
10 to 12-1	5	25	15	35
16 to 20-1	10	30	20	40
24 to 30-2	10	40	25	55

## Fit

For the dimensional tolerance of the Cam Follower in stud-mounting hole, we recommend the following fitting.

The dimensional tolerance of the stud-mounting hole: H7

## Installation

### [Mounting Section]

Establish perpendicularity between the stud-mounting hole and the mounting surface, and chamfer the mouth of the hole to the smallest possible radius, preferably C0.5. Also, the diameter of the mounting surface should preferably be at least equal to the dimension "f" indicated in the specification table.

If the outer ring unilaterally or unevenly contacts the mating raceway, we recommend using model CF-R, whose outer ring circumference is spherically ground.

### [Mating Raceway]

For the material of the mating raceway, see Track Load Capacity on A-887.

### [About the Mounting Method]

Do not tap the bracket and directly tighten the product without using a nut as shown in Fig.1. Doing so may result in an insufficient tightening torque, or cause the bending stress to concentrate in the male thread and damage the stud if the thread is loosened.

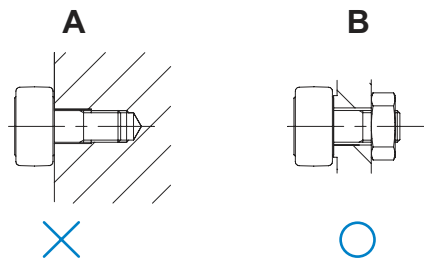
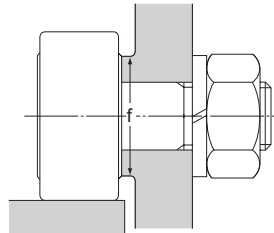


Fig.1

## Installation

### [Installing the Cam Follower]

If the Cam Follower is to be used under a heavy load, it is necessary to install the product so that the greasing hole on the stud is out of the loaded area. To help identify the position of the greasing hole, the THK logo is marked on the side face of the stud collar. (See Fig.1.)

The vertical hole in the middle of the stud is used as a whirl stop or a greasing hole.

Make sure that the outer ring is evenly in contact with the mating surface. When installing the Cam Follower, also make sure its axis is perpendicular to the traveling direction.

### ● Tightening Torque for the Stud

Since the stud of the Cam Follower receives bending stress and tensile stress caused by a bearing load, it is necessary to keep the tightening torque of the screw from exceeding the values indicated in Table1.

If the mounting screw may be loosened due to vibrations or impact, use a spring washer, thin nuts of JIS B 1811 Class 3 as double-nuts or a special nut capable of preventing itself from loosening.

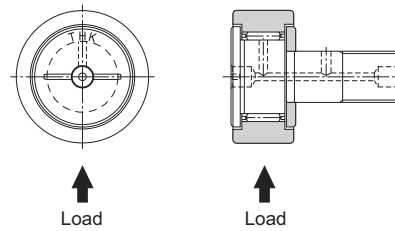


Fig.1 Positions of the THK Logo and the Greasing Holes

Table1 Maximum Tightening Torque of the Screw

Model No CF, CFN, CFH, CFT	Maximum tightening torque N-m
3	0.392
4	0.98
5	1.96
6	2.94
8	7.84
10 10-1	16.7
12 12-1	29.4
16	70.6
18	98
20 20-1	137
24 24-1	245
30 30-1 30-2	480

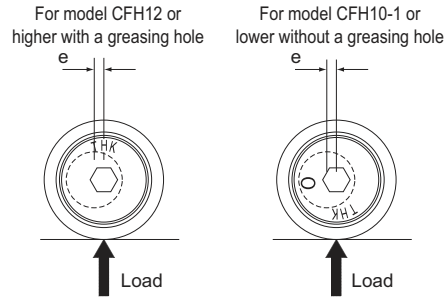
Note) 1 N-m equals to 0.102 kgf-m.

### [Installing the Eccentric Cam Follower]

The eccentricity is adjusted in the following steps.

- (1) Insert the stud into the mounting hole, and lightly tighten the nut until the nut starts turning. In doing so, position the THK logo in relation to the load direction as shown in Fig.2.
- (2) Use the hexagon socket on the stud head to turn the stud and adjust the clearance between the stud and the mating contact surface.
- (3) After adjusting the clearance, tighten the nut while keeping the stud from turning. Be sure the maximum tightening torque in Table1 on A-889 is not exceeded.

The surface of the Cam Follower stud is hardened. Take this into account when machining the stud.



The figure shows the position of the THK logo in relation to the eccentricity direction for model CFH12 or higher with a greasing hole.

For model CFH10-1 or lower without a greasing hole, the "O" mark indicates the eccentricity direction. There is no relationship between the THK logo and the eccentricity direction.

Fig.2

## Contamination Protection and Lubrication

The Cam 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 cam follower and the lubricant from leaking.

Since each Cam Follower unit with seals contains high-quality lithium soap group grease No. 2, you can start using the product without replenishing grease. Exceptionally, model CFN contains AFC Grease.

If your Cam Follower does not have seals, fill grease from the greasing hole on the stud or the inner ring. However, some of the model numbers with stud diameters of 10 mm or less do not have a greasing hole and are provided with initial lubrication only, and therefore do not allow replenishment of grease.

The appropriate fill quantity is a half to one third of the space inside the bearing. 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 6 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.

When driving the dedicated grease nipple onto the Cam Follower, use a jig like the one shown in Fig.3 to provide pressure to the flange of the nipple.

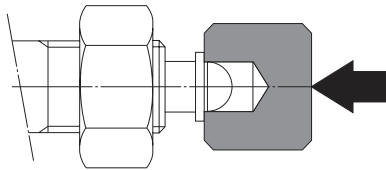


Fig.3

## Accessories for the Cam Follower

Table1 shows accessories for standard types of Cam Followers. The dedicated grease nipple is attached at your request. If desiring the dedicated grease nipple, add symbol "N" to the end of the model number.

Example: CF 12 UUR -N  
 Dedicated grease nipple

Table1 Accessories

Model No.		Plug <sup>note 1</sup>	Plug <sup>note 2</sup>	Nut JIS Class 2	Grease <sup>note 3</sup>
CF	Without seal	Included in package	Included in package	Included in package	Not contained
CFH	With seal	Included in package	Included in package	Included in package	Filled with grease
CFN		Included in package	Included in package	Included in package	Filled with grease
CFT	Without seal	—	—	Included in package	Not contained
	With seal	—	—	Included in package	Filled with grease

Note1) The plug is used to prevent grease from leaking. However, it is not included in the packages of model CF5, and hexagon socket types of models CFN10 (R)-A and CF (CFH) 10-1 (R)-A or lower.

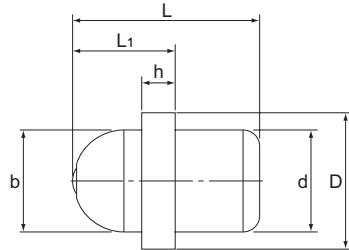
Note2) The plug is used to close an unused greasing hole. However, it is not attached to model CF (CFH) 10-1 or lower.

Note3) All models without a greasing hole are filled with grease when assembled regardless of whether a seal is attached or not.

Table2 Specification Table for Grease Nipples

Supported models	Nipple dimensions						Nipple model No.
	d	b	D	h	L	L <sub>1</sub>	
CF, CFN, CFH	d	b	D	h	L	L <sub>1</sub>	
5	3.1	6	7.5	1.5	9	5.5	NP3.2×3.5
6 to 10	4	6	7.5	1.5	10	5.5	PB1021B
12 to 18	6	6	8	2	11	6	NP6×5
20 to 30	8	6	10	3	16	7	NP8×9

Note) The grease nipple is not attached to models CFN10 (R)-A and CF (CFH) 10-1 (R)-A or lower.



### [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 Cam 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 Cam Follower do not contain grease depending on the size and on whether seals are attached. Carefully refer to Table1 on A-892, 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. (Use THK AFC Grease for model CFN.)
- (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 Cam Follower travels.

### [Precautions on Use]

- (1) When securing the Cam Follower, use a torque wrench or the like to tighten the product at a torque equivalent to the corresponding value in Table1 on A-889.
- (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 may cause damage or functional loss. Prevent foreign material, such as dust and cutting chips, from entering the product.
- (4) Cam Followers are designed for use under a radial load. Do not use the product under a thrust load.

### [Storage]

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

